Project Manual:

Early Childhood Education Center
Chestnut Building
749 Chestnut Walk
Terre Haute, Indiana 47809

Owner Project Manager:

Indiana State University

Department of Facilities Management
951 Sycamore Walk
Terre Haute, Indiana 47809
812-237-8100

Owner:

Indiana State University

Early Childhood Education Center
ISU Byah College of Education
401 North 7th Street
Terre Haute, Indiana 47809

ARCHITECT

arcDESIGN, PC
201 N. Delaware St., Suite B
Indianapolis, IN 46204
Telephone: 317.951.9192
Fax: 317.951.9194

www.arcdesign.us

STRUCTURAL ENGINEER

Lynch, Harrison & Brumleve, Inc.
550 Virginia Ave.
Indianapolis, IN 46203
Telephone: 317.423.1550
Fax: 317.423.1551

www.lhb-eng.com

MEP ENGINEER

R. E. Dimond and Associates, Inc.
732 N Capitol Avenue
Indianapolis, IN 46204
Telephone: 317.634.4672

www.redimond.com

LANDSCAPE ARCHITECT

Mader Design
302 Main St.
Beech Grove, IN 46107
Telephone: 317.889.1775
Fax: 317.862.5521

www.maderdesignllc.com

Bid Number B0028379

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NOTICE TO BIDDERS

Sealed proposals are requested for the Early Childhood Education Center, Bid Number B0028379. Proposals will be received for the above contract at the Office of the Department of Purchasing, Indiana State University, Facilities Management and Purchasing Building, 951 Sycamore Street, Terre Haute, Indiana 47809, until 2:00pm Local Time, June 25, 2024. Effective March 5, 2022 Facial PPE (masks) are not required in Indiana State University Buildings so respondents delivering Bids are not required to wear facial PPE when delivering Bids.

There will be no in person Public Bid Opening. The Bids will be opened at 2:15pm on the due date and read aloud via Teams conference call. For conference call access call 812-228-8187 and enter conference ID 949 113 844 followed by #.

Bidding Documents may be downloaded from the ISU Plan Room at http://www.indstateplanroom.com/ on **May 23, 2024** for $5.00 per person/download which covers all downloads for that particular Project. Bidders must register for a free account the first time they access the website. Bid Documents may be ordered for purchase on CD, for $7.50 per CD, or on paper copy at applicable printing costs from Rapid Reproductions, Inc.,129 South 11th Street, Terre Haute, IN 47807 (812-238-1681 Toll Free 800-736-7084).
Proposals are to be made on the Bid Form published in the Project Manual, based on Form 96 (Revised), as prescribed by the State Board of Accounts. As a mandatory requirement the Proposal shall be accompanied by a certified check; cashier's check or a Bid Bond (AIA A310) for an amount not less than 5% of the total bid price for Base Bid(s) and all add Alternates. See Section 00 10 10 Instructions to Bidders 3.01 for Bid Bond Requirements
Bidder(s) receiving awards shall be required to provide acceptable surety in the form of a Performance and Labor and Materials Payment Bond for the full amount of the award. Include the cost of all bonds and insurance in the Bid amount.
Federal Funds are used on this Project and any Project in excess of $2,000.00 is required to comply with the Davis Bacon Act and associated wage scale for the applicable State and County. It is the Bidders responsibility to determine the appropriate wage to be paid to their employees. See Section 00 10 10 Instructions to Bidders 1.09 for more information.
Indiana State University is a Tax Exempt Institution and Indiana Sales Tax for products permanently incorporated in work shall not be included as part of the Bid or on any Application for Payment.
All Bidders must comply with All State and Federal Non-Discrimination laws.

Responsive bidders may not have an active dispute, claim, or litigation with Indiana State University.

Indiana State University reserves the right to accept or reject any Bid and to waive any irregularities in Bidding. Any proposal received after the time fixed herein shall be returned unopened.
No bid may be withdrawn after the opening of Bids without the consent of Indiana State University for a period of One Hundred Twenty (120) days after the time of opening Bids.
There will not be an actual Pre-Bid conference meeting for the Project. A copy of a Pre-Bid Information sheet will be included with the Bidding Documents. Bidders shall review the information sheet and the contained information will become a part of the Bidding Documents.
Pre-Bid site visits have been scheduled at 10:30am on June 4, 2024 at the Chestnut Building North entrance, 749 Chestnut Walk, Terre Haute, Indiana 47809. While masks are not required on the ISU campus or in campus buildings attendees are reminded to practice social distancing whenever possible. *Representatives of each of the Bidders are strongly urged to attend.*
Contract Award shall be to a Single Prime Bidder for all single Base Bid project work or the Contract Award may be to multiple Single Prime Bidders for multiple Base Bid Package project work. The prime Bidder(s) shall be an experienced and qualified Contractor(s) having successfully completed a minimum of three (3) projects of similar size and scope. The Bid form for this Project requires the Bidder to submit evidence of successful installation of similar projects (minimum of three projects), including customer information, scope, dates, Contract dollar amounts. With their Bid the Bidder shall submit their most current audited financial statement and vendor trade credit references as evidence of financial capability to perform the work.

NOTICE TO BIDDERS

All questions relating to this Project shall be addressed to:
Greg Miller, arcDESIGN, PC
Phone Office 317-951-9194 Desk 317-559-1044 E-mail gmiller@arcdesign.us

INDIANA STATE UNIVERSITY BOARD OF TRUSTEES
By: Diann E. McKee
Senior Vice President for Finance and Administration and University Treasurer
Indiana State University

END OF SECTION 00 10 00

PART 1- INSTRUCTIONS TO BIDDERS

1.01 GENERAL

A. Bidders shall carefully read the Notice to Bidders with regard to preparation of proposals, which includes the date and place for receiving proposals. See PART 3 of this Section 00 10 10 Instructions to Bidders for a complete list of the required forms for Bidding.

B. All Bidders shall fully inform themselves of the conditions under which the work is to be performed, the site of the work, the obstacles that may be encountered, and other relevant matters concerning the work to be performed.

C. The Contractor shall begin Work within seven (7) days after Award preparing submittals and procuring material. Actual Work shall begin on or about July 22, 2024, with all Work substantially completed by July 28, 2025. Final closeout shall be within sixty (60)) calendar days thereafter. A warranty walk-thru may be held eleven (11) months from the date of substantial completion.

D. No Bidder, after being awarded the contract, shall be allowed any extra compensation for reason of their failure to fully inform themselves, prior to their Bidding, of all requirements of the Contract Documents, the Drawings, and Specifications.

E. If any Bidder for the proposed contract is in doubt as to the true meaning of any part of the Drawings, Specifications or their proposed Contract Documents, they may submit to the Owner written request for any interpretation thereof. The Bidder submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by an Addendum duly issued. A copy of such Addendum will be posted to the ISU Plan Room and e-mail notification sent to each registered plan holder (see 1.07 of this Section). Such Addendum, if any, issued before submission of the Bids, shall be taken into account and included in the proposal.

F. Any Bidder may withdraw their Bid at any time prior to the scheduled time for the receipt of bids.

G. No Bidder may withdraw their Bid or proposal for a period of One Hundred Twenty (120) calendar days after date and time set for opening Bids.

H. It is understood that the Owner reserves the right to waive any irregularities in Bidding and to accept or reject any or all Bids.

I. It is further understood on Bids with multiple Bid Packages the Owner reserves the right to selectively Award individual Bid Packages to multiple Prime Bidders submitting the lowest and best Bids for the individual Bid Packages.

1.02 EXAMINATION OF SITE AND BIDDING DOCUMENTS

A. The site shall be carefully examined prior to bidding to ascertain the location of the work, existing conditions, and all other matters which may affect the work under this Contract. Each Bidder by making their Bid represents that they have visited the site and familiarized themselves with the local conditions under which the Work is to be performed.

B. The Bidding Documents shall be carefully examined to ascertain the character, quality and quantity of the work to be performed, of materials and items to be furnished, of equipment and facilities needed during construction, of utilities and of all other matters which may affect the work under the Contract. Each Bidder by making their Bid represents that they have read and fully understands the Bidding Documents.

1.03 PRE-BID CONFERENCE

A. There will not be an actual Pre-Bid conference. A pre-bid site visit will be held to allow Bidders' to visit the site. All questions, even if asked and answered at the pre-bid site visit, shall be submitted in writing via e-mail to the Project main contact and Owner.

B. An Addendum will be issued confirming any information conveyed at pre-bid site visit and no verbal response tendered during pre-bid site visit shall have legal standing unless so confirmed by Addendum.

C. Additional site visits may be arranged with the Project's Main Contact or Owner's Main Contact.

1.04 BIDDING QUESTIONS

A. Questions regarding the Bidding Documents and Project shall be submitted in writing via e-mail to the Project main contact and Owner. An Addendum will be issued to respond to all questions received. No verbal or direct e-mail response shall have legal standing unless so confirmed by Addendum.

B. The last day for questions to submitted shall be three (3) business days prior to the scheduled date for the receipt of Bids. Any questions submitted after that date may not receive consideration.

1.05 EXECUTION OF AGREEMENT

A. For all Projects the forms of agreement which the successful Bidder, as Contractor, will enter into will be an ISU Award Letter, an ISU Purchase Order and a Contract for Construction. Prior to issuance of the Purchase Order the Contractor shall provide to the Director of Purchasing the Labor and Material Performance Bond, their most current financial statement and vendor trade credit references as evidence of financial capability to perform the work and the policies of insurance or insurance certificates as required by the Contract Documents and listed in the Award Letter. All Bonds and Insurance shall have an A.M. Best rating of not less than an "A". Once all the required paperwork has been received by ISU Purchasing and the Purchase Order issued, an electronic PDF copy of the Contract for Construction Between Indiana State University and Contractor, will be e-mailed to the Contractor for their signature and return to the Department of Facilities Management Contract Administrator for forwarding to the Senior Vice President for Finance and Administration for Owner signature. A fully executed copy of this Contract will be returned to the Contractor via e-mail for their files.

B. Time Limits for Execution of Agreement.

1. The successful Bidder shall supply the required paperwork (their Financial Statement (if not supplied with their Bid), Certificate of Insurance and their Performance and Payment Bond) to the ISU Purchasing Department within ten (10) calendar days after receipt of the ISU Award Letter.

2. The successful Bidder shall within seven (7) calendar days after receipt of the Contract for Construction Between Indiana State University and Contractor enter into the written Contract to perform the work in accordance with the Drawings and Specifications by signing and returning the Contract to the Department of Facilities Management Contract Administrator for forwarding to the Senior Vice President for Finance and Administration for Owner's signature and return to the Bidder.

C. In the case a Bidder whose Bid is accepted, fails to perform their Bid by providing the required paperwork within ten (10) calendar days after receipt of the Award Letter and entering into the written Contract with the Owner within seven (7) calendar days after receipt, then this failure may be cause for their certified check, draft or Bid Bond, and the proceeds thereof, to remain the absolute property of the Owner, as liquidated damages, it being impossible to estimate the amount of damages such failure would occasion.

1.06 INDEMNIFICATION

A. Bidders, in consideration of the privilege of Bidding, specifically waive all rights both legal and equitable which they have or might be construed to have against Indiana State University because of any action taken in accepting or rejecting bids and proposals, for themselves, and /or for subcontractors, suppliers and/or manufacturers, who may file an action based on any such acceptance or rejection. Bidders shall be liable for any resultant reasonable attorney fees and expenses incurred by Indiana State University.

1.07 ADDENDA

A. All Addenda for the Project will be posted on the ISU Plan Room at: http://www.indstateplanroom.com/. Addenda may be downloaded at no cost to registered plan holders.
B. A Bidder must register for a free account the first time they access the ISU Plan Room website.
C. The Bidder will receive an e-mail notifying that an Addendum is available for download from this site. The Bidder is advised to periodically check this link in the event an e-mail fails to deliver.

1.08 SUBSTITUTIONS PRIOR TO BID

A. Requests for substitution of any material, construction, equipment and methods named or described in the Specifications, on the Drawings and any Addenda issued shall be submitted in writing to the Architect/Engineer and Owner a minimum of seven (7) calendar days prior to Bidding. Complete support documentation shall be provided that the item to be substituted is equal to or exceeds the material, construction, equipment or methods named or described in the Specifications, on the Drawings and any Addenda issued with the request for substitution. It is solely at the discretion of the Architect/Engineer and the Owner to allow any requests for substitution.
B. Should it be determined after Award of the Bid that the Bidder based their Bid on any material, construction, equipment and methods not named or described in the Specifications, on the Drawings and any Addenda issued as approved for substitution prior to Bidding shall be disallowed and the material, construction, equipment and methods named or described in the Specifications, on the Drawings and any Addenda issued shall be provided at no additional cost to the Owner.

1.09 DAVIS-BACON AND RELATED ACTS

A. Any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the laws referenced by § 5.1 of 29 CFR Part 5 is subject to the Davis-Bacon and Related Acts (DBRA). A copy of 29CFR Part 5 is issued with these Specifications as Section 00 25 50 DBRA for reference/Information.
B. For Davis-Bacon Projects the WHD issues a Prevailing Wage scale for the State and County where the work will occur. The prevailing wage for Indiana Vigo County may be found at SAM.gov SAM.gov | Home.
    1. Once you are on the SAM.gov home page click on “Wage Determinations” in the left dialog box.
    2. On the Wage Determinations page click on the “Public Building or Works” graphic box. This will open a Search Criteria screen.

3. In the left pane select the State (Indiana) from the drop-down menu; select the County (Vigo) from the drop-down menu; for the DBA Construction Type select Building from the drop-down menu and finally for the Published Date select “Past Month” from the drop-down menu.
4. At the top of the right pane, you will see the Davis-Bacon Act WD#: click on the “IN” number to link to the wage scale most current wage scale.
5. You can select download or print the wage scale.
6. For purposes of preparing Bids the most current wage scale ten (10) days prior to receipt of Bids will be in effect for the duration of the Project.

C. Copeland Act Anti-Kickback law and Certified Payroll Record Submissions
1. The Copeland Act's Anti-Kickback provision prohibits contractors and subcontractors performing work on covered contracts from in any way inducing an employee to give up any part of the compensation to which he or she is entitled. The Copeland Act and implementing regulations also require contractors and subcontractors performing on covered contracts to pay their employees on a weekly basis and in cash or a negotiable instrument payable on demand and to submit weekly payroll reports of the wages paid to their laborers and mechanics during the preceding payroll period. Additionally, the Act's regulations at 29 CFR 3.5 and 3.6 list payroll deductions that are permissible without the approval of DOL and those deductions that require consent of DOL and prohibit all other payroll deductions.
2. Each contractor or subcontractor engaged in the construction, prosecution, completion, or repair of any public building or public work, or building or work financed in whole or in part by loans or grants from the United States, each week must provide a copy of its weekly payroll for all laborers and mechanics engaged on work covered by this part and part 5 of this chapter during the preceding weekly payroll period, accompanied by a statement of compliance certifying the accuracy of the weekly payroll information. This statement must be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, and must be on the back of Form WH-347, “Payroll (For Contractors Optional Use)” or on any form with identical wording. Copies of WH-347 may be obtained from the contracting or sponsoring agency or from the Wage and Hour Division website at *https://www.dol.gov/agencies/whd/government-contracts/construction/forms* or its successor site. The signature by the contractor, subcontractor, or the authorized officer or employee must be an original handwritten signature or a legally valid electronic signature.
3. The Prime Contractor shall be responsible to require all their subcontractors submit certified payroll records as detailed in the item above and shall be responsible for the delivery of the records to the Owner.
4. A copy of the Copeland Act 29CFR Part 3 is included with these Specifications under Section 00 29 30 29CFR PART 3.
5. Records must be maintained by the Contractor for a period of 3 years from the date of Substantial Completion.

D. Job Site Postings
1. The wage determination (including any additional classifications and wage rates conformed under paragraph (a)(1)(iii) of this section 29CFR Part 3) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

PART 2 - SUBCONTRACTORS, SUPPLIER AND MANUFACTURER'S BIDS TO BIDDERS

2.01 SUBCONTRACTOR, SUPPLIER AND MANUFACTURE BUNDLING OF PRICES TO PROSPECTIVE BIDDERS

A. Subcontractors, Suppliers and Manufacturers are permitted to bundle quote prices to Bidders however these bundled prices may not be used to withhold providing individual pricing to a Bidder for bundled items when requested by a Bidder to provide individual pricing. No subcontractor or supplier shall make it a condition of their bid that another part of the project be awarded to them.

B. Failure to provide individual pricing upon Bidder's request may be cause to disqualify a Subcontractor or Supplier and Manufacturer from Indiana State University Projects.

PART 3 - EXECUTION FORMS FOR BIDDING

3.01 BID BOND

A. A certified or cashier's check or Bid Bond is a mandatory requirement to be submitted with the Bid and shall be based on not less than five (5) percent of the Bid amount total of the Base Bid(s) and all add Alternates.

B. The Bid bond shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. The Bid Bond shall be obtained from surety or insurance company that is duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. In addition to appearing on Circular 570 U.S. Dept. of the Treasury, such Surety or insurance company shall maintain an A.M. Best's Rating of not less than "A.

C. Failure to submit an acceptable Bid Bond with the Bid shall disqualify a Bidder.

3.02 BIDDERS FINANCIAL STATEMENT

A. With their Bid the Bidder shall submit their most current independently audited or reviewed financial statement and vendor trade credit references as evidence of financial capability to perform the work.

B. Failure to submit the Bidder's financial statement may be cause to disqualify a Bidder.

3.03 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION (SECTION 00 10 20 OF PROJECT MANUAL)

A. This certificate is required by the regulations implementing Executive Order 12549 Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participants' responsibilities. The regulations were published as Part V11 of the May 26, 1988 Federal Register (pages 19160-19211).

B. Submit at time of Bid. Failure to submit with the Bid may be cause to disqualify a Bidder.

3.04 MBE/WBE/VBE PARTICIPATION PLAN. (SECTION 00 10 40 OF THE PROJECT MANUAL)

A. See Section 00 10 30 MBE/WBE/VBE COMPLIANCE INSTRUCTIONS for full details on submission of the Participation Plan.

B. This Plan must be submitted at time of Bid by **all Bidders**. Failure to submit with the Bid may be cause to disqualify a Bidder.

3.05 MANDATORY TIER II REPORTING REQUIREMENT FOR PROJECTS EQUAL TO OR GREATER THAN $150,000.00. (Note: this form may not be included in all Project Manuals)

A. MBE/WBE/VBE utilization in the performance of this Contract must be reported with each Application for Payment using the ISU Business Diversity Spend Reporting Form for Construction/Renovation/Facilities Repair Projects (see included: Tier II Spend Report Form.xlsx.)

B. Compliance with Owner's Mandatory Tier II Reporting Requirement is a condition for the approval of an Applications for Payment.

C. An electronic copy in Excel format will be included with the Award Letter when applicable.

3.06 BIDDER'S CERTIFICATION OF A**U**THORIZED EMPLOYMENT (SECTION 00 10 45 OF THE PROJECT MANUAL)

A. Bidder must certify at time the of Bidding that they have read and understand the "Contractor's Certification of Authorized Employment" provision of the Contract Documents In Section 00 20 11 Amendments to General Conditions Article 13, subparagraph 13.1.7.3 and its subparagraphs

B. Submit at time of Bid. Failure to submit with the Bid may be cause to disqualify a Bidder.

3.07 BID FORM (SECTION 00 20 00 OF THE PROJECT MANUAL)

A. In order to receive consideration, make all Bids in strict accordance with the following:

1. Proposals shall be submitted only on the form furnished, a copy of which is bound into and forms a part of this Project Manual, and which will become a part of the Purchase Order Contract of the successful Bidder (use a photocopy of the Bid Form herein).
2. Proposals shall be completely and correctly filled out using ink or typewriter, with signatures in ink.
3. Prices, except unit prices and percentages, shall be stated both in figures and in writing. In the event of a discrepancy between writing and the figures, the written amount shall govern.
4. Proposals shall be signed by the Bidder, by a partner, or a duly authorized officer for a corporation, and shall give the Bidder's business address and telephone number. Failure to sign the Bid form may be cause to disqualify a Bid.
5. Proposals submitted by non-Indiana corporations shall be accompanied by a certificate of existence issued by the Indiana Secretary of State.
6. Any interlineation, alteration or erasure of the published Bid Form may be grounds for rejection of the proposal. Proposal shall contain no recapitulation of the work to be done.
7. Proposals shall be based only on the material, construction, equipment and methods named or described in the Specifications, on the Drawings, and any Addenda issued prior to Bidding. See item 1.08 of this Sections for substitution request requirements.

B. Modification of proposals already submitted will be accepted by letter, fax or telegram if received by the Owner prior to the date and hour set for opening of proposals.

C. Each Bid shall be addressed to the Owner, and shall be delivered to the Office of the Director of Purchasing at the address given in the Notice to Bidders on or before the day and hour set for opening of Bids. Each Bid shall be enclosed in a sealed envelope bearing the title of the Project, the name of the Bidder, and the date and hour of the Bid opening. It is the sole responsibility of the bidder to see that their bid is received on time.

3.08 ADDENDA

A. Indicate receipt of Addenda on the Bid Form in the spaces provided for acknowledgement.
B. Failure to indicate receipt may be cause to disqualify a Bid.

3.09 BID FORM - BASE BID(S)

A. Base Bid(s) shall be based only on the material, construction, equipment and methods named or described in the Specifications, on the Drawings, and any Addenda issued prior to Bidding. See item 1.08 of this Section for substitution request requirements.
B. On Bids with multiple Base Bid Packages the Owner reserves the right to selectively Award individual Base Bid Packages to multiple Prime Bidders submitting the lowest and best Bids for the individual Bid Packages.

3.10 BID FORM - ALTERNATE BID(S)

A. Each Bidder, in addition to submission of the Base Bid, shall submit a Bid for any Alternate(s) as called for (if any). Failure to submit said Alternate Bid(s) shall be sufficient cause for the Owner to reject any proposal in its entirety. Also the Owner may consider the Alternate Bid in awarding of a Contract, but is under no obligation to accept any Alternate Bid.

B. Proposals shall be based only on the material, construction, equipment and methods named or described in the Specifications, on the Drawings, and any Addenda issued prior to Bidding. See item 1.08 of this Section for substitution request requirements.

3.11 BID FORM – ALLOWANCES

A. Allowances (if any) shall be included in the applicable Bid (Base Bid(s) or Alternate Bid(s)) as called for in the Allowance Section of the Bid Form and/or Section 01 23 60 Allowances.
B. It is solely at the discretion of the Architect/Engineer/Owner what costs may be applied to an Allowance.
C. Any unused portion of an Allowance shall be returned to the Owner at Contract Closeout.

3.12 COMPLIANCE WITH LAWS

A. The Bidder shall comply with all applicable federal, state, and local laws, rules, regulations, and ordinances including but not limited to Indiana Code 5-16 and all provisions required thereby to be included herein are hereby incorporated by reference. Bidder warrants Contractor and any subcontractors shall obtain and maintain all required permissions, permits, licenses, registrations, accreditations, certifications, and approvals, and shall comply with all employment, labor, EEOC, E-verify, health, safety, and environmental statutes, rules, or regulations related to the products and services offered under this agreement. Bidder and any principals of the Contractor certify compliance with the requirements of Indiana Code § 5-16-1-9 Application of Indiana Code 5-22-16.5 (e.g. Company has not and will not participate in any investments or activities in Iran and refrains from engaging in any new investments or activities in Iran).

B. Submission of the signed Bid Form indicates compliance.

3.13 NON-COLLUSION AFFIDAVIT

A. The Bidder, by its officers and agents or representatives present at the time of filing their bid, being duly sworn, say on their oaths that neither they nor any of them have in any way, directly or indirectly, entered into any arrangement or agreement with any other bidder, or with any public office of the State of Indiana, of any county or municipality or other public offices whereby such affiance or either of them, has paid or is to pay to such other bidder or public officer any sum of money, or has given or is to vie to such other

bidders or public officer anything of value whatever, or such affiance of affiance or either of them has not, directly or indirectly entered into any arrangement or agreement with any other bidder or bidders, which tends to or does lessen or destroy free competition in letting of the contract sought for by the attached bids; that no inducement of any form or character other than which appears upon the face of the bid will be suggested, offered, paid, or delivered to any person whomsoever to influence the acceptance of the said bid or awarding of the contract, nor has this bidder any agreement or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds of the contract sought by this bid.

B. Submission of the signed Bid Form indicates compliance.

3.14 NON-DISCRIMINATION

A. The Bidder and its Subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to their hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of their sex, race, natural origin, ancestry or religion or disability as prohibited under the Americans with Disabilities Act. Breach of this covenant may be regarded as a material breach of the Contract.

B. Submission of the signed Bid Form indicates compliance.

3.15 CERTIFICATION OF UNITED STATES STEEL PRODUCTS

A. The Bidder certifies that the Bidder and all Subcontractors will comply with the statutory obligations to use steel products made in the United States.

B. Submission of the signed Bid Form indicates compliance.

3.16 BID FORM - APPENDIX A SUBCONTRACTOR AND SUPPLIER/MANUFACTURERS LISTS

A. The Prime Contractor (Bidder) shall list all Subcontractors and Suppliers/Manufacturers called for in Appendix A of the Bid Form at the time of Bid Submission. Failure to provide this information may be sufficient cause to disallow a Bid.

B. **The Prime Contractor (Bidder) shall use the Subcontractors, Suppliers, Materials and Equipment as listed in the Bid Form Appendix "A" submitted at the time of Bid. It is the Prime Contractor's (Bidder's) responsibility to assure they have listed the correct Subcontractors, Suppliers, Materials and Equipment on their Bid Form. THERE SHALL BE NO CHANGES PERMITTED TO THESE LISTS.**

1. Exception: If the Owner determines the Subcontractors, Suppliers, Materials or Equipment are not acceptable, the Owner shall notify the Prime Contractor (Bidder) in writing within two (2) working days after receipt of Bids of the unacceptable Subcontractor(s), Supplier(s), Material(s) and/or Equipment(s).

3.17 BID FORM - APPENDIX B COMPREHENSIVE SUBCONTRACTOR AND SUPPLIER/MANUFACTURER LIST

A. The comprehensive subcontractor and Supplier/Manufacturer list shall be submitted by the two apparent low Bidders by 4:30pm on the day Bids are received. The A/E or Owner may request other Bidders to submit the list.

B. Submit via e-mail to:
1. Greg Miller, arcDESIGN gmiller@arcdesign.us
2. Dale Warner, R.E. Dimond and Associates dale.warner@redimond.com
3. Pat Teeters, ISU Department of Facilities Management patrick.teeters@indstate.edu

C. Failure to submit within the time given may be cause to disallow the Bid.

3.18 BID FORM - APPENDIX C UNIT PRICES

A. Each Bidder shall submit pricing for Unit Prices as called for (if any) in Appendix B. Failure to submit said pricing may be sufficient cause for the Owner to reject any proposal in its entirety. Also the Owner may consider the Unit Pricing in awarding of a Contract.
B. Unit Prices shall be based only on the material, construction, equipment and methods named or described in the Specifications, on the Drawings, and any Addenda issued prior to Bidding.
C. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

3.19 BID FORM - APPENDIX D

A. By 2:00pm on the next business day after receipt of Bids the Bidder shall submit, a wage rate schedule for the workers of the Prime Bidder and all major Subcontractors involved in the Work. The wage rate shall include the worker's hourly rate plus all fringe benefits to be paid to the worker.
B. A major Subcontractor is defined as any Subcontractor whose portion of the Bid is in excess of $250,000 or 20% of the total Bid whichever is less.
C. Failure to submit this wage rate schedule within the allotted time may be sufficient cause to disallow a Bid. The wage rates provided may be used as a basis for Award of the Bid.
D. The Owner reserves the right to require certified payroll records to be provided to verify the wage rates listed on the wage rate schedule are accurate.

END OF SECTION 00 10 10

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00 10 20

CERTIFICATION REGARDING SUSPENSION, DEBARMENT, INELIGIBILITY AND VOLUNTARY EXCLUSION

This certificate is required by the regulations implementing Executive Orders 12549 and 12689, Uniform Guidance 2 CFR 200.213 and 2 CFR 180 sections regarding Suspension and Debarment

Is your organization, or its principals, suspended, debarred, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction, by any Federal department or agency? ☐ Yes ☐ No

Are any of your subcontractors, or its principals, suspended, debarred, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction, by any Federal department or agency? ☐ Yes ☐ No

_____
Your Company's Name

_____
Signature

_____
Print Your Name

_____
Date

END OF SECTION 00 10 20

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PART 1 – CONSTRUCTION SERVICES – INSTRUCTION TO BIDDERS

1.01 MBE/WBE/VBE Participation Plan

A. Indiana State University is committed to diversity and non-discrimination in all aspects of its operations. This initiative is to ensure that certified MBEs, WBEs, and VBEs are included in all invitations for quotes and bids, and that all prospective bidders are notified of Indiana State University's expectation for diversity, including but not limited to MBE/WBE/VBE participation in procurement contracts for professional services, materials, supplies and equipment, and in contracts for the construction, architectural services, renovation or repair of university facilities and equipment. This expectation extends to all tiers of contractor utilization. Each Prime contractor should actively solicit and include certified minority, women and veteran owned subcontractors in bid submissions if economically feasible.

B. The Minority, Women's and Veteran's Business Enterprise Participation Plan (form included in specifications) shall be submitted with the bid. This Participation Plan will be considered during the proposal evaluation process.

C. Indiana State University's annual MBE, WBE, and VBE participation goals parallel those set by the Indiana Department of Administration for its own business diversity efforts. The State MBE/WBE participation goals may be found at www.in.gov/idoa/mwbe/2743.htm and VBE participation goals may be found at www.in.gov/idoa/2862.htm

1.02 Definitions

A. "Minority-owned Business Enterprise" (MBE) means an individual, partnership, corporation, limited liability company, or joint venture of any kind that is 51% owned and controlled by (1) or more persons who are (a) United States citizens; and (b) members of a racial minority group: African American, American Indians, Hispanics, Asian Americans, or other similar minority group as defined by 13 CFR 124.103 and have been certified by the State of Indiana.

B. "Women-owned Business Enterprise" (WBE) means an individual, partnership, corporation, limited liability company, or joint venture of any kind that is 51% owned and controlled by (1) or more persons who are (a) United States citizens; and (b) whose gender is female and have been certified by the State of Indiana.

C. "Veteran-owned Business Enterprise" (VBE) means an Indiana firm with its principal place of business location in Indiana and is currently certified by the Department of Veterans Affairs as a veteran-owned business and have been certified by the State of Indiana or who have been Federally certified.

1.03 Qualifications for Participation

A. In order to count toward participation goals, the MBEs and WBEs must be certified by the State of Indiana.

B. VBEs must be certified by the State of Indiana or have been Federally certified.

1.04 Failure to Participate

A. Failure to submit the Minority, Women's and Veteran's Business Enterprise Participation Plan with the Bid may be cause to reject a Bid.

B. The Owner retains the right to hold payment, and/or to reject future bids submitted by the successful Contractor in the event that Contractor misrepresents either MBE/WBE/VBE participation in this Project, or its efforts to obtain MBE/WBE/VBE participation in this project, or fails to report MBE/WBE/VBE spend on this project.

C. The Owner, at its discretion, may waive in part or in whole the minority-owned business enterprise, women-owned business enterprise and/or veteran-owned business enterprise requirement if in the opinion of the Owner it would be impractical, or not in the best interest of the Owner.

1.05 Mandatory Tier II Reporting Requirement for Projects equal to or greater than $150,000.00

A. The successful Contractor shall take all necessary and reasonable steps to ensure that MBE/WBE/VBEs have the maximum opportunity to compete for and perform work on this Contract.

B. MBE/WBE/VBE utilization in the performance of this Contract must be reported with each Application for Payment using the ISU Business Diversity Spend Reporting Form for Construction/Renovation/Facilities Repair Projects (see included: Tier II Spend Report Form.xlsx.)

C. Compliance with Owner's Mandatory Tier II Reporting Requirement is a condition for the approval of an Applications for Payment.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 00 10 30

00 10 40
MBE/WBE/VBE PARTICIPATION PLAN

Project Name _____

Bid Number _____ Bid Date _____

This Form must be completed by all Bidders and submitted with the Bid. **Failure to submit may be cause to reject the Bid.**

Check if Bidder is an MBE, WBE or VBE

Bidders Firm _____ MBE ☐ WBE ☐ VBE ☐

Address _____

City/State/Zip _____

Phone _____

E-mail _____

The following certified minority, women and/or veteran -owned firms will be participating in the project according to the following schedule. Indicate whether each firm is an MBE, WBE or VBE by selecting the MBE, WBE or VBE box below.

1. _____ _____ _____ _____
FIRM MBE ☐ WBE ☐ VBE ☐ TRADE AMOUNT % OF TOTAL BID

_____ _____ _____
CONTACT NAME PHONE E-MAIL

2. _____ _____ _____ _____
FIRM MBE ☐ WBE ☐ VBE ☐ TRADE AMOUNT % OF TOTAL BID

_____ _____ _____
CONTACT NAME PHONE E-MAIL

3. _____ _____ _____ _____
FIRM MBE ☐ WBE ☐ VBE ☐ TRADE AMOUNT % OF TOTAL BID

_____ _____ _____
CONTACT NAME PHONE E-MAIL

4. _____ _____ _____ _____
FIRM MBE ☐ WBE ☐ VBE ☐ TRADE AMOUNT % OF TOTAL BID

_____ _____ _____
CONTACT NAME PHONE E-MAIL

If more space is need attach additional sheet

If no MBE, WBE or VBE contractors are listed above please indicate reason(s) why:

☐ Unable to locate any MBEs, WBEs or VBEs.

☐ Unable to secure competitive pricing from any MBEs, WBEs or VBEs.

☐ Other reasons, please describe: _____

MBE/WBE/VBE PARTICIPATION PLAN

Describe below your efforts to obtain minority, women and veteran's business enterprise participation for this project.
Be sure to attach a copy of all solicitation efforts, e.g., ads that were published or networking events, etc.

_____

_____

_____

_____

List below the MBE/WBE/VBE contractors you individually contacted to request a quote for this project. If all work is to be self-performed and your Firm is not MBE, WBE or VBE list N/A in top left line below.

MBE, WBE, VBE Firms Contacted

Check all that apply:

1. _____ _____ ☐ MBE ☐ WBE ☐ VBE ☐ Not Low ☐ No reply
   FIRM CONTACTED TRADE

   _____ _____ _____
   CONTACT NAME PHONE E-MAIL

2. _____ _____ ☐ MBE ☐ WBE ☐ VBE ☐ Not Low ☐ No reply
   FIRM CONTACTED TRADE

   _____ _____ _____
   CONTACT NAME PHONE E-MAIL

3. _____ _____ ☐ MBE ☐ WBE ☐ VBE ☐ Not Low ☐ No reply
   FIRM CONTACTED TRADE

   _____ _____ _____
   CONTACT NAME PHONE E-MAIL

4. _____ _____ ☐ MBE ☐ WBE ☐ VBE ☐ Not Low ☐ No reply
   FIRM CONTACTED TRADE

   _____ _____ _____
   CONTACT NAME PHONE E-MAIL

If more space is need attach additional sheet

By my signature, I certify that the above statements are true and accurate, all as of the date below. I also understand that any changes to this plan must be approved by Indiana State University and documented by Construction Change Directive.

Agent of Bidder _____

Date_____

END OF SECTION 00 10 40

Business Diversity Spend Reporting Form for Construction/Renovation/Facilities Repair Projects

Date Submitted		**IMPORTANT NOTICE**
Submitter's Name		Tier II & Tier III Reporting must be submitted with each payment request.
Submitter's Phone #		This is a monthly report. Only report the Tier II and Tier III spend for the month you are reporting.
Submitter's Email		In addition to submitting this form with each payment request, please email this EXCEL file to Mike Bonnett (must be in excel format).
Vendor Name		Email: Mike.Bonnett@indstate.edu
Project Name		Phone: 812-237-3600
Project Street Address		The person submitting this report certifies that to the best of their knowledge, it is true and correct and complete.
Project city/state		
ISU Bid/Project Number		
ISU Purchase Order No.		

Actual Spend Dates (MM/DD/YYYY) for the month you are reporting.

Month Beginning	
Month Ending	

Tier II

Subcontractor Name	Total Contract Committed Amount	For This Month Only Spend Against Committed	Total Spend-to-Date Against Committed	Diversity Class (MBE, MWBE, WBE, VBE)
Total Amount	$ -	$ -	$ -	$ -

Tier III

Subcontractor Name	Total Contract Committed Amount	For This Month Only Spend Against Committed	Total Spend-to-Date Against Committed	Diversity Class (MBE, MWBE, WBE, VBE)
Total Amount	$ -	$ -	$ -	$ -

Spend Outside Committed

Subcontractor Name	Invoiced Amount	Diversity Class (MBE, MWBE, WBE, VBE)
Total Amount		$ -

Summary of all spend to date compared to commitment

Total Contract Award		
Total Contract Diversity Spend Committed in $		
Total Contract Percentage of Committed Diversity Spend as %		
Total Contract Spend-to Date		
Total Diversity Spend-to Date in $		
Total Diversity Spend-to Date as %		

Definitions:
Tier II is defined as Minority, Minority Women, Women and Veteran Owned business who are supplying you with goods, or services, as a Subcontractor, or Supplier on this project.
Tier III is defined as Minority, Minority Women, Women and Veteran Owned business who supply materials, goods, or services to your Subcontractors, or your Suppliers on this project.
MBE is defined as a Minority Owned Business, owns 51% or higher.
MWBE is defined as a Minority/Women Owned Business, owns 51% or higher.
WBE is defined as a Women Owned Business, owns 51% or higher.
VBE is defined as a Veteran Owned Business, owns 51% or higher.

00 10 45

BIDDER'S CERTIFICATION OF A**U**THORIZED EMPLOYMENT

In accordance with Indiana Code 22-5-1. 7 as amended, each Contractor in any tier of a public works project shall not knowingly employ unauthorized aliens. Every contractor shall enroll in and verify the work eligibility status of all employees hired after June 30, 2015 using the U.S. Citizenship and Immigration Services (USCIS) E-Verify program as defined in IC §22-5-1.7-3, unless the E-Verify program no longer exists.

The Prime Contractor shall require their subcontractors who perform work under this Contract to certify to the Prime Contractor that the subcontractor does not knowingly employ or contract with an unauthorized alien and that the subcontractor has enrolled and is participating in the E-Verify program. The Prime Contractor agrees to maintain this certification throughout the duration of the term of a contract with a subcontractor. The successful Prime Contractor and its sub-contractors at all levels shall comply with all provisions of the statute or the Contract is subject to cancellation.

I hereby certify that I have read and understand the "Contractor's Certification of Authorized Employment" provision of the Contract Documents In Section 00 20 11 Amendments to General Conditions Article 13, subparagraph 13.1.7.3 and its subparagraphs and that the undersigned and proposed and actual sub-contractors at all tiers shall comply with the provisions of the Statute

On behalf of and as authorized by the Bidder, I affirm and depose that the Bidder and our Subcontractors shall not knowingly employ unauthorized aliens.

_____

(Bidder - Please print full name of your proprietorship, partnership, or corporation)

_____

(Name - Authorized Signing Officer)

_____

(Title)

_____

(Signature)

_____

(Date)

END OF SECTION 00 10 45

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Indiana State University

Office of the Senior Vice President for
Finance and Administration and University Treasurer
Rankin Hall Suite 200
210 North 7th Street
Terre Haute, Indiana 47809

Contract for Construction Between Indiana State University and Contractor

ISU Form CfC101-19
Based on AIA Form A101

AGREEMENT
Agreement for the Contract of Construction made as of the _____ day of _____ in the year of Two Thousand and _____

BETWEEN the Owner
Indiana State University
210 North Seventh Street
Terre Haute, Indiana 47809-0001

and the Contractor:
(Name and address)

Project is:
(Name and location)

The Architect/Engineer is:
(Name and address)

Indiana State University and the Contractor agree as set forth below:

Part 1 – Contract Documents:

The Contract Documents include this Contract for Construction, Conditions of the Contract (General and Special Conditions), Drawings, Specifications, Addenda issued prior to execution of this Contract, other documents listed in this Contract, and Modifications issued after execution of this Contract; these form the Contract, and are as fully a part of the Contract as if attached to this Contract or repeated herein. This Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representation or agreements, either written or oral. An enumeration of the Contract Documents and other Modifications appears in Part 9 of this document.

Part 2 – Work of This Contract:

The Contractor shall execute the entire work as described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others, or as follows:

Part 3 – Start Date and Substantial Completion Date:

3.01 The Start Date shall be as indicated in Section 00 10 10 of the Project Specifications, as listed in any subsequent Addenda, the Notice to Proceed Letter or as listed below:

3.02 The Contractor shall achieve Substantial Completion as indicated in Section 00 10 10 of the Project Specifications, as listed in any subsequent Addenda, the Notice to Proceed Letter or as listed below:

3.03 Substantial Completion maybe adjusted as allowed under Contract Documents or as mutually agreed upon in writing by the Owner and the Contractor.

Part 4 – Contract Sum:

4.01 Indiana State University shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of _____dollars ($_____) subject to additions or deductions as provided in the Contract Documents

4.02 The Contract Sum is based upon the following Alternates, if any, which are described in the Contract Documents and are hereby accepted by Indiana State University:

4.03 Unit Prices, if any, are as follows:

4.04 Allowances

Part 5 – Progress Payments

5.01 Based on an Application for Payment Issued to the Architect/Engineer by the Contractor, Indiana State University shall make progress payments on the account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.02 The period covered by each Application for Payment shall be on a regular monthly basis of not less than Twenty Eight (28) calendar days.

5.03 When the Application for Payment is received by the Architect/Engineer, Indiana State University shall make payment within fifteen (15) days after the approval of the Application for Payment by the Architect/Engineer and receipt by Indiana State University Office of Finance and Administration.

5.04 Each Application for Payment shall be based on the schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of Work and shall be prepared in a form and supported by such data as required by the Architect/Engineer and Indiana State University to evaluate and substantiate the accuracy of the Application for Payment. Unless objected to by the Architect/Engineer or Indiana State University this schedule of values shall be the basis for all Contractor Applications for Payment.

5.05 Applications for Payment shall indicate the percentage of completion of each portion of Work as of the end of the application period.

5.06 A Partial Waiver of Lien shall be included with each progress Application for Payment.

5.07 Subject to provisions of the Contract Documents, the amount of the Application for Payment shall be computed as follows:

A. Total of all portions of Work indicted on the schedule of values completed during the application period.
B. Total of verified stored materials indicated on the schedule of values acquired during the application period, provided proof of insurance on the storage facility is submitted.
C. Total of all Change Orders approved or Change Directives issued during the application period.
D. Less a Retainage of ten percent (10%)
E. Subtract the aggregate of previous Applications of Payments made to Indiana State University and subtract amounts, if any, withheld or nullified by the Architect/Engineer.

5.08 The progress payment amount determined by Section 5.06 shall be further modified under the following circumstances

A. Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to ninety five percent (95%) of the Contract Sum; less any amounts the Architect/Engineer or Indiana State University shall determine for incomplete work and unsettled claims.
B. Add, if final completion of the work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Subparagraph 9.10.3 of the General Conditions.

5.09 Reduction or Limitation of Retainage:

A. At the sole written discretion of Indiana State University, if acceptable progress is made, at fifty percent (50%) completion of the Contract Sum the remaining Retainage may be reduced to 0%.

Part 6 – Final Payment

6.01 Final payment, constituting the remaining unpaid balance of the Contract Sum, shall be made to the Contractor by Indiana State University when:

A. The Contract has been fully performed by the Contractor as detailed in the Contract Documents.
B. Approval of the Final Application for Payment is received from the Architect/Engineer.

6.02 No Contractor claims for additional compensation shall be permitted or accepted more than sixty (60) days following the Contractor's submission of their Final Application for Payment.

6.03 Payment shall be made by Indiana State University 61 days after issuance of the of the Contractor's Final Application for Payment and Final Waiver of Lien and final approval from the Architect/Engineer of the Final Application for Payment.

Part 7 – Miscellaneous Provisions

7.01 Where reference is made in this document to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

Part 8 – Termination or Suspension

8.01 The Contract may be terminated by Indiana State University or the Contractor as provided in Article 14 of the General Conditions.

8.02 The Work may be suspended by Indiana State University as provided in Article 14 of the General Conditions.

Part 9 – Enumeration of Contract Documents

9.01 The Contract Documents, except for Modifications issued after execution of this Contract, are enumerated as follows:

A. The agreement is this executed **Contract for Construction Between Indiana State University and Contractor, ISU Form CfC101-20**.

B. The General Conditions are the General Conditions of the Contract for Construction, AIA Document A201.

C. The Supplementary and Other Conditions are those contained in the Project Specifications and are as follows:
See attached Exhibit A Sections 00 and 01

D. The Specifications:
See attached Exhibit A Sections 02-33 as applicable

E. The Drawings:
See attached Exhibit B

F. The Addenda:

Number	Date	Pages

G. Other Documents, if any, forming the Contract Documents are as follows:
Certification Regarding Suspension, Debarment, Ineligibility and Voluntary Exclusion Form, MBE/WBE/VBE Participation Plan, Contractor's Certification of Authorized Employment Form, Award Letter, Purchase Order

This agreement is entered into as of the day and year first written above and is executed by electronic copy in PDF format of which one is delivered to the Contractor, one is delivered to the Architect/Engineer, and the remainder to Indiana State University for distribution to the ISU Purchasing Department, the Office of the Senior Vice President for Finance and Administration and the ISU Department of Facilities Management.

Indiana State University	Contractor
_____	_____
(Signature)	*(Signature)*
Diann E. McKee	_____
(Printed or Typed Name)	*(Printed or Typed Name)*

Exhibit A – Refer to Addenda for any additions, deletions or revisions to these Specification Sections

Exhibit B – Refer to Addenda for any additions, deletions or revisions to these Drawings

BID FORM

BASED ON BID FORM
FORM NO. 96
REVISED FORMAT 1/14/2013

GENERAL BID FOR PUBLIC BUILDING

PROJECT: **Early Childhood Education Center Bid Number B0028379**

TO: INDIANA STATE UNIVERSITY
BOARD OF TRUSTEES
TERRE HAUTE, INDIANA

FROM:

_____
(Name of Bidder) (Company Name)

_____
(Address)

_____
(City, State, Zip)

PHONE NUMBER _____

DATE: _____

SUBMITTED BY: _____ _____
(Signature) (Title)
The Bidder's signature certifies the Bidder is in compliance with all aspects of the Bid Documents

ADDENDA
The following Addenda have been received. The modifications to the bidding documents noted therein have been considered and all costs thereto are included in the Bid Sum(s).

Addendum #_____	Dated _____
Addendum #_____	Dated _____
Addendum #_____	Dated _____
Addendum #_____	Dated _____
Addendum #_____	Dated _____
Addendum #_____	Dated _____

OWNER'S RIGHTS REGARDING ACCEPTANCE OF BIDS
It is understood that the Owner reserves the right to accept or reject any Bid and to waive any irregularities in Bidding. It is further understood on Bids with multiple Base Bid Packages the Owner reserves the right to selectively Award individual Base Bid Packages to multiple Prime Bidders submitting the lowest and best Bids for the individual Base Bid Packages.

TAX EXEMPT
Indiana State University is a Tax Exempt Institution and Indiana Sales Tax for products permanently incorporated in work shall not be included as part of the Bid. All other applicable Federal, State and Local taxes shall be included in the Bid sum. Tax exempt certificate available upon request.

BID FORM

OFFER:
Pursuant to and in compliance with 'Instructions to Bidders', and other Bidding Documents prepared by the Indiana State University Facilities Management Department for the above mentioned project, the signer, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the Work at the place where the Work is to be completed, and having fully inspected the site in all particulars, hereby proposes and agrees to fully perform the Work within the time stated and in strict accordance with the intent of the proposed Contract Documents, including furnishing bonds, insurance, labor, materials, and to do all the Work required to construct and complete in accordance with the proposed Contract Documents as follows:

BASE BID
Renovation of the existing Chestnut Building and surrounding site for the Bayh College of Education Early Childhood Education Center per Specifications and Drawings.

Base Bid Total $_____
_____ Dollars
(State Amount in Words)

ALTERNATE BIDS Refer to Section 01 10 00 Summary of Work 1.04 Scope of Work-Alternates for details

1. Alternate No. 1: High STC Walls

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

2. Alternate No. 2: Kitchen Equipment

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

3. Alternate No. 3: Exterior Entrance Canopy

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

4. Alternate No. 4: Second Floor Glazing Systems

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

5. Alternate No. 5: Crib Dividers

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

6. Alternate No. 6: Residential Appliances

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

7. Alternate No. 7: Replace Domestic Water Heater

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

8. Alternate No. 8: Remove Abandoned Chiller

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

9. Alternate No. 9: Fencing

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

10. Alternate No. 10: Outdoor Storage

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

11. Alternate No. 11: Lighting replacement Parking Lot 21

_____ Dollars ($_____)
(State Amount in Words) Add ☐ Deduct ☐

ALLOWANCES

1. A $10,000.00 Allowance shall be included in the Base Bid for the A/E to create “Record Drawings” as detailed in Section 01 77 00 Contract Closeout.
2. A $200,000.00 Allowance shall be included in the Base Bid for Unforeseen Conditions and General Construction Contingency. It is solely at the discretion of the Architect/Engineer/Owner what costs may be applied to this Allowance.
3. A $15,000 shall be included in the Base Bid for Custom Wall Graphics including staging and scaffolding required for installation.

ACCEPTANCE

This offer shall be opened to acceptance and is irrevocable for the period as follows:

- Base Bid and All Alternates - One Hundred Twenty (120) calendar days from the Bid opening date.

If the Owner accepts the Bid within the time period stated above, Bidder will:

- Furnish the required bonds and insurance certificates within ten (10) calendar days of receipt of the Award Letter
- Commence work within seven (7) calendar days of receipt of the Award Letter or as Directed by the Owner.
- Execute the Contract for Construction Between Indiana State University and Contractor within seven (7) calendar days of receipt of the Contract.

The Bidder agrees to coordinate and expedite their work and that if the Award is given within fourteen (14) calendar days from the Bid opening date the work shall be substantially completed as listed in Section 00 10 10 Instructions to Bidders 1.01 C. If the Award is not made within the stated fourteen (14) calendar days then the substantial completion date may be adjusted as allowed by the Contract Documents or as mutually agreed upon in writing by the Owner and Contractor.

COMPLIANCE WITH LAWS

The Bidder shall comply with all applicable federal, state, and local laws, rules, regulations, and ordinances including but not limited to Indiana Code 5-16 and all provisions required thereby to be included herein are hereby incorporated by reference. Bidder warrants Contractor and any subcontractors shall obtain and maintain all required permissions, permits, licenses, registrations, accreditations, certifications, and approvals, and shall comply with all employment, labor, EEOC, E-verify, health, safety, and environmental statutes, rules, or regulations related to the products and services offered under this agreement. Bidder and any principals of the Contractor certify compliance with the requirements of Indiana Code § 5-16-1-9 Application of Indiana Code 5-22-16.5 (e.g. Company has not and will not participate in any investments or activities in Iran and refrains from engaging in any new investments or activities in Iran).

NON-COLLUSION AFFIDAVIT

The Bidder, by its officers and agents or representatives present at the time of filing their bid, being duly sworn, say on their oaths that neither they nor any of them have in any way, directly or indirectly, entered into any arrangement or agreement with any other bidder, or with any public office of the State of Indiana, of any county or municipality or other public offices whereby such affiance or either of them, has paid or is to pay to such other bidder or public officer any sum of money, or has given or is to vie to such other bidders or public officer anything of value whatever, or such affiance of affiance or either of them has not, directly or indirectly entered into any arrangement or agreement with any other bidder or bidders, which tends to or does lessen or destroy free competition in letting of the contract sought for by the attached bids; that no inducement of any form or character other than which appears upon the face of the bid will be suggested, offered, paid, or delivered to any person whomsoever to influence the acceptance of the said bid or awarding of the contract, nor has this bidder any agreement or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds of the contract sought by this bid.

NON-DISCRIMINATION

The Bidder and its Subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to their hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of their sex, race, natural origin, ancestry or religion or disability as prohibited under the Americans with Disabilities Act. Breach of this covenant may be regarded as a material breach of the Contract.

CERTIFICATION OF UNITED STATES STEEL PRODUCTS

The Bidder certifies that the Bidder and all Subcontractors will comply with the statutory obligations to use steel products made in the United States.

MBE/WBE/VBE BIDDING:
See Section 00 10 30 for requirements for MBE/WBE/VBE Compliance. Section 00 10 40 MBE/WBE/VBE Participation Plan must be completed by **all Bidders** and submitted with the Bid. Failure to submit with the Bid may be sufficient cause to disqualify a Bid.

EXPERIENCE QUESTIONNAIRE

List similar projects completed by your organization:

1. Contract Amount _____

   Description _____

   Date Completed _____

   Owner_____
   (Name and phone #)

2. Contract Amount _____

   Description _____

   Date Completed _____

   Owner _____
   (Name and phone #)

List similar projects currently under construction by your organization

1. Contract Amount _____

   Description _____

   Date Completed _____

   Owner _____
   (Name and phone #)

2. Contract Amount _____

   Description _____

   Date Completed _____

   Owner _____
   (Name and phone #)

Yes ☐ No ☐ Has your organization ever failed to complete any work awarded it?
If yes, where and why?

_____

_____

_____

Yes ☐ No ☐ Does your Organization have any pending litigation or litigation completed within the past five (5) years initiated by your Organization or the Owner as a result of your work on another Project?

If yes, attach a complete listing, with your Bid, of all such litigation(s) and name(s) of Institutions and/or Parties involved with complete contact information. Failure to submit this information may result in disqualification of your Bid.

Yes ☐ No ☐ Has your Organization been cited for violation of State or Federal regulations within the past twelve months?

If yes, what was the violation and resolution?

_____

_____

_____

List references from firms for which your organization has performed work. Provide firm name, contact person name and phone number.

_____

_____

_____

APPENDICES

The following Appendices are submitted with the Bid:
Appendix A - Subcontractors and Material/Supplier Lists
Appendix B - Unit Prices
Appendix C - Wage Rate Schedule

OATH AND AFFIRMATION

Attested to this ____ day of _____, 202____

By _____

ACKNOWLEDGMENT

State of _____
SS:

County of _____

_____ being duly sworn, deposes and
(Name of person)

says that he/she is _____ of
(Title)

_____ and that the
(Name of organization)
statements contained in the foregoing bid, certification and affidavit are true and correct.

Subscribed and sworn to before me by _____

this _____ day of _____, 202___

_____
Notary Public

My Commission Expires _____

County of Residence _____

SUPPLEMENTS TO BID FORM

TO: INDIANA STATE UNIVERSITY

PROJECT: **Early Childhood Education Center Bid Number B0028379**

DATE: _____

SUBMITTED BY:
(full name)

(full address)

In accordance with Instructions to Bidders and Bid Form, we include the Supplements to Bid Form for Appendices listed below. The information provided shall be considered an integral part of the Bid Form.

Appendix A - Subcontractor and Manufacturers List (to be submitted at time of Bid)
Failure to submit may be cause to disqualify bid

_____
(Bidder)

_____
(Project)

The following will be performed (or provided) by the Subcontractors and Manufacturers listed herein and coordinated by us.
The Prime Contractor (Bidder) shall list all Subcontractors and Suppliers/Manufacturers called for in Appendix A of this Bid Form at the time of Bid Submission. Failure to provide this information may be sufficient cause to disallow a Bid.
The Prime Contractor (Bidder) shall use the Subcontractors, Suppliers, Materials and Equipment as listed in the Bid Form Appendix "A" submitted at the time of Bid. It is the Prime Contractor's (Bidder's) responsibility to assure they have listed the correct Subcontractors, Suppliers, Materials and Equipment on their Bid Form. THERE SHALL BE NO CHANGES PERMITTED TO THESE LISTS.
Exception: If the Owner determines the Subcontractors, Suppliers, Materials or Equipment are not acceptable, the Owner shall notify the Prime Contractor (Bidder) in writing within two (2) working days after receipt of Bids of the unacceptable Subcontractor(s), Supplier(s), Material(s) and/or Equipment(s).

(Listings begin on next page)

SUBCONTRACTOR LIST

Bidder shall provide the names of all applicable Subcontractors

Description	Subcontractor
HVAC	_____
Sheet Metal	_____
Plumbing	_____
Fire Protection	_____
Electrical	_____
Telecommunications	_____

SUPPLIER & MANUFACTURERS LIST

Bidder shall provide the names of all applicable Suppliers and Manufacturers

Product Description	Supplier	Manufacturer
Elevator	_____	_____

(Appendix B begins on the next page)

Appendix B – Comprehensive Subcontractor and Supplier & Manufacturer List to be submitted by 4:30pm on the day Bids are received by the two apparent low Bidders. See Section 00 10 10 Instructions to Bidders Part 3 3.17 for full details.

SUBCONTRACTOR LIST
Bidder shall provide the names of all applicable Subcontractors

Description	Subcontractor
Cast-In-Place Concrete	_____
Saw-Cutting	_____
Masonry	_____
Structural Steel	_____
Interior Metal Framing / Gypsum Board	_____
Flooring	_____
Painting	_____
Fencing	_____
Playground Surfacing	_____
Concrete Paving	_____
Lawns / Landscaping	_____
Air Balancing	_____
Temperature Controls	_____
Access Control Installation	_____
Security Camera Installation	_____

SUPPLIER & MANUFACTURERS LIST
Bidder shall provide the names of all applicable Suppliers and Manufacturers

Product Description	Supplier	Manufacturer
Hollow Metal Frames	_____	_____
Flush Wood Doors	_____	_____
Door Hardware	_____	_____
Ceiling Grid	_____	_____
Ceiling Tile	_____	_____

Resilient Base	_____	_____
Resilient Tile Flooring	_____	_____
Tile Carpeting	_____	_____
Casework	_____	_____
Metal Pan Stairs/Pipe and Tube Railings	_____	_____
Aluminum Storefront and Entrance Systems	_____	_____
Glazed Aluminum Curtainwalls	_____	_____
Aluminum Windows	_____	_____
AHU Fans	_____	_____
Pumps	_____	_____
VAV Boxes	_____	_____
Fire Pump	_____	_____
Water Heater	_____	_____
Plumbing Fixtures	_____	_____
Electrical Panels	_____	_____
Transformers	_____	_____
Interior Lighting	_____	_____
Exterior Lighting	_____	_____
Lighting Controls	_____	_____
Emergency Generator	_____	_____
Transfer Switches	_____	_____
Wiring Devices	_____	_____
Adjustable Frequency Drives	_____	_____
Fire alarm	_____	_____
Access Control	_____	_____
Security Cameras	_____	_____

Appendix C – Unit Prices

No Unit Prices Requested

Appendix D – Wage Rate Schedules
By 2:00pm on the next business day after receipt of Bids the Bidder shall submit, a wage rate schedule for the workers of the Prime Bidder and all major Subcontractors involved in the Work. Failure to supply the wage rate schedule(s) as required by the Bidding Documents may be sufficient cause to disallow a Bid

END OF SECTION 00 20 00

DRAFT

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
« »
« »

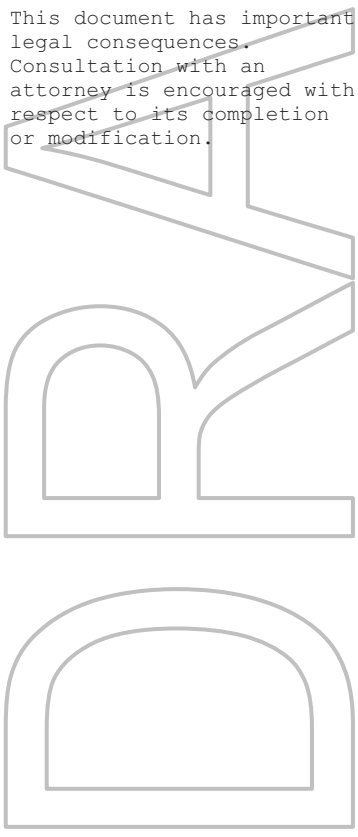
THE OWNER:
(Name, legal status and address)
« »« »
« »

THE ARCHITECT:
(Name, legal status and address)
« »« »
« »

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.



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INDEX
(Topics and numbers in bold are section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or

the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other

facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume

the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be

required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may

be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that

the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a separate contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect,

stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the

Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction

of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or

otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the

Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an

additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

PART 1 – GENERAL

1.01 AMENDMENTS TO GENERAL CONDITIONS

A. The General Conditions for this Project shall be the American Institute of Architects' Document A201-2007, "General Conditions of the Contract for Construction, Articles 1 through 15, inclusive, 38 pages, and hereafter referred to as the "General Conditions." Such document is specifically made a part of the Contract Documents.

B. The following amendments shall modify, delete, and supplement the General Conditions. Where any Article, Paragraph, or Subparagraph in the General Conditions is supplemented by one of the following Paragraphs, the provisions of such Article, Paragraph, or Subparagraph shall remain in full force and effect and the supplemental provisions shall be considered as added thereto. Where any Article, Paragraph not so amended, deleted, voided, or superseded shall remain in full force and the order and numbering of subsequent articles, Paragraphs or Subparagraphs shall be changed to read as if in sequence.

C. Refer to other Division 00 documents for additional supplemental requirements.

PART 2 – AMENDMENT ARTICLES

2.01 ARTICLE 1

A. Subparagraph 1.1.1: Amend this Subparagraph by deleting the last sentence beginning with the words "Unless specifically enumerated" and substituting the following sentence: "The Contract Documents shall also include the Notice to Bidders, Instructions to Bidders, Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion, Bid Form, Subcontractors and Materials Listing, Contractor's Non-Collusion Affidavit, and all portions of Addenda relating to Bidding Requirements."

B. Add the following Subparagraph 1.1.7

"1.1.7 ARCHITECT/ENGINEER"

"Where the word Architect is used in the AIA A201-2007 it shall be inferred to also include the Design Engineer(s), e.g. Architect/Engineer, Engineer (for Engineer only Administered Projects).

C. Add the following Section 1.7

"1.7 LITIGATION

1.7.1 All litigation under this Contract must be initiated in Vigo County, Indiana and Contractor consents to the jurisdiction of the Vigo County courts.

1.7.2 Contractor hereby waives its right to a jury trial in any matters litigated in Vigo County.

1.7.3 In any litigation initiated by Contractor, Contractor shall reimburse all attorney's fees and expenses incurred by Owner up to a maximum of $100,000 provided Contractor has presented its claims as required by this Contract and the Owner has made a good faith offer to resolve any dispute prior to litigation. The determination of a 'good faith offer' shall rest solely with the Architect who will render their opinion in writing to Contractor or Owner upon request prior to Contractor initiating litigation or thereafter as requested. The Architect's decision is binding on Owner and Contractor and admissible in court as determinative of this issue.

1.7.4 In any litigation initiated by Owner against Contractor, provided Contractor was given the opportunity to resolve all issues prior to litigation being initiated and failed to do so through a reasonable offer, as determined by the Architect, then Contractor shall be responsible to reimburse all attorney's fees and expenses incurred by Owner for all litigation as well as for all pre-litigation activities engaged in by the Owner for

investigating, evaluating, or mediating any claims, issues, or matters related to Contractor."

2.02 ARTICLE 2

A. Subparagraph 2.1.2: Delete this Subparagraph in its entirety.

B. Subparagraph 2.2.5: Amend this Subparagraph by adding "electronically" after the word Documents in the second line.

2.03 ARTICLE 3

A. Paragraph 3.2: Amend this Paragraph by deleting Subparagraph 3.2.1 in its entirety and replacing with the following new subparagraph 3.2.1 and its subparagraphs:

"3.2.1 By executing the Contract, the Contractor represents to the Owner that:"

"3.2.1.1 The Contractor has a high level of experience and expertise in the business administration construction, management, workplace health and safety supervision and superintendence of projects of similar size and complexity and that it will perform the Work with the care, skill and diligence of such a contractor."

"3.2.1.2 Contractor and, to the best of its knowledge, its subcontractors are financially solvent, able to pay all debts as they mature and have sufficient working capital to complete the Work and all obligations thereunder."

"3.2.1.3 The Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work."

"3.2.1.4 Contractor is authorized to do business in the State of Indiana."

"3.2.1.5 Contractor's execution of the Contract and its performance thereof are within its authorized powers."

"3.2.1.6 Contractor has:"

"3.2.1.6.1 Studied the Contract Documents, understands their provisions and that that they are sufficiently detailed and complete to permit the Contractor to perform the Work in accordance with the Contract Documents, within the Contract Time and for the Contract Sum."

"3.2.1.6.2. Inspected the Project site."

"3.2.1.6.3 Investigated and satisfied itself as to:"

"3.2.1.6.3.1 The site and locality where the Work is to be performed and the conditions and difficulties to be encountered, including access thereto."

"3.2.1.6.3.2 The availability of utilities and access thereto."

"3.2.1.6.3.3 Conditions affecting transportation, disposal, handling and storage of materials, supplies and equipment."

"3.2.1.6.3.4 Any materials, supplies or equipment which are to be furnished by the Owner for the Contractor's use."

"3.2.1.6.3.5 The type and availability of tools, equipment and facilities to perform the Work."

"3.2.1.6.3.6 The availability and adequacy of labor and trades, and, if applicable, union wage scales, benefits, working conditions, craft jurisdictions, area practices and collective bargaining agreements affecting the Work."

"3.2.1.6.3.7 Prevailing weather and climatological conditions."

"3.2.1.6.3.8 All laws applicable to the Work and to the Contractor."

"3.2.1.6.3.9 All other factors which may affect the Contractor's performance of the Work."

B. Paragraph 3.4: Amend this Paragraph by adding Subparagraphs 3.4.4 through 3.4.7 as follows:

"3.4.4 The Contractor shall employ competently trained and experienced engineers and supervisors, who shall coordinate general, mechanical, and electrical Work and crafts with the required construction progress. The Contractor shall exercise complete control over their Subcontractor(s) in a manner which will unite their efforts toward completion of the project as contracted."

"3.4.5 The Contractor shall continuously maintain adequate protection of all their Work and the Work of Subcontractors from damage and shall hold harmless the Owner and Architect/Engineer from injury or loss arising in connection with this contract, including legal defense costs. The Contractor shall make good any such damage, injury, or loss, except such as may be directly due to errors in the Contract Documents or those caused by agents or employees of the Owner."

"3.4.6 The Contractor shall be responsible for and shall establish and verify exterior lines and the required elevations of all buildings and structures to be erected at the site."

"3.4.7 The Contractor shall coordinate and expedite the Work of all lower tier Contractors."

C. Paragraph 3.5: Amend this Paragraph by adding Subparagraphs 3.5.1, 3.5.2, and 3.5.3 as follows:

"3.5.1 The Contractor shall warranty that all Work executed under the respective sections will be free from defects of materials and workmanship for the period of one (1) year from the Date of Substantial Completion of the Work or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents. The Contractor further agrees that they will, at their own expense, repair and replace all such defective Work, and all other Work damaged that becomes defective during the term of the warranty. Where warranties are required, Contractor shall secure warranties in writing from Subcontractors, manufacturers and/or material suppliers addressed to and in favor of the Owner and deliver same to the Owner upon completion of Work. Delivery of warranties shall not relieve the Contractor from any obligations assumed under any other provisions of Contract."

"3.5.2 Any damage to the building or its contents and/or Work of other Contractors caused by failure of any piece of equipment and/or faulty installation shall be repaired or replaced by the party or parties furnishings the original equipment/installation and paid for by the Contractor at fault."

"3.5.3 An inspection of the installed Work and/or equipment will be made just before the end of the stipulated warranty period and any installations and/or equipment which, in the opinion of the Architect/Engineer and/or Owner, show undue wear, failure, incorrect operation, or otherwise do not conform to the letter and intent of the Contract Documents shall be repaired or replaced by the Contractor furnishing same at no additional charge."

D. Paragraph 3.6: Amend this Subparagraph by adding the words "Unless otherwise provided in the Contract Documents," to the beginning of this Paragraph.

E. Paragraph 3.9: Amend this Paragraph by adding Subparagraph 3.9.4 as follows:

"3.9.4 Subcontractors for any other Work shall have a competent superintendent at the site at all times when Work is being performed under their contracts.

F. Paragraph 3.13: Amend this Paragraph by adding Subparagraph 3.13.1 as follows:

"3.13.1 The Contractor shall prepare an overlay sketch of the construction areas indicating spaces assigned for field office, storage sheds, containers, trailers and field

shops, and for stockpiles and staging of materials for all trades. This sketch shall be submitted to the Owner and the Architect/Engineer for their information prior to moving any such equipment and materials onto the Project Site."

G. Paragraph 3.16: Amend this Paragraph 3.16 adding the following to the end:
"If Work is being executed at locations other than the Project site, the Contractor shall notify the Architect/Engineer where such Work is being executed, and at what time such Work will be ready for inspection, in order that the Architect/Engineer may inspect such Work Prior to its delivery to the Project Site."

H. Paragraph 3.18: Amend this Paragraph by adding Subparagraph 3.18.3 as follows:
"3.18.3 The Contractor shall indemnify the Owner and Architect/Engineer for any claim, demand or expense which may be made by reason of:
".1 Any injury to person or property sustained by the Owner or by any person, firms, or corporations, if caused by the Contractor."
".2 Any injury to person or property sustained by any person, firms, or corporations caused by an act or omission of the Contractor or of any person, firm, or corporation directly or indirectly employed by him in connection with this Work, whether the said injury or damage occurs upon or adjacent to the Work."
".3 The Contractor, at his own cost, expense, and risk, shall defend any and all actions, suits, or other legal proceedings that may be rendered against the Owner and Architect/Engineer in any such action, suit, or proceedings."
".4 The Contractor shall indemnify the Owner and Architect/Engineer from any and all costs resulting from any claim or suits in connection with liens that may be brought or instituted against the Owner. Neither the final payment or any part of the retained percentage of the Contract shall become due until the Contractor has delivered to the Owner a complete release of all liens arising out of the Contract."

2.04 ARTICLE 4

A. Subparagraph 4.1.2: Delete this Subparagraph in its entirety.

B. Subparagraph 4.2.7: Modify the first sentence of this Subparagraph by deleting the words "approve or take" and substituting the word "indicate."

C. Subparagraph 4.2.10: Amend this Subparagraph by adding the words "in writing" after the word "agree" in the first sentence.

2.05 ARTICLE 5

A. Paragraph 5.3: Amend this Paragraph by adding the following sentence thereto:
"Unless otherwise excepted, nothing contained in this Contract shall create any contractual relationship between any Subcontractor and the Owner."

2.06 ARTICLE 6 (NO CHANGE)

2.07 ARTICLE 7

A. Paragraph 7.1: Amend this Paragraph by adding the following new Subparagraph 7.1.4:
"7.1.4 When a change in the Work is contemplated which may affect the Contract Sum or duration of the Work, the Architect/Engineer will issue a 'Proposal Request' detailing the Work involved in such proposed change. Upon receipt of such 'Proposal Request,' the Contractor shall promptly, but in no case longer than five (5) working days, issue a reply or 'Change Quotation,' stipulating the change in cost of Project and/or duration as a result of the proposed change. This issuance of a Proposal Request does not, in any way, authorize commencement of the Work therein described. Should, after review and consultation with the Owner, the Architect/Engineer find the 'Change Quotation' by the

Contractor to be acceptable, the Architect/Engineer will within thirty (30) calendar days issue a written 'Change Order' to the Contractor."

B. Add the following Subparagraph 7.1.5 as follows

"7.1.5 If Contractor proceeds with change order work before receiving a fully executed change order or change directive, then Contractor waives the right to object to the scope of work change, the amount of the change order, and the adjustment, if any, to the time of performance."

C. Amend Subparagraph 7.3.3 by adding the following Subparagraphs:

".5 Time and material."

".6 Extra Work performed under Item .5 above shall be upon the option of the Owner only in the event that the lump sum required under Item .1 is not acceptable."

".7 Extra Work shall be performed for the cost of the labor payroll plus 15% of the labor payroll and the cost of the material plus 5% of the material cost. Said markup fees are intended to compensate for the cost of payroll taxes, insurance of all kinds, all taxes of the Contractor, including State Taxes, Federal Income Tax, Unemployment, and FICA Taxes, as well as all other overhead costs, expenses, and carrying charges whatsoever, including the profit to be derived from such additional Work. Labor payroll is defined as the actual hourly labor cost plus any fringes payable as listed on the wage rate schedule(s) provided as required by the Bidding Documents.

.8 In case such Work is performed by a Subcontractor or a lower tier Contractor with the Owner's consent, the Work shall be marked up as indicated in 7.3.3.7 by the Contractor actually performing the Work. Each succeeding Contractor may mark up their direct labor and material costs as indicated in 7.3.3.7. Otherwise each succeeding Contractor, including the Prime Contractor, may add 5% for handling/coordination. Additional mark-ups of a Subcontractor's costs shall not be permitted.

".9 Costs for bond premiums are allowable provided documentation from the Bonding Company is included detailing the added bond cost premium, the current bond total and the new bond total."

D. Subparagraph 7.3.7: Amend the following:

.1 Delete the text and replace with:

".1 The cost of the labor payroll plus 15% of the labor payroll;"

.2 Delete the semicolon at the end of the sentence and add "plus 5% of the total of the costs;"

.3 Delete the semicolon at the end of the sentence and add "plus 5% of the total of the costs;"

.4 Delete all text following the word bonds in the first line and replace with ",with documentation from the Bonding Company including details of the added bond cost premium, the current bond total and the new bond total;"

.5 Delete the text and replace with:

".5 Additional costs of supervision directly attributable to the change if the change results in supervision of change work at a time outside the normal work hours of the Project."

E. Paragraph 7.3: Add the following new Subparagraphs 7.3.11, 7.3.12, and 7.3.13:

"7.3.11 When extra Work is performed under Item 7.3.3.2 above, said unit prices shall represent the total cost to the Owner and shall not be subject to any additional charges whatsoever."

"7.3.12 In order to facilitate checking of quotations for extras or credits, all proposals shall be accompanied by a complete breakdown of costs, including labor, material, and subcontracts. Labor and material shall be marked up in the manner prescribed herein. Where cost items consist of major subcontracts, such contracts shall be broken down in a similar fashion."

"7.3.13 When changes are made that result in a credit to the Owner, the value of the credit will be established by the method indicated in Items 7.3.3.1 or 7.3.3.2"

2.08 ARTICLE 8 (NO CHANGE)

2.09 ARTICLE 9

A. Subparagraph 9.3.1: Amend this Subparagraph by deleting the words "if required" in the third line.

B. Paragraph 9.3: Amend this Paragraph by adding Subparagraph 9.3.4 as follows:

"9.3.4 The Owner will retain, until the Work is at least fifty percent (50%) complete, ten percent (10%) of the amount due the Contractor on account of approved progress payments. At the time the Work is at least fifty percent (50%) completed or thereafter, if the manner of completion of the Work and its progress are and remain satisfactory to the Owner and Architect/Engineer, and in the absence of other good and sufficient reasons, the Architect/Engineer will (upon presentation by the Contractor of Consent of Surety) recommend to the Owner that any remaining approved partial payments be paid in full. Regardless of the Owner's decision relative to further retainage, all prior retainages that were withheld will be held until completion of the contract Work and all remedial Work, listed as conditions of substantial completion, and following final payment. If retainage is limited to ten percent (10%) of the first fifty percent (50%) of the contract amount, as described above, five percent (5%) will be withheld from payments for all subsequent change orders; therefore, the minimum retainage shall be five percent (5%) of the current contract amount."

C. Subparagraph 9.6.3: Delete this Subparagraph in its entirety.

D. Subparagraph 9.6.5: Delete this Subparagraph in its entirety.

E. Paragraph 9.7: Delete the text of this Paragraph and replace with the following new Subparagraphs 9.7.1 and 9.7.2

"9.7.1 The Architect shall issue to the Owner a Certificate for Payment within seven calendar days after receipt of the Contractor's Application for Payment. Upon receipt of the Certificate for Payment (Application for Payment) from the Architect, the Owner will endeavor to make payment to the Contractor within fifteen calendar days. If payment is not made within a reasonable time, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents."

"9.7.2 If an Application for Payment is being held for just cause, the Architect shall notify the Contractor in writing of the cause and what remedial action must be taken for the Application for Payment to be released for payment.

F. Subparagraph 9.10.2: Amend this Subparagraph by deleting the word "and" in the eighth line and adding the following after the "Owner" in the eleventh line:

"and (6) the Architect/Engineer has received the required Record Drawings, brochures, manuals, operating instructions, warranties, affidavits, final application for payment, any other special data requirements and has performed a final inspection and confirmed that all items of completion are correct and acceptable at which time he will initiate a 'Final Completion' letter establishing the date of Final Completion."

2.10 ARTICLE 10

A. Subparagraph 10.2.2: Amend this Subparagraph by adding the following to the end thereof:
"In the event of conflict between these Contract Documents and any Federal, State, or Local Authority laws, rules, regulations, or requirements, the most stringent requirement shall govern the Work."

B. Subparagraph 10.3.1: Amend this Subparagraph by deleting the phrase "and Architect" in the sixth line.

C. Subparagraph 10.3.2: Amend this Subparagraph by deleting the phrase "and Architect" in the second sentence; deleting the phrase "and the Architect" from the third sentence; and by deleting the words "either" and "or Architect" from the fourth sentence; by replacing the phrase, "and the Architect have" with the word "has" in the fourth sentence.

D. Paragraph 10.3 add the following Subparagraph 10.3.7
10.3.7 "The Contractor shall also comply with all the safety paragraphs listed in Section 00 30 00 of the Contract Documents. In the event of conflict between 10.3 and Section 00 30 00, Section 00 30 00 shall prevail."

2.11 ARTICLE 11

A. Article 11: Insert a new Subparagraph 11.1 and renumber each succeeding Paragraph accordingly:
11.1 See Specification Section 00 20 20 for additional requirements. In the event of conflict between Section 00 20 20 and this Paragraph 11, requirements of Section 00 20 20 shall prevail.

B. Subparagraph 11.1.1 (renumbered 11.2.1): Amend this Subparagraph by adding the phrase, "and that are acceptable to the Owner," following the word "located," in the second line.

C. Subparagraph 11.1.1 (renumbered 11.2.1): Amend this Subparagraph by adding the phrase, ", Indiana State University, the Indiana State University Board of Trustees and the Architect/Engineer," following the word "Contractor," in the second line.

D. Subparagraph 11.1.1 (renumbered 11.2.1): Amend this Subparagraph by adding Sub-Subparagraphs .9 and .10 as follows:
".9 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:
Premises Operations (including X, C, and U coverage's as applicable)
Independent Contractor's Protective
Products and Completed Operations
Personal Injury Liability with Employment Exclusion deleted
Contractual, including specified provision for the Contractor's obligations under Paragraph 3.18
Owned, non-owned and hired motor vehicles"
".10 Broad Form Property Damage including Completed Operations: If the General Liability coverage's are provided by a Commercial General Liability Policy on a claims made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverage's required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2."

E. Subparagraph 11.1.2 (renumbered 11.2.2): Add the following renumbered Subparagraph 11.2.2.1

"11.2.2.1 The insurance required by renumbered Subparagraph 11.2.1 shall be written for not less than the following limits, or greater if required by law:
See Section 00 20 20 for Insurance Requirement Levels

F. Subparagraph 11.1.3 (renumbered 11.2.3): Amend this Subparagraph by changing the word "30" to "60" in the second sentence.

G. Subparagraph 11.1.3 (renumbered 11.2.3): Amend this Subparagraph by deleting the last sentence beginning with the phrase, "Information concerning reduction…." And substituting the following:
"The form of the certificate shall be AIA Document G715, SUPPLEMENTAL ATTACHMENT for Acord Certificate of Insurance 25-S (7/90). Contractor shall furnish promptly to the Owner copies of any endorsements that are subsequently issued amending coverage or limits. Certificates of Insurance shall name the Owner (Indiana State University Board of Trustees) and Architect/Engineer as 'Additional Insured's."

H. Paragraph 11.1(renumbered 11.2): Amend this Paragraph by adding Subparagraph 11.2.5 as follows:
"11.2.5 The Contractor, in connection with the above mentioned Workmen's Compensation and Occupational Disease Insurance, shall furnish to the Owner, prior to commencement of the Work, duly executed and validated forms as prescribed by the Indiana Industrial Board showing that such insurance is in full force and effect."

I. Sub-subparagraph 11.3.1.1 (renumbered 11.4.1.1): Amend this Subparagraph by adding the following Subparagraph 11.4.1.1.1:
"11.4.1.1.1: Such Insurance shall not insure against loss due to theft of Contractor's, Subcontractor's, Sub-Subcontractor's tools, equipment, and other personal property. The responsibility to guard against such thefts shall lie with the respective Contractor, Subcontractor, or Sub-Subcontractor whose tools, equipment, and other personal property are susceptible to such thefts."

J. Subparagraph 11.3.1.3 (renumbered 11.4.1.3): Add the following phrase to the end of the sentence:

The deductible amount shall be $25,000.00 unless otherwise advised by the Owner.

K. Subparagraph 11.3.9 (renumbered 11.4.9): Delete this Subparagraph in its entirety.

2.12 ARTICLE 12

A. Subparagraph 12.2.2.1: Amend this Subparagraph by adding the following sentence to the end:
"Where special warranties of longer duration are required, the Contractor shall secure warranties from Subcontractors, manufacturers and/or material suppliers as applicable, addressed to and in favor of the Owner, and deliver copies of same to the Owner upon completion of the Work. Delivery of said warranties shall not relieve Contractor of any obligation assumed under any other provisions of the Contract."

2.13 ARTICLE 13

A. Subparagraph 13.1: Delete the text in its entirety and replace with the following:
"13.1 Contractor and all Subcontractors are responsible to comply with Indiana Code as it pertains to public works projects. The following are notable requirements set forth in IC 5-16-13, in effect as of July 1, 2015, but are not inclusive of all requirements."

B. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.1:
"13.1.1 Contractor agrees, and represents to Owner, that at least 15% of the Contract Price (at the time this Agreement is executed) is comprised of any combination of the

following: 1) Work performed by Contractor's employees; 2) Services supplied directly by Contractor's employees; or 3) Materials supplied directly by Contractor.

C. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.2:
"13.1.2 Contractor and all Subcontractors, regardless of tier, shall not pay cash to its employees for Work performed on this public works Project."

D. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.3:
"13.1.3 Contractor and all Subcontractors, regardless of tier, shall comply with federal Fair Labor Standards Act of 1938."

E. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.4:
"13.1.4 Contractor and all Subcontractors, regardless of tier, shall be in compliance with workers compensation requirements of Indiana Code 22-3-5-1 and Indiana Code 22-3-7-34 and commits worker's compensation fraud if such Contractor or Subcontractor falsely classifies an employee as an independent contractor, sole proprietor, owner, partner, officer, or member of a limited liability company."

F. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.5:
"13.1.5 Contractor and all Subcontractor, regardless of tier, shall be in compliance with unemployment compensation system requirements of Indiana Code 22-4-1 through 22-4-39-5."

G. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.6:
"13.1.6 Contractor and all Subcontractors, regardless of tier, shall be in compliance with requirements for drug testing of its employees set forth in Indiana Code 4-13-18-1 through 4-13-18-7 if estimated cost of public works Contract is at least $150,000. With each application for payment the Contractor shall submit an affidavit, dated and signed by the Contractor, that neither they nor, to their knowledge, any of their subcontractors has violated the "Drug Testing Program provision of the Indiana Code."

H. Subparagraph 13.1: Add the following numbered Subparagraph 13.1.7:
"13.1.7 Following provisions shall be in effect for Contracts awarded after March 31, 2018."

I. Subparagraph 13.1.7: Add the following numbered Subparagraph 13.1.7.1:
"13.1.7.1 Contractor and Subcontractors, regardless of tier, shall preserve its payroll and related records for three (3) years after completion of the project work and such records shall be open to inspection by the Indiana Department of Workforce Development."

J. Subparagraph 13.1.7: Add the following numbered Subparagraphs 13.1.7.2 and 13.1.7.2.1:
"13.1.7.2 Recommended Employment of Apprentices"
"13.1.7.2.1 Owner strongly recommends that Contractor employs apprentices from each building trades craft involved in the Project to the maximum extent feasible. In doing so, the Contractor shall consider whether such apprentices are indentured into a Joint Apprenticeship Training Program or other comparable bona fide apprenticeship training program, registered and certified with the U.S. Department of Labor, Bureau of Apprenticeship and Training and shall use as a guide the Apprenticeship Standards of the Labor-Management Contract for the appropriate jurisdictional area when determining the appropriate ratio of apprentices from each respective craft."

K. Subparagraph 13.1.7: Add the following numbered Subparagraphs 13.1.7.3, 13.1.7.3.1 and 13.1.7.3.2:

"13.1.7.3 Contractor's Certification of Authorized Employment (E-Verify Requirements.)"

"13.1.7.3.1 In accordance with Indiana Code 22-5-1. 7 as amended, each Contractor in any tier of a public works project shall not knowingly employ unauthorized aliens. Every contractor shall enroll in and verify the work eligibility status of all employees hired after June 30, 2015 using the U.S. Citizenship and Immigration Services (USCIS) E-Verify program as defined in IC §22-5-1.7-3, unless the E-Verify program no longer exists. "13.1.7.3.2 The Prime Contractor shall require their subcontractors who perform work under this Contract to certify to the Prime Contractor that the subcontractor does not knowingly employ or contract with an unauthorized alien and that the subcontractor has enrolled and is participating in the E-Verify program. The Prime Contractor agrees to maintain this certification throughout the duration of the term of a contract with a subcontractor. The Prime Contractor and its sub-contractors at all levels must comply with all provisions of the statute or the Contract is subject to cancellation.**"**

L. Subparagraph 13.1.7: Add the following numbered Subparagraphs 13.1.7.4 and 13.1.7.4.1
"13.1.7.4 Non-Collusion Affidavit"

"13.1.7.4.1 The Bidder, by its officers and agents or representatives present at the time of filing their bid, being duly sworn, say on their oaths that neither they nor any of them have in any way, directly or indirectly, entered into any arrangement or agreement with any other bidder, or with any public office of the State of Indiana, of any county or municipality or other public offices whereby such affiance or either of them, has paid or is to pay to such other bidder or public officer any sum of money, or has given or is to vie to such other bidders or public officer anything of value whatever, or such affiance of affiance or either of them has not, directly or indirectly entered into any arrangement or agreement with any other bidder or bidders, which tends to or does lessen or destroy free competition in letting of the contract sought for by the attached bids; that no inducement of any form or character other than which appears upon the face of the bid will be suggested, offered, paid, or delivered to any person whomsoever to influence the acceptance of the said bid or awarding of the contract, nor has this bidder any agreement or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds of the contract sought by this bid."

M. Subparagraph 13.1.7: Add the following numbered Subparagraphs 13.1.7.5 and13.1.7.5.1
"13.1.7.5 Non-Discrimination"
"13.1.7.5.1 The Bidder and its Subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to their hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of their sex, race, natural origin, ancestry or religion or disability as prohibited under the Americans with Disabilities Act. Breach of this covenant may be regarded as a material breach of the Contract."

N. Subparagraph 13.1.7: Add the following numbered Subparagraphs 13.1.7.6 and13.1.7.6.1
"13.1.7.6 Certification of United States Steel"
"13.1.7.6.1 The Bidder certifies that the Bidder and all Subcontractors will comply with the statutory obligations to use steel products made in the United States.

O. Subparagraph 13.5.1: Add the following Subparagraph 13.5.1.1:

"13.5.1.1: Prior to commencing the Project the Contractor shall submit a list of all proposed testing companies for the Project to the Architect/Engineer and Owner for approval."

P. Subparagraph 13.5.2: Add the following Subparagraph 13.5.2.1

"13.5.2.1: Prior to testing, unless the testing company has been previously approved, the Contractor shall submit to the Architect/Engineer and Owner the proposed testing company for approval."

2.14 ARTICLE 14

A. Subparagraph 14.1.1: Amend this Subparagraph by deleting Sub-Subparagraph .4.
B. Subparagraph 14.2.1: Amend this Subparagraph by adding a new Sub-Subparagraph 14.2.1.5 as follows:
"5 becomes financially incapable of completing the Work contemplated by the Contract Documents."

C. Add subparagraph 14.2.5 as follows
"14.2.5 Contractor shall be responsible to reimburse Owner all attorney's fees and expenses incurred by Owner if Contractor is terminated for cause."

2.15 ARTICLE 15

A. Subparagraph 15.1.2: Delete the text of this Subparagraph and replace by adding the following Subparagraph 15.1.2.1, Subparagraph 15.1.2.2 and Subparagraph 15.1.2.3:
"Subparagraph 15.1.2.1 Claims must be initiated by written notice to the Architect within 21 calendar days after the occurrence of the event."
"Subparagraph 15.1.2.2 Notice of a claim must include what the claim is for, when the event occurred causing the claim, the amount of additional time (Project extension) being requested and any financial implications of the claim with sufficient specificity to allow the Owner an opportunity to modify the Project scope to remain within the Owner's approved budget."

"Subparagraph 15.1.2.3 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction."

B. Subparagraph 15.1.4 delete this Subparagraph in its entirety.
C. Subparagraph 15.1.5 delete this and all its subparagraphs in their entirety.
D. Subparagraph 15.3.2 Delete the text in its entirety and replace with the following:
"15.3.2. If, through acts of neglect on the part of the Contractor, any other Contractor or Subcontractor shall suffer loss or damage on the Work, the Contractor shall agree to settle with such other Contractor or Subcontractor by negotiation or binding dispute resolution, if such other Contractor or Subcontractor will so settle. If such other Contractor or Subcontractor shall assert any claim against the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim, including legal defense costs."
E. Subparagraph 15.3.3 In the first sentence after the word "fee" add a period and delete the remainder of that sentence.
F. Paragraph 15.4: Delete this Paragraph in its entirety. Additionally; delete all references and requirements for Arbitration throughout the entire AIA A201-2007 Document and replace with Litigation.

PART 3 – NOT USED

END OF SECTION 00 20 11

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Preface: ***These Supplementary General Conditions supplement and modify AIA Document A201 General Conditions of the Contract for Construction (2007 Edition), General Conditions between the Owner and Contractor.***

PART 1 - SUPPLEMENTARY GENERAL CONDITIONS

1.01 DEFINITIONS

A. "Contract". The Contract or Agreement, the Notice to Bidders, the Instructions to Bidders, the Bid or Proposal, the General Conditions, The Special Conditions, the Specification and Drawings, also any Addenda or the Modifications incorporated in any of the above documents before the execution of the Contract or Agreement.

B. "Owner": The Indiana State University Board of Trustees.

C. “Architect/Engineer”: the individual or firm hired by the Owner to prepare the Construction Documents and to Administer the Contract.

D. "Contractor": The person, firm or corporation who, with the Owner, executes the Contract, or the duly recognized assignee thereof.

E. "Subcontractor": A person, firm or corporation who, under contract with Contractor, furnished material only, labor and materials, or labor only, at the site of or for the project.

F. “Director": The Director of Department of Facilities Management at Indiana State University, or his duly authorized representative.

G. "Surety": Any person, firm or corporation which has executed, as surety, the Contractor's performance bond securing the performance of the within contracts.

H. "Work": Includes both materials and labor.

1.02 BOND

A. Before any contract made for this work becomes valid, the Contractor shall furnish the Owner a satisfactory performance and payment bonds, in such form as the Owner may prescribe and with such surety or sureties as it may approve each in an amount equal to 100% of the total contract price. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. These bonds shall guarantee all labor and material to be as required, the faithful payment of any claim or liens from any cause for which the Contractor or any Subcontractor is liable, including those for labor, materials, utility service, transportation costs and for supplies, equipment, machinery (or the rental thereof).

B. Licensed Sureties and Insurers

1. All bonds required by the Contract Documents (such as the Bid Specifications, Award Letter, Contract for Construction, etc.) to be purchased and maintained by the Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. In addition to appearing on Circular 570 U.S. Dept. of the Treasury, such Surety or insurance company shall maintain an A.M. Best's Rating of not less than "A".

C. The surety bond shall contain the following paragraph:
   1. "The said surety for value received hereby stipulates and agrees that no change, extension of time, alterations, or additions to the terms of the contract, or to the work to be performed hereunder, or the specifications accompanying them, shall in any way affect its obligations on this bond, alteration or addition to the terms of the contract, or to the work or the specifications."

1.03 INSURANCE

NOTE: The dollar amounts shown in this paragraph are for jobs over $50,000. See footnotes and amounts for jobs less than $50,000.

A. The Prime Contractor(s) shall provide all insurances listed here-in in these Specifications and shall require the Subcontractor(s) to provide the same. The Prime Contractor(s) shall not commence work under this Contract until they have obtained all insurance required by these specifications and until such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until all similar insurance required of the Subcontractor has been obtained. Policies expiring on a fixed date before final acceptance of the project must be renewed and evidence of such renewal submitted to the Owner before such date.

B. The Prime Contractor(s) shall furnish the Owner with satisfactory evidence of the insurance required, with satisfactory compliance as determined solely by Owner.

C. It is solely the responsibility of the Prime Contractor(s) to confirm that the Subcontractor(s) are in compliance with the insurance requirements of these Specifications, to maintain copies of the Subcontractors insurance on file and to be prepared to provide evidence of these insurances to the Owner upon demand.

D. Insurance Required:
   1. Worker's Compensation and Employers Insurance:
      a. The Prime Contractor(s) shall maintain during the life of this contract Worker's Compensation and Employers Liability Insurance for all Prime Contractor's employees employed at or involved in any manner with the project, and, in case any work is sublet, the Prime Contractor(s) shall require the Subcontractor(s), at their own expense, similarly to provide Worker's Compensation and Employers Liability Insurance for all of the Subcontractor's employees engaged in or involved in any manner with work under this contract. Such Workers' Compensation insurance will be in accordance with the statutory requirements of the State of Indiana, with and including Worker's Compensation for All Other States, if any. The Prime Contractor(s) shall and require Subcontractor(s) to provide insurance coverage equal to that provided under the Worker's Compensation Act, for the protection of the Contractor's employees not otherwise protected. Employer's liability coverage must be maintained in amounts not less than $500,000/$500,000/$500,000. Limits may be provided through a single policy or a primary/excess policy basis.
   2. Commercial General Liability Insurance.[1]
      a. The Contractor shall and require Subcontractors, at their own expense respectively, to maintain during the life of this contract Commercial General Liability Insurance insuring the Prime Contractor and any subcontractor, and owner and any other party required to be insured, from claims for bodily injury, death, personal injury and property damage which may arise from or on account of operations under this Contract, whether such operations be by the Prime Contractor(s) or by any

[1] For Smaller Contracts, the following limits (including umbrella liability) are permitted:

Contracts $25,000 to $49,999.....	$ 2,000,000
" $10,000 to $24,999.....	$ 1,000,000
" $ 9,999 and under.....	$ 500,000

Subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall be as follows:

- $2,000,000 General Aggregate
- $1,000,000 Combined Single Limit Bodily Injury, Property Damage
- $1,000,000 Products/Completed Operations
- $1,000,000 Personal Injury and Advertising Injury
- $ 100,000 Fire Damage

The General Aggregate limit shall apply separately, in total, to this project only.

3. Business Auto Insurance[2]:
   a. The Prime Contractor(s) shall and shall require all Subcontractors to maintain at their own expense respectively, at all times during the life of this contract, business auto insurance covering all liability and claims arising from the ownership, use, maintenance, operation, loading or unloading of automobiles anywhere in the United States, in connection with the performance of the Contract, whether such automobiles are owned, hired, or non-owned by the Contractor or Subcontractors.
   b. Such auto insurance shall be written with a limit of not less than $1,000,000 per occurrence as a combined single limit for Bodily Injury and Property Damage coverage.
4. Umbrella Liability Insurance[2]:
   a. The Prime Contractor(s) shall and shall require all Subcontractors to maintain at their own expense respectively, at all times during the life of this Contract, Umbrella Liability Insurance providing excess coverage over the above specified primary insurance in an amount not less than:
      - $1,000,000 for contracts $50,000 to $99,999.99
      - $2,000,000 for contracts $100,000 to $999,999.99
      - $3,000,000 for contracts $ 1,000,000 to $2,999,999.99
      - $5,000,000 for contracts over $3,000,000

E. Additional Insurance Requirements:
   1. The Prime Contractor(s) shall and shall require all Subcontractors to include Indiana State University, Indiana State University Board of Trustees and any Architect/Engineer Firm hired by Indiana State University for the Project, as an additional insured on their Commercial General Liability, Umbrella Liability Insurance and Business Auto Insurance policies with regard to this contract.
   2. Certificate(s) of Insurance shall include an endorsement of a Waiver of Subrogation in favor of the Owner for Commercial General Liability Insurance, Umbrella Liability Insurance, Worker's Compensation and Employers Liability Insurance and Business Auto Insurance.
   3. On Projects in excess of $1,000,000.00 a copy of the applicable pages from the Contractor's policy shall be provided showing the endorsements listed in paragraphs 1 and 2 of this Item 1.03 E.
   4. With regard to the above mentioned Commercial General Liability, Business Auto, and Umbrella Liability Insurance, if in the event of any major change or cancellation of such policy, the Prime Contractor(s) shall and shall require all Subcontractors to give a 30-day advance notice to the Owner.
   5. The Prime Contractor(s) shall and shall require of all Subcontractors that the insurance companies must have an A.M. Best's rating of not less than an "A" for projects over $150,000 and a rating of B+ or higher for projects under $150,000 and that the insurance

[2] For Smaller Contracts, the following limits (including umbrella liability) are permitted

Contracts $25,000 to $49,999.....$2,000,000
$10,000 to $24,999.....$1,000,000
$ 9,999 and under.....$ 500,000

companies are duly licensed or authorized in the jurisdiction in which the Project is located to issue insurance policies for the limits and coverages so required.

F. Builders Risk Insurance:
   1. The Owner agrees to provide property insurance including Builders Risk insurance for property under construction, and all materials and labor at or within 1,000 feet of the site intended for use in the "work" or project. Pursuant to this agreement, Owner hereby affirms the policy contains a waiver of subrogation in favor of the contractor or subcontractors should loss or damage of the type insured against result in loss to covered property; and Owner agrees to release from liability the contractor, to the extent such loss or damage is insured by said policy.
   2. Coverage does not extend to personal property, tools, equipment, scaffolding, staging, or similar equipment of the contract or subcontractor(s), or any employees thereof.
   3. Notwithstanding the foregoing however, Contractor is responsible for the property insurance deductible of $25,000 applicable to each covered loss to the work or project. Contractor acknowledges and affirms it will, without delay, pay the deductible, or if the loss remains within the deductible, pay that part of the deductible that equals the loss amount.

G. Indemnification:

   1. The Prime Contractor shall and shall require Subcontractors to indemnify the Owner and any other party required to be insured from all claims arising from the failure of the Prime Contractor(s) to require the Subcontractors to provide the insurance required by these Specifications.
   2. Notwithstanding any other provision to the contrary, the Contractor(s) agree to indemnify the Owner only for losses due to personal injury, or property damage to the extent caused by Contractor's negligent acts or omissions, or the negligent acts or omissions of Contractor's employees, agents and subcontractors during the performance of this Contract, but not to the extent caused by others. The Contractor shall defend Owner on claims that do not present a conflict of legal theory or fact between Owner and Contractor. Each party shall defend itself on any claim that does present a conflict of legal theory or fact between the parties.
   3. Under no circumstances shall either party be liable for any loss, damage or delay due to any cause beyond either party's reasonable control, including but not limited to acts of government, fire, explosion, theft, weather damage, flood, earthquake, riot, civil commotion, war, mischief or act of God.
   4. In the event of a strike or work stoppage by Contractor's employees, the Contractor agrees to use its best efforts to fulfill its obligations pursuant to their contract utilizing management and supervisory personnel.
   5. Under no circumstances shall either party be liable to the other for special, indirect, or consequential damages of any kind including, but not limited to, loss of profits, loss of good will, loss of business opportunity, additional financing costs or loss of use of any equipment or property, whether in contract, tort (including negligence), warranty or otherwise, notwithstanding any indemnity or other provision to the contrary.

1.04 SUBCONTRACTORS

A. At the time of Bid the Prime Contractor(s) (Bidder(s)) shall provide the names of the proposed Subcontractors listed in Appendix A of the Bid Form. Prior to the Awarding of the Contract, the Contractor shall submit to the Owner, in writing, the names of all the proposed Subcontractors and major material vendors. All Subcontractors shall be licensed and bonded and shall be held to the same level of experience and qualifications as are required of the Prime Contractor (Bidder) in Section 001000 NOTICE TO BIDDERS last paragraph.

B. The Prime Contractor shall be responsible for the acts and omissions of his Subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

C. Nothing contained in the Contract shall create any contractual relationship between any Subcontractor and the Owner, and no Subcontractor will be recognized as a party to the Contract.

D. The Prime Contractor shall use the Subcontractors, Suppliers, Materials and Equipment as listed in the Bid Form Appendix “A” submitted at the time of Bid. There shall be no changes permitted to this list except as listed in Section 00 10 10 Paragraph 3.14 APPENDIX A, Item B.1.

1.05 DRAWINGS

A. The drawings referred to in these specifications show such plans and details as are regarded necessary by the Architect/Engineer and/or the Owner to properly illustrate the work required, to estimate the cost of the work, and to complete its construction.

B. The Architect/Engineer and/or the Owner will from time to time furnish such additional detail and working drawings as may be deemed necessary to interpret and explain the Contract drawings and all such additional drawings shall be of equal force with those mentioned above and shall be considered as forming part of this Contract.

C. The general character of the work shall be subject to minor modifications when detailed or full sized drawings for such work are prepared.

D. All lettering on drawings is to be considered a part of the drawings.

E. All drawings, specifications, etc., are the property of the Owner and shall be returned before the final award is issued, if so requested.

1.06 RELATIONSHIP AND PRIORITY OF DOCUMENTS

A. The documents comprising the Contract are complementary and what is called for by one shall be as binding as if called for by all. The intention of the Contract is to include all labor, materials, and equipment necessary for the proper execution of the work.

B. In the case of a discrepancy between the requirements of the Drawings and the Specifications or between Sections of the Specifications:
   1. The more stringent shall apply.
   2. In equal situations the Specifications or as directed by the Owner prevails.

1.07 PERMITS

A. The Contractor shall give all requisite notices to public officials, secure and pay for all permits, legal fees or charges, have the work inspected by all proper public authorities, pay all charges connected with such inspections and deliver the proper inspection certificates and all receipts for charges to the Owner.

B. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Owner in writing, and any necessary change shall be accomplished by the appropriate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations and without such notice to the Architect, he shall assume full responsibility therefore and shall bear all cost attributable thereto.

1.08 SAMPLES

A. The Contractor shall submit in writing to the Owner for approval samples and shop or installation drawings of the materials he proposes to use, or such other related materials as owner otherwise requests.

B. Each sample shall be labeled, bearing the name and quality of the material, the Contractor's name, the date and a description of the sample. A letter from the Contractor stating that the samples conform to the requirements of the drawings and specifications shall accompany all such samples. Transportation charges on all samples shall be prepaid.

C. Samples and drawings shall be submitted in due time so as to permit proper consideration without delaying the Contractor's operation. Material shall not be ordered until approval is received from the Owner, in writing. The use of any material will be permitted only so long as it remains equal to the approved sample.

1.09 CONTRACTOR'S SUPERVISION

A. The Prime Contractor shall maintain on the Project site a competent Project Superintendent at all times any work is being performed; either by the Prime Contractor's workers or any Subcontractor's workers**. If the Project Superintendent is not on the Project site the Owner shall be notified immediately. If the Project Superintendent is not on the jobsite, without written prior approval or notification to be away from the jobsite, the Owner may be entitled to a $1,000 credit for each day or part of the day the Project Superintendent is not onsite while actual work is being performed.**

B. The Contractor's superintendent shall represent the Contractor during their absence and all directions given the superintendent shall be as binding as if given to the Contractor.

1.11 LAYING OUT AND UTILITY LOCATES

A. The Contractor shall thoroughly examine the drawings and specifications before commencing work and report to the Owner if any discrepancy, errors, or defect appears, but he shall not be held responsible for their existence.

B. The Contractor shall lay out his own work.

C. Prior to any cutting, drilling, trenching, excavating or other earthwork the Contractor shall determine the exact location of all utility lines and appurtenances that could be encountered which are not shown on the drawings as follows.

1. A minimum of forty eight (48) hours prior to commencing work the Contractor shall contact Indiana Locates for all public utility locates.
2. A minimum of forty eight (48) hours prior to commencing work the Contractor shall contact the Project Coordinator for all ISU Utility locates.

D. Failure to contact for the appropriate locates shall make Contractor solely responsible for all costs incurred to repair all damaged utility lines or appurtenances.

E. The Contractor shall hand excavate within three (3) feet, or as required by the Utility Company, on either side of a marked utility unless exact depth of the marked utility is known and the planned work will in no way be in close proximity with the utility line or appurtenance.

1.12 MATERIAL AND LABOR

A. Except as otherwise stipulated, the Contractor shall provide and pay for all materials, labor, tools and equipment necessary for the execution of the work.

B. The Owner reserves the right to require the Contractor to discontinue the service of any workmen employed on the work whom he deems incompetent, negligent, or otherwise objectionable, and to suspend any portion of the work embraced in the Contract whenever, in his opinion, it would be inexpedient to start or continue such work.

1.13 DEFECTIVE WORK AND MATERIALS

A. Any materials and workmanship found to be defective, improperly placed, not in strict conformity with the drawings and specifications, or defaced or injured through action of fire or elements, through usage by the Contractor or his employees or from any other cause, shall be removed immediately from the premises and satisfactory materials or work substituted therefore without delay. This shall include making good the work of other Contractors destroyed or damaged by such removal or replacement. The cost of the above replacements shall be borne by the Contractor responsible for the defective work or material.

B. Should the Contractor in the execution of his work discover any imperfections or errors in the work of other Contractors that would interfere with the proper execution of his contract, he

shall immediately report this fact to the Owner. Errors or imperfections in the work of other Contractors will in no case excuse installation of imperfect work by this Contractor.

C. No previous inspection shall be held as an acceptance of defective work or materials or relieve the Contractor from the obligation to furnish sound materials or to perform satisfactory work in accordance with the contract requirements. The final payment shall not relieve the Contractor of the responsibility for faulty materials or workmanship and he shall remedy all such defects, settlements, or other work resulting there from, which shall appear within a period of one (1) year from date of final acceptance or within the period stipulated in certain separate guarantees or bonds required elsewhere in the specifications, whichever may be the longer.

D. The Owner shall be the sole judge of the materials furnished and the character of work performed.

1.14 RESPONSIBILITY FOR DAMAGE

A. The Contractor shall be responsible for all damages to life and property due to his action or failure to act when action would reasonably be expected. He shall be responsible for all parts of his work, both temporary and permanent, until the work under his contract is declared accepted by the Owner.

B. The Contractor shall continuously maintain adequate protection of all his work from damage, and shall protect the Owner's property and all adjacent property from injury in connection with the Contract.

C. The Contractor shall be held responsible for damage to work of other Contractors that is the result of his operation.

D. Should the Contractor believe that the work shown by the drawings or specifications is not correct when executed to obtain safe and substantial results, or if any discrepancy appears, it is his duty to immediately notify the Owner in writing, stop work on same, and await written instruction.

1.15 INDIANA SALES TAX

A. Indiana State University is a Tax Exempt Institution and Indiana Sales Tax for products permanently incorporated in work shall not be included as part of the Bid or on any Application for Payment.

B. Contractor Responsibilities:

1. Pay Indiana Sales Tax on all non-exempt purchases and provide the Owner with detailed documentation of all taxes of non-exempt items invoiced on their Application for Payment. Documentation shall be provided with their Application for Payment at the time of first billing of each taxable item.
2. Upon completion of work, file with Owner notarized statement that all purchases were made under their exemption certificate where entitled to be exempt.
3. Pay legally assessed penalties for improper use of the exemption certificate number.

1.16 CLEANING UP

A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish.

B. When directed by the Owner, the Contractor shall clear out and remove any rubbish that may constitute an obstruction to the progress of the work.

C. At completion of the contract, the Contractor shall remove from the premises all rubbish and surplus material, and shall repair any damage to his work no matter by who caused, and shall leave the premises clean and in perfect repair and order.

1.17 NON-DISCRIMINATION CLAUSE

A. "Pursuant to the requirements of Indiana Code 22-9-1-10 and 5-16-6-1, Contractor and his Subcontractors may not discriminate against any employee or applicant for employment to be employed in the performance of such contract, with respect to their hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of their sex, race, natural origin, ancestry or religion or disability as prohibited under the Americans With Disabilities Act. The contractor and subcontractor, if any, agrees to comply with all the provisions contained in the Equal Opportunity Clause quoted in Executive Orders No. 11246 and No. 11375. In addition, the contractor shall cause this Equal Opportunity Clause to be included in the subcontracts or purchase orders hereunder unless exempted by rules, regulations and orders of the Secretary of Labor issued pursuant to Section 204 of the Executive Orders No. 11246 and No. 11375 as amended. Breach of the covenant may be regarded as a material breach of contract."

1.18 PUBLIC RELATIONS

A. Indiana State University is an Affirmative Action Institution. Any inappropriate actions toward any Indiana State University student, faculty or staff member by any Contractor's Employee shall result in the employee being told to leave the Campus of Indiana State University immediately. This employee shall not be allowed to return to work on the Project for the duration of the Project or longer. Repeated offences by a Contractor's employees may result in disqualification of the Contractor for this and future Indiana State University Projects.

1.19 "OR APPROVED EQUAL" CLAUSE

A. Unless the Specifications indicates that substitutions are not allowed, whenever a material or article required is specified or shown on the plans by using the name of the proprietary product or of a particular manufacturer or vendor, any material or article which will perform adequately the duties imposed by the general design will be considered equal and satisfactory providing the material or article so proposed is of equal substance and function in the Architect/Engineer and Owner's opinion. It shall not be purchased or installed without written approval. Requests for substitution prior to Bidding shall be as per Section 001010 INSTRUCTIONS TO BIDDERS Item 1.08

B. Complete descriptive information, specifications and samples or sample material must be submitted at the time the proposal is submitted. In addition, a list of projects with dates and contact persons must be submitted at the time the proposal is submitted showing where the proposed alternate material or article has been installed or used. Failure to submit information as requested will be cause for rejection of the Bid submitted.

1.20 VERIFYING MEASUREMENTS

A. The Contractor shall verify all measurements on the site and be responsible for any mistakes he may make and their results. If the Contractor discovers any discrepancy, in figures on the drawings, he shall report same to the Architect/Engineer and Owner before proceeding with any work affected by the discrepancy and shall be held responsible for results should he fail to make such reports.

1.21 EXTRAS

A. Without invalidating the Contract, the Owner may order extra work or make changes by altering, adding to, or deducting from the work, the Contract sum being adjusted accordingly, and the consent of the Surety being first obtained where necessary or desirable. All work of the kind Bid upon shall be paid for at the price stipulated in the proposal, and no claims for any extra work or materials shall be allowed unless the work is ordered in writing by the Owner, and the price is stated in such order.

B. Requests for compensation, for previously approved Change Orders omitted from an Application for Payment, received sixty (60) calendar days after Owner receipt of the Final Application for Payment (Release of Retainage) shall not be honored.

1.22 GENERAL GUARANTY

A. Neither the final certificate of payment nor any provision in the Contract documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting there from, which shall appear within a period of one (1) year from the date of final acceptance of the work, unless a longer period is specified.

PART 2 – NOT USED

PART 3– NOT USED

END OF SECTION 00 20 20

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Title 29 —Labor
Subtitle A —Office of the Secretary of Labor

PART 3—CONTRACTORS AND SUBCONTRACTORS ON PUBLIC BUILDING OR PUBLIC WORK FINANCED IN WHOLE OR IN PART BY LOANS OR GRANTS FROM THE UNITED STATES

Authority: R.S. 161, sec. 2, 48 Stat. 848; Reorg. Plan No. 14 of 1950, 64 Stat. 1267; 5 U.S.C. 301; 40 U.S.C. 3145; Secretary's Order 01-2014 (Dec. 19, 2014), 79 FR 77527 (Dec. 24, 2014).

Source: 29 FR 97, Jan. 4, 1964, unless otherwise noted.

§ 3.1 Purpose and scope.

This part prescribes “anti-kickback” regulations under section 2 of the Act of June 13, 1934, as amended (40 U.S.C. 3145), popularly known as the Copeland Act. This part applies to any contract which is subject to Federal wage standards and which is for the construction, prosecution, completion, or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States. The part is intended to aid in the enforcement of the minimum wage provisions of the Davis-Bacon Act and the various statutes dealing with federally assisted construction that contain similar minimum wage provisions, including those provisions which are not subject to Reorganization Plan No. 14 of 1950 (*e.g.,* the College Housing Act of 1950, the Federal Water Pollution Control Act, and the Housing Act of 1959), and in the enforcement of the overtime provisions of the Contract Work Hours and Safety Standards Act whenever they are applicable to construction work. The part details the obligation of contractors and subcontractors relative to the weekly submission of statements regarding the

wages paid on work covered thereby; sets forth the circumstances and procedures governing the making of payroll deductions from the wages of those employed on such work; and delineates the methods of payment permissible on such work.

[88 FR 57728, Aug. 23, 2023]

§ 3.2 Definitions.

As used in the regulations in this part:

Affiliated person. The term "affiliated person" includes a spouse, child, parent, or other close relative of the contractor or subcontractor; a partner or officer of the contractor or subcontractor; a corporation closely connected with the contractor or subcontractor as parent, subsidiary, or otherwise, and an officer or agent of such corporation.

Agency. The term "agency" means any Federal, State, or local government agency or instrumentality, or other similar entity, that enters into a contract or provides assistance through loan, grant, loan guarantee or insurance, or otherwise, for a project subject to the Davis-Bacon labor standards, as defined in § 5.2 of this subtitle.

(1) ***Federal agency.*** The term "Federal agency" means an agency or instrumentality of the United States or the District of Columbia, as defined in this section, that enters into a contract or provides assistance through loan, grant, loan guarantee or insurance, or otherwise, to a project subject to the Davis-Bacon labor standards.

(2) [Reserved]

Building or work. The term "building or work" generally includes construction activity of all types, as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The term includes, without limitation, buildings, structures, and improvements of all types, such as bridges, dams, solar panels, wind turbines, broadband installation, installation of electric car chargers, plants, highways, parkways, streets, subways, tunnels, sewers, mains, powerlines, pumping stations, heavy generators, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals; dredging, shoring, rehabilitation and reactivation of plants, scaffolding, drilling, blasting, excavating, clearing, and landscaping. The term "building or work" also includes a portion of a building or work, or the installation (where appropriate) of equipment or components into a building or work.

(1) ***Building or work financed in whole or in part by loans or grants from the United States.*** The term "building or work financed in whole or in part by loans or grants from the United States" includes any building or work for which construction, prosecution, completion, or repair, as defined in this section, payment or part payment is made directly or indirectly from funds provided by loans or grants by a Federal agency. The term includes any building or work for which the Federal assistance granted is in the form of loan guarantees or insurance.

(2) [Reserved]

Construction, prosecution, completion, or repair. The term "construction, prosecution, completion, or repair" mean all types of work done on a particular building or work at the site thereof as specified in § 5.2 of this subtitle, including, without limitation, altering, remodeling, painting and decorating, installation on the site

of the work of items fabricated offsite, covered transportation as reflected in § 5.2, demolition and/or removal as reflected in § 5.2, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work, performed by laborers and mechanics at the site.

Employed (and wages). Every person paid by a contractor or subcontractor in any manner for their labor in the construction, prosecution, completion, or repair of a public building or public work or building or work financed in whole or in part by assistance from the United States through loan, grant, loan guarantee or insurance, or otherwise, is "employed" and receiving "wages", regardless of any contractual relationship alleged to exist between the contractor and such person.

Public building (or public work). The term "public building (or public work)" includes a building or work the construction, prosecution, completion, or repair of which, as defined in this section, is carried on directly by authority of or with funds of a Federal agency to serve the general public regardless of whether title thereof is in a Federal agency. The construction, prosecution, completion, or repair of a portion of a building or work, or the installation (where appropriate) of equipment or components into a building or work, may still be considered a public building or work, even where the entire building or work is not owned, leased by, or to be used by the Federal agency, as long as the construction, prosecution, completion, or repair of that portion of the building or work, or the installation (where appropriate) of equipment or components into that building or work, is carried on by authority of or with funds of a Federal agency to serve the interest of the general public.

United States or the District of Columbia. The term "United States or the District of Columbia" means the United States, the District of Columbia, and all executive departments, independent establishments, administrative agencies, and instrumentalities of the United States and of the District of Columbia, and any corporation for which all or substantially all of the stock of which is beneficially owned by the United States, by the District of Columbia, or any of the foregoing departments, establishments, agencies, and instrumentalities.

[88 FR 57729, Aug. 23, 2023]

§ 3.3 Certified payrolls.

(a) [Reserved]

(b) Each contractor or subcontractor engaged in the construction, prosecution, completion, or repair of any public building or public work, or building or work financed in whole or in part by loans or grants from the United States, each week must provide a copy of its weekly payroll for all laborers and mechanics engaged on work covered by this part and part 5 of this chapter during the preceding weekly payroll period, accompanied by a statement of compliance certifying the accuracy of the weekly payroll information. This statement must be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, and must be on the back of Form WH-347, "Payroll (For Contractors Optional Use)" or on any form with identical wording. Copies of WH-347 may be obtained from the contracting or sponsoring agency or from the Wage and Hour Division website at *https://www.dol.gov/agencies/whd/government-contracts/construction/forms* or its successor site. The signature by the contractor, subcontractor, or the authorized officer or employee must be an original handwritten signature or a legally valid electronic signature.

(c) The requirements of this section do not apply to any contract of $2,000 or less.

(d) Upon a written finding by the head of a Federal agency, the Secretary of Labor may provide reasonable limitations, variations, tolerances, and exemptions from the requirements of this section subject to such conditions as the Secretary of Labor may specify.

[88 FR 57729, Aug. 23, 2023]

§ 3.4 Submission of certified payroll and the preservation and inspection of weekly payroll records.

(a) ***Certified payroll.*** Each certified payroll required under § 3.3 must be delivered by the contractor or subcontractor, within 7 days after the regular payment date of the payroll period, to a representative at the site of the building or work of the agency contracting for or financing the work, or, if there is no representative of the agency at the site of the building or work, the statement must be delivered by mail or by any other means normally assuring delivery by the contractor or subcontractor, within that 7 day time period, to the agency contracting for or financing the building or work. After the certified payrolls have been reviewed in accordance with the contracting or sponsoring agency's procedures, such certified payrolls must be preserved by the agency for a period of 3 years after all the work on the prime contract is completed and must be produced for inspection, copying, and transcription by the Department of Labor upon request. The certified payrolls must also be transmitted together with a report of any violation, in accordance with applicable procedures prescribed by the United States Department of Labor.

(b) ***Recordkeeping.*** Each contractor or subcontractor must preserve the regular payroll records for a period of 3 years after all the work on the prime contract is completed. The regular payroll records must set out accurately and completely the name; Social Security number; last known address, telephone number, and email address of each laborer and mechanic; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid. The contractor or subcontractor must make such regular payroll records, as well as copies of the certified payrolls provided to the contracting or sponsoring agency, available at all times for inspection, copying, and transcription by the contracting officer or their authorized representative, and by authorized representatives of the Department of Labor.

[88 FR 57730, Aug. 23, 2023]

§ 3.5 Payroll deductions permissible without application to or approval of the Secretary of Labor.

Deductions made under the circumstances or in the situations described in the paragraphs of this section may be made without application to and approval of the Secretary of Labor:

(a) Any deduction made in compliance with the requirements of Federal, State, or local law, such as Federal or State withholding income taxes and Federal social security taxes.

(b) Any deduction of sums previously paid to the laborer or mechanic as a bona fide prepayment of wages when such prepayment is made without discount or interest. A bona fide prepayment of wages is considered to have been made only when cash or its equivalent has been advanced to the person employed in such manner as to give him complete freedom of disposition of the advanced funds.

(c) Any deduction of amounts required by court process to be paid to another, unless the deduction is in favor of the contractor, subcontractor, or any affiliated person, or when collusion or collaboration exists.

(d) Any deduction constituting a contribution on behalf of the laborer or mechanic employed to funds established by the contractor or representatives of the laborers or mechanics, or both, for the purpose of providing either from principal or income, or both, medical or hospital care, pensions or annuities on retirement, death benefits, compensation for injuries, illness, accidents, sickness, or disability, or for insurance to provide any of the foregoing, or unemployment benefits, vacation pay, savings accounts, or similar payments for the benefit of the laborers or mechanics, their families and dependents: *Provided, however,* That the following standards are met:

(1) The deduction is not otherwise prohibited by law;

(2) It is either:

(i) Voluntarily consented to by the laborer or mechanic in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of or for the continuation of employment; or

(ii) Provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its laborers or mechanics;

(3) No profit or other benefit is otherwise obtained, directly or indirectly, by the contractor or subcontractor or any affiliated person in the form of commission, dividend, or otherwise; and

(4) The deductions must serve the convenience and interest of the laborer or mechanic.

(e) Any deduction requested by the laborer or mechanic to enable him or her to repay loans to or to purchase shares in credit unions organized and operated in accordance with Federal and State credit union statutes.

(f) Any deduction voluntarily authorized by the laborer or mechanic for the making of contributions to governmental or quasi-governmental agencies, such as the American Red Cross.

(g) Any deduction voluntarily authorized by the laborer or mechanic for the making of contributions to charitable organizations as defined by 26 U.S.C. 501(c)(3).

(h) Any deductions to pay regular union initiation fees and membership dues, not including fines or special assessments: *Provided, however,* That a collective bargaining agreement between the contractor or subcontractor and representatives of its laborers or mechanics provides for such deductions and the deductions are not otherwise prohibited by law.

(i) Any deduction not more than for the "reasonable cost" of board, lodging, or other facilities meeting the requirements of section 3(m) of the Fair Labor Standards Act of 1938, as amended, and 29 CFR part 531. When such a deduction is made the additional records required under 29 CFR 516.25(a) must be kept.

(j) Any deduction for the cost of safety equipment of nominal value purchased by the laborer or mechanic as their own property for their personal protection in their work, such as safety shoes, safety glasses, safety gloves, and hard hats, if such equipment is not required by law to be furnished by the contractor, if such deduction does not violate the Fair Labor Standards Act or any other law, if the cost on which the deduction is based does not exceed the actual cost to the contractor where the equipment is purchased from the contractor and does not include any direct or indirect monetary return to the contractor where the equipment is purchased from a third person, and if the deduction is either:

(1) Voluntarily consented to by the laborer or mechanic in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance; or

(2) Provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its laborers and mechanics.

[88 FR 57730, Aug. 23, 2023]

§ 3.6 Payroll deductions permissible with the approval of the Secretary of Labor.

Any contractor or subcontractor may apply to the Secretary of Labor for permission to make any deduction not permitted under § 3.5. The Secretary may grant permission whenever he finds that:

(a) The contractor, subcontractor, or any affiliated person does not make a profit or benefit directly or indirectly from the deduction either in the form of a commission, dividend, or otherwise;

(b) The deduction is not otherwise prohibited by law;

(c) The deduction is either

(1) voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance, or

(2) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees; and

(d) The deduction serves the convenience and interest of the employee.

§ 3.7 Applications for the approval of the Secretary of Labor.

Any application for the making of payroll deductions under § 3.6 must comply with the requirements prescribed in the following paragraphs of this section:

(a) The application must be in writing and addressed to the Secretary of Labor. The application must be submitted by email to *dbadeductions@dol.gov*, by mail to the United States Department of Labor, Wage and Hour Division, Director, Division of Government Contracts Enforcement, 200 Constitution Ave., NW, Room S-3502, Washington, DC 20210, or by any other means normally assuring delivery.

(b) The application need not identify the contract or contracts under which the work in question is to be performed. Permission will be given for deductions on all current and future contracts of the applicant for a period of 1 year. A renewal of permission to make such payroll deduction will be granted upon the submission of an application which makes reference to the original application, recites the date of the Secretary of Labor's approval of such deductions, states affirmatively that there is continued compliance with the standards set forth in the provisions of § 3.6, and specifies any conditions which have changed in regard to the payroll deductions.

(c) The application must state affirmatively that there is compliance with the standards set forth in the provisions of § 3.6. The affirmation must be accompanied by a full statement of the facts indicating such compliance.

(d) The application must include a description of the proposed deduction, the purpose of the deduction, and the classes of laborers or mechanics from whose wages the proposed deduction would be made.

(e) The application must state the name and business of any third person to whom any funds obtained from the proposed deductions are to be transmitted and the affiliation of such person, if any, with the applicant.

[88 FR 57731, Aug. 23, 2023]

§ 3.8 Action by the Secretary of Labor upon applications.

The Secretary of Labor will decide whether or not the requested deduction is permissible under provisions of § 3.6; and will notify the applicant in writing of the decision.

[88 FR 57731, Aug. 23, 2023]

§ 3.9 Prohibited payroll deductions.

Deductions not elsewhere provided for by this part and which are not found to be permissible under § 3.6 are prohibited.

§ 3.10 Methods of payment of wages.

The payment of wages shall be by cash, negotiable instruments payable on demand, or the additional forms of compensation for which deductions are permissible under this part. No other methods of payment shall be recognized on work subject to the Copeland Act.

§ 3.11 Regulations part of contract.

All contracts made with respect to the construction, prosecution, completion, or repair of any public building or public work or building or work financed in whole or in part by loans or grants from the United States covered by the regulations in this part must expressly bind the contractor or subcontractor to comply with such of the regulations in this part as may be applicable. In this regard, see § 5.5(a) of this subtitle. However, these requirements will be considered to be effective by operation of law, whether or not they are incorporated into such contracts, as set forth in § 5.5(e) of this subtitle.

[88 FR 57731, Aug. 23, 2023]

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Title 29 —Labor
Subtitle A —Office of the Secretary of Labor

PART 5—LABOR STANDARDS PROVISIONS APPLICABLE TO CONTRACTS COVERING FEDERALLY FINANCED AND ASSISTED CONSTRUCTION (ALSO LABOR STANDARDS PROVISIONS APPLICABLE TO NONCONSTRUCTION CONTRACTS SUBJECT TO THE CONTRACT WORK HOURS AND SAFETY STANDARDS ACT)

Authority: 5 U.S.C. 301; Reorganization Plan No. 14 of 1950, 5 U.S.C. appendix; 28 U.S.C. 2461 note; 40 U.S.C. 3141 *et seq.;* 40 U.S.C. 3145; 40 U.S.C. 3148; 40 U.S.C. 3701 *et seq.;* Secretary's Order No. 01-2014, 79 FR 77527; and the laws referenced by § 5.1(a).

Source: 48 FR 19541, Apr. 29, 1983, unless otherwise noted.

Subpart A—Davis-Bacon and Related Acts Provisions and Procedures

Source: 48 FR 19540, Apr. 29, 1983, unless otherwise noted.

Editorial Note: Nomenclature changes to subpart A of part 5 appear at 61 FR 19984, May 3, 1996.

§ 5.1 Purpose and scope.

(a) The regulations contained in this part are promulgated under the authority conferred upon the Secretary of Labor by Reorganization Plan No. 14 of 1950 (64 Stat. 1267, as amended, 5 U.S.C. appendix) and the Copeland Act (48 Stat. 948; 18 U.S.C. 874; 40 U.S.C. 3145) in order to coordinate the administration and enforcement of labor standards provisions contained in the Davis-Bacon Act (46 Stat. 1494, as amended; 40 U.S.C. 3141 *et seq.*) and its related statutes ("Related Acts").

(1) A listing of laws requiring Davis-Bacon labor standards provisions can be found at *www.dol.gov/agencies/whd/government-contracts* or its successor website.

(2) [Reserved]

(b) Part 1 of this subtitle contains the Department's procedural rules governing requests for wage determinations and the issuance and use of such wage determinations under the Davis-Bacon Act and its Related Acts.

[88 FR 57731, Aug. 23, 2023]

§ 5.2 Definitions.

Administrator. The term "Administrator" means the Administrator of the Wage and Hour Division, U.S. Department of Labor, or authorized representative.

Agency. The term "agency" means any Federal, State, or local government agency or instrumentality, or other similar entity, that enters into a contract or provides assistance through loan, grant, loan guarantee or insurance, or otherwise, to a project subject to the Davis-Bacon labor standards, as defined in this section.

(1) ***Federal agency.*** The term "Federal agency" means an agency or instrumentality of the United States or the District of Columbia, as defined in this section, that enters into a contract or provides assistance through loan, grant, loan guarantee or insurance, or otherwise, to a project subject to the Davis-Bacon labor standards.

(2) [Reserved]

Agency Head. The term "Agency Head" means the principal official of an agency and includes those persons duly authorized to act on behalf of the Agency Head.

Apprentice and *helper.* The terms "apprentice" and "helper" are defined as follows:

(1) "Apprentice" means:

(i) A person employed and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship, or with a State Apprenticeship Agency recognized by the Office of Apprenticeship; or

(ii) A person in the first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice;

(2) These provisions do not apply to apprentices and trainees employed on projects subject to 23 U.S.C. 113 who are enrolled in programs which have been certified by the Secretary of Transportation in accordance with 23 U.S.C. 113(c).

(3) A distinct classification of helper will be issued in wage determinations applicable to work performed on construction projects covered by the labor standards provisions of the Davis-Bacon and Related Acts only where:

(i) The duties of the helper are clearly defined and distinct from those of any other classification on the wage determination;

(ii) The use of such helpers is an established prevailing practice in the area; and

(iii) The helper is not employed as a trainee in an informal training program. A "helper" classification will be added to wage determinations pursuant to § 5.5(a)(1)(iii)(A) only where, in addition, the work to be performed by the helper is not performed by a classification in the wage determination.

Building or work. The term "building or work" generally includes construction activities of all types, as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The term includes, without limitation, buildings, structures, and improvements of all types, such as bridges, dams, solar panels, wind turbines, broadband installation, installation of electric car chargers, plants, highways,

parkways, streets, subways, tunnels, sewers, mains, power lines, pumping stations, heavy generators, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, canals, dredging, shoring, rehabilitation and reactivation of plants, scaffolding, drilling, blasting, excavating, clearing, and landscaping. The term "building or work" also includes a portion of a building or work, or the installation (where appropriate) of equipment or components into a building or work.

Construction, prosecution, completion, or repair. The term "construction, prosecution, completion, or repair" means the following:

(1) These terms include all types of work done—

(i) On a particular building or work at the site of the work, as defined in this section, by laborers and mechanics employed by a contractor or subcontractor, or

(ii) In the construction or development of a project under a development statute.

(2) These terms include, without limitation (except as specified in this definition):

(i) Altering, remodeling, installation (where appropriate) on the site of the work of items fabricated offsite;

(ii) Painting and decorating;

(iii) Manufacturing or furnishing of materials, articles, supplies or equipment, but only if such work is done by laborers or mechanics

(A) Employed by a contractor or subcontractor, as defined in this section, on the site of the work, as defined in this section, or

(B) In the construction or development of a project under a development statute;

(iv) "Covered transportation," defined as any of the following activities:

(A) Transportation that takes place entirely within a location meeting the definition of "site of the work" in this section;

(B) Transportation of one or more "significant portion(s)" of the building or work between a "secondary construction site" as defined in this section and a "primary construction site" as defined in this section;

(C) Transportation between an "adjacent or virtually adjacent dedicated support site" as defined in this section and a "primary construction site" or "secondary construction site" as defined in this section;

(D) "Onsite activities essential or incidental to offsite transportation," defined as activities conducted by a truck driver or truck driver's assistant on the site of the work that are essential or incidental to the transportation of materials or supplies to or from the site of the work, such as loading, unloading, or waiting for materials to be loaded or unloaded, but only where the driver or driver's assistant's time spent on the site of the work is not *de minimis;* and

(E) Any transportation and related activities, whether on or off the site of the work, by laborers and mechanics employed in the construction or development of the project under a development statute.

(v) Demolition and/or removal, under any of the following circumstances:

(A) Where the demolition and/or removal activities themselves constitute construction, alteration, and/or repair of an existing building or work. Examples of such activities include the removal of asbestos, paint, components, systems, or parts from a facility that will not be demolished; as well as contracts for hazardous waste removal, land recycling, or reclamation that involve substantial earth moving, removal of contaminated soil, re-contouring surfaces, and/or habitat restoration.

(B) Where subsequent construction covered in whole or in part by the labor standards in this part is contemplated at the site of the demolition or removal, either as part of the same contract or as part of a future contract. In determining whether covered construction is contemplated within the meaning of this provision, relevant factors include, but are not limited to, the existence of engineering or architectural plans or surveys of the site; the allocation of, or an application for, Federal funds; contract negotiations or bid solicitations; the stated intent of the relevant government officials; and the disposition of the site after demolition.

(C) Where otherwise required by statute.

(3) Except for transportation that constitutes "covered transportation" as defined in this section, construction, prosecution, completion, or repair does not include the transportation of materials or supplies to or from the site of the work.

Contract. The term "contract" means any prime contract which is subject wholly or in part to the labor standards provisions of any of the laws referenced by § 5.1 and any subcontract of any tier thereunder, let under the prime contract. With the exception of work performed under a development statute, the terms contract and subcontract do not include agreements with employers that meet the definition of a material supplier under this section.

Contracting officer. The term "contracting officer" means the individual, a duly appointed successor, or authorized representative who is designated and authorized to enter into contracts on behalf of an agency, sponsor, owner, applicant, or other similar entity.

Contractor. The term "contractor" means any individual or other legal entity that enters into or is awarded a contract that is subject wholly or in part to the labor standards provisions of any of the laws referenced by § 5.1, including any prime contract or subcontract of any tier under a covered prime contract. In addition, the term contractor includes any surety that is completing performance for a defaulted contractor pursuant to a performance bond. The U.S. Government, its agencies, and instrumentalities are not contractors, subcontractors, employers or joint employers for purposes of the labor standards provisions of any of the laws referenced by § 5.1. A State or local government is not regarded as a contractor or subcontractor under statutes providing loans, grants, or other Federal assistance in situations where construction is performed by its own employees. However, under development statutes or other statutes requiring payment of prevailing wages to all laborers and mechanics employed on the assisted project, such as the U.S. Housing Act of 1937, State and local recipients of Federal-aid must pay these workers according to Davis-Bacon labor standards. The term "contractor" does not include an entity that is a material supplier, except if the entity is performing work under a development statute.

Davis-Bacon labor standards. The term "Davis-Bacon labor standards" as used in this part means the requirements of the Davis-Bacon Act, the Contract Work Hours and Safety Standards Act (other than those relating to safety and health), the Copeland Act, and the prevailing wage provisions of the other statutes referenced in § 5.1, and the regulations in this part and in parts 1 and 3 of this subtitle.

Development statute. The term "development statute" includes the United States Housing Act of 1937; the Housing Act of 1949; and the Native American Housing Assistance and Self-Determination Act of 1996, and any other Davis-Bacon Related Act that requires payment of prevailing wages under the Davis-Bacon labor standards to all laborers and mechanics employed in the development of a project and for which the Administrator determines that the statute's language and/or legislative history reflected clear congressional intent to apply a coverage standard different from the Davis-Bacon Act itself.

Employed. Every person performing the duties of a laborer or mechanic in the construction, prosecution, completion, or repair of a public building or public work, or building or work financed in whole or in part by assistance from the United States through loan, grant, loan guarantee or insurance, or otherwise, is "employed" regardless of any contractual relationship alleged to exist between the contractor and such person.

Laborer or *mechanic.* The term "laborer or mechanic" includes at least those workers whose duties are manual or physical in nature (including those workers who use tools or who are performing the work of a trade), as distinguished from mental or managerial. The term "laborer" or "mechanic" includes apprentices, helpers, and, in the case of contracts subject to the Contract Work Hours and Safety Standards Act, watchpersons or guards. The term does not apply to workers whose duties are primarily administrative, executive, or clerical, rather than manual. Persons employed in a bona fide executive, administrative, or professional capacity as defined in 29 CFR part 541 are not deemed to be laborers or mechanics. Forepersons who devote more than 20 percent of their time during a workweek to mechanic or laborer duties, and who do not meet the criteria of part 541, are laborers and mechanics for the time so spent.

Material supplier. The term "material supplier" is defined as follows:

(1) A material supplier is an entity meeting all of the following criteria:

(i) Its only obligations for work on the contract or project are the delivery of materials, articles, supplies, or equipment, which may include pickup of the same in addition to, but not exclusive of, delivery, and which may also include activities incidental to such delivery and pickup, such as loading, unloading, or waiting for materials to be loaded or unloaded; and

(ii) Its facility or facilities that manufactures the materials, articles, supplies, or equipment used for the contract or project:

(A) Is not located on, or does not itself constitute, the project or contract's primary construction site or secondary construction site as defined in this section; and

(B) Either was established before opening of bids on the contract or project, or is not dedicated exclusively, or nearly so, to the performance of the contract or project.

(2) If an entity, in addition to being engaged in the activities specified in paragraph (1)(i) of this definition, also engages in other construction, prosecution, completion, or repair work at the site of the work, it is not a material supplier.

Prime contractor. The term "prime contractor" means any person or entity that enters into a contract with an agency. For the purposes of the labor standards provisions of any of the laws referenced by § 5.1, the term prime contractor also includes the controlling shareholders or members of any entity holding a prime contract, the joint venturers or partners in any joint venture or partnership holding a prime contract, and any contractor (*e.g.,* a general contractor) that has been delegated the responsibility for overseeing all

or substantially all of the construction anticipated by the prime contract. For the purposes of the provisions in §§ 5.5 and 5.9, any such related entities holding different prime contracts are considered to be the same prime contractor.

Public building or *public work.* The term "public building or public work" includes a building or work, the construction, prosecution, completion, or repair of which, as defined in this section, is carried on directly by authority of or with funds of a Federal agency to serve the interest of the general public regardless of whether title thereof is in a Federal agency. The construction, prosecution, completion, or repair of a portion of a building or work, or the installation (where appropriate) of equipment or components into a building or work, may still be considered a public building or work, even where the entire building or work is not owned, leased by, or to be used by a Federal agency, as long as the construction, prosecution, completion, or repair of that portion of the building or work, or the installation (where appropriate) of equipment or components into that building or work, is carried on by authority of or with funds of a Federal agency to serve the interest of the general public.

Secretary. The term "Secretary" includes the Secretary of Labor, and their authorized representative.

Site of the work. The term "site of the work" is defined as follows:

(1) "Site of the work" includes all of the following:

(i) The primary construction site(s), defined as the physical place or places where the building or work called for in the contract will remain.

(ii) Any secondary construction site(s), defined as any other site(s) where a significant portion of the building or work is constructed, *provided* that such construction is for specific use in that building or work and does not simply reflect the manufacture or construction of a product made available to the general public, and *provided further* that the site is either established specifically for the performance of the contract or project, or is dedicated exclusively, or nearly so, to the performance of the contract or project for a specific period of time. A "significant portion" of a building or work means one or more entire portion(s) or module(s) of the building or work, such as a completed room or structure, with minimal construction work remaining other than the installation and/or final assembly of the portions or modules at the place where the building or work will remain. A "significant portion" does not include materials or prefabricated component parts such as prefabricated housing components. A "specific period of time" means a period of weeks, months, or more, and does not include circumstances where a site at which multiple projects are in progress is shifted exclusively or nearly so to a single project for a few hours or days in order to meet a deadline.

(iii) Any adjacent or virtually adjacent dedicated support sites, defined as:

(A) Job headquarters, tool yards, batch plants, borrow pits, and similar facilities of a contractor or subcontractor that are dedicated exclusively, or nearly so, to performance of the contract or project, *and* adjacent or virtually adjacent to either a primary construction site or a secondary construction site, and

(B) Locations adjacent or virtually adjacent to a primary construction site at which workers perform activities associated with directing vehicular or pedestrian traffic around or away from the primary construction site.

(2) With the exception of locations that are on, or that themselves constitute, primary or secondary construction sites as defined in paragraphs (1)(i) and (ii) of this definition, site of the work does not include:

(i) Permanent home offices, branch plant establishments, fabrication plants, tool yards, etc., of a contractor or subcontractor whose location and continuance in operation are determined wholly without regard to a particular Federal or federally assisted contract or project; or

(ii) Fabrication plants, batch plants, borrow pits, job headquarters, tool yards, etc., of a material supplier, which are established by a material supplier for the project before opening of bids and not on the primary construction site or a secondary construction site, even where the operations for a period of time may be dedicated exclusively, or nearly so, to the performance of a contract.

Subcontractor. The term "subcontractor" means any contractor that agrees to perform or be responsible for the performance of any part of a contract that is subject wholly or in part to the labor standards provisions of any of the laws referenced in § 5.1. The term subcontractor includes subcontractors of any tier.

United States or the District of Columbia. The term "United States or the District of Columbia" means the United States, the District of Columbia, and all executive departments, independent establishments, administrative agencies, and instrumentalities of the United States and of the District of Columbia, including non-appropriated fund instrumentalities and any corporation for which all or substantially all of its stock is beneficially owned by the United States or by the foregoing departments, establishments, agencies, or instrumentalities.

Wages. The term "wages" means the basic hourly rate of pay; any contribution irrevocably made by a contractor or subcontractor to a trustee or to a third person pursuant to a bona fide fringe benefit fund, plan, or program; and the rate of costs to the contractor or subcontractor which may be reasonably anticipated in providing bona fide fringe benefits to laborers and mechanics pursuant to an enforceable commitment to carry out a financially responsible plan or program, which was communicated in writing to the laborers and mechanics affected. The fringe benefits enumerated in the Davis-Bacon Act include medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing; unemployment benefits; life insurance, disability insurance, sickness insurance, or accident insurance; vacation or holiday pay; defraying costs of apprenticeship or other similar programs; or other bona fide fringe benefits. Fringe benefits do not include benefits required by other Federal, State, or local law.

Wage determination. The term "wage determination" includes the original decision and any subsequent decisions revising, modifying, superseding, correcting, or otherwise changing the provisions of the original decision. The application of the wage determination must be in accordance with the provisions of § 1.6 of this subtitle.

[88 FR 57731, Aug. 23, 2023]

§§ 5.3-5.4 [Reserved]

§ 5.5 Contract provisions and related matters.

Link to an amendment published at 88 FR 57734, Aug. 23, 2023.

(a) ***Required contract clauses.*** The Agency head will cause or require the contracting officer to require the contracting officer to insert in full, or (for contracts covered by the Federal Acquisition Regulation (48 CFR chapter 1)) by reference, in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the laws referenced by § 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) ***Minimum wages*** —

(i) ***Wage rates and fringe benefits.*** All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of this section, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(v) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph (a)(4) of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (a)(1)(iii) of this section) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) ***Frequently recurring classifications.***

(A) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph (a)(1)(iii) of this section, provided that:

(*1*) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(*2*) The classification is used in the area by the construction industry; and

(*3*) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(B) The Administrator will establish wage rates for such classifications in accordance with paragraph (a)(1)(iii)(A)(*3*) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

(iii) ***Conformance.***

(A) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is used in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(C) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov,* refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(E) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs (a)(1)(iii)(C) and (D) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph (a)(1)(iii)(C) or (D) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iv) ***Fringe benefits not expressed as an hourly rate.*** Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(v) ***Unfunded plans.*** If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(vi) ***Interest.*** In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

(2) ***Withholding*** —

(i) ***Withholding requirements.*** The [write in name of Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in paragraph (a) of this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work (or otherwise working in construction or development of the project under a development statute) all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph (a)(3)(iv) of this section, the [Agency] may on its own initiative and after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

(3) ***Records and certified payrolls*** —

(i) ***Basic record requirements*** —

(A) ***Length of record retention.*** All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(B) ***Information required.*** Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(C) ***Additional records relating to fringe benefits.*** Whenever the Secretary of Labor has found under paragraph (a)(1)(v) of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(D) ***Additional records relating to apprenticeship.*** Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

(ii) ***Certified payroll requirements*** —

(A) ***Frequency and method of submission.*** The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the [write in name of appropriate Federal agency] if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the certified payrolls to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency]. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(B) ***Information required.*** The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph (a)(3)(i)(B) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the sponsoring government agency (or the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records).

(C) ***Statement of Compliance.*** Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(*1*) That the certified payroll for the payroll period contains the information required to be provided under paragraph (a)(3)(ii) of this section, the appropriate information and basic records are being maintained under paragraph (a)(3)(i) of this section, and such information and records are correct and complete;

(*2*) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(D) ***Use of Optional Form WH-347.*** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(C) of this section.

(E) ***Signature.*** The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(F) ***Falsification.*** The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(G) ***Length of certified payroll retention.*** The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iii) ***Contracts, subcontracts, and related documents.*** The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iv) ***Required disclosures and access*** —

(A) ***Required record disclosures and access to workers.*** The contractor or subcontractor must make the records required under paragraphs (a)(3)(i) through (iii) of this section, and any other documents that the [write the name of the agency] or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the [write the name of the agency] or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(B) ***Sanctions for non-compliance with records and worker access requirements.*** If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into

consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(C) ***Required information disclosures.*** Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the [write in name of appropriate Federal agency] if the agency is a party to the contract, or to the Wage and Hour Division of the Department of Labor. If the Federal agency is not such a party to the contract, the contractor, subcontractor, or both, must, upon request, provide the full Social Security number and last known address, telephone number, and email address of each covered worker to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency], the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

(4) ***Apprentices and equal employment opportunity*** —

(i) ***Apprentices*** —

(A) ***Rate of pay.*** Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(B) ***Fringe benefits.*** Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(C) ***Apprenticeship ratio.*** The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph (a)(4)(i)(D) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(4)(i)(A) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In

addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(D) ***Reciprocity of ratios and wage rates.*** Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

(ii) ***Equal employment opportunity.*** The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses contained in paragraphs (a)(1) through (11) of this section, along with the applicable wage determination(s) and such other clauses or contract modifications as the [write in the name of the Federal agency] may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate.

(7) ***Contract termination: debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(iii) The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

(11) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

(iv) Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

(b) ***Contract Work Hours and Safety Standards Act (CWHSSA).*** The Agency Head must cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1) through (5) of this section in full, or (for contracts covered by the Federal Acquisition Regulation) by reference, in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses must be inserted in addition to the clauses required by paragraph (a) of this section or 29 CFR 4.6. As used in this paragraph (b), the terms “laborers and mechanics” include watchpersons and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the conract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) ***Violation; liability for unpaid wages; liquidated damages.*** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $32 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1).

(3) ***Withholding for unpaid wages and liquidated damages*** —

(i) ***Withholding process.*** The [write in the name of the Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor

so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this paragraph (b) on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

(4) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs (b)(1) through (5) of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (5). In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

(5) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

(iv) Informing any other person about their rights under CWHSSA or this part.

(c) ***CWHSSA required records clause.*** In addition to the clauses contained in paragraph (b) of this section, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other laws referenced by § 5.1, the Agency Head must cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor must maintain regular payrolls and other basic records during the course of the work and must preserve them for a period of 3 years after all the work on the prime contract is completed for all laborers and mechanics, including guards and watchpersons, working on the contract. Such records must contain the name; last known address, telephone number, and email address; and social security number of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid; daily and weekly number of hours actually worked; deductions made; and actual wages paid. Further, the Agency Head must cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph must be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview workers during working hours on the job.

(d) ***Incorporation of contract clauses and wage determinations by reference.*** Although agencies are required to insert the contract clauses set forth in this section, along with appropriate wage determinations, in full into covered contracts, and contractors and subcontractors are required to insert them in any lower-tier subcontracts, the incorporation by reference of the required contract clauses and appropriate wage determinations will be given the same force and effect as if they were inserted in full text.

(e) ***Incorporation by operation of law.*** The contract clauses set forth in this section (or their equivalent under the Federal Acquisition Regulation), along with the correct wage determinations, will be considered to be a part of every prime contract required by the applicable statutes referenced by § 5.1 to include such clauses, and will be effective by operation of law, whether or not they are included or incorporated by reference into such contract, unless the Administrator grants a variance, tolerance, or exemption from the application of this paragraph. Where the clauses and applicable wage determinations are effective by operation of law under this paragraph, the prime contractor must be compensated for any resulting increase in wages in accordance with applicable law.

(The information collection, recordkeeping, and reporting requirements contained in the following paragraphs of this section were approved by the Office of Management and Budget:

Paragraph	OMB Control No.
(a)(1)(ii)(B)	1235-0023
(a)(1)(ii)(C)	1235-0023
(a)(1)(iv)	1235-0023
(a)(3)(i)	1235-0023
(a)(3)(ii)(A)	1235-0023
	1235-0008
(c)	1235-0023

[48 FR 19540, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 55 FR 50150, Dec. 4, 1990; 57 FR 28776, June 26, 1992; 58 FR 58955, Nov. 5, 1993; 61 FR 40716, Aug. 5, 1996; 65 FR 69693, Nov. 20, 2000; 73 FR 77511, Dec. 19, 2008; 81 FR 43450, July 1, 2016; 82 FR 2225, 2226, Jan. 9, 2017; 83 FR 12, Jan 2, 2018; 84 FR 218, Jan. 23, 2019; 87 FR 2334, Jan. 14, 2022; 88 FR 2215, Jan. 13, 2023; 88 FR 57734, Aug. 23, 2023; 89 FR 1815, Jan. 11, 2024]

§ 5.6 Enforcement.

(a) ***Agency responsibilities.***

(1)

(i) The Federal agency has the initial responsibility to ascertain whether the clauses required by § 5.5 and the appropriate wage determination(s) have been incorporated into the contracts subject to the labor standards provisions of the laws referenced by § 5.1. Additionally, a Federal agency that provides Federal financial assistance that is subject to the labor standards provisions of the Act must promulgate the necessary regulations or procedures to require the recipient or sub-recipient of the Federal assistance to insert in its contracts the provisions of § 5.5. No payment, advance, grant, loan, or guarantee of funds will be approved by the Federal agency unless it ensures that the clauses required by § 5.5 and the appropriate wage determination(s) are incorporated into such contracts. Furthermore, no payment, advance, grant, loan, or guarantee of funds will be approved by the Federal agency after the beginning of construction unless there is on file with the Federal agency a certification by the contractor that the contractor and its subcontractors have complied with the provisions of § 5.5 or unless there is on file with the Federal agency a certification by the contractor that there is a substantial dispute with respect to the required provisions.

(ii) If a contract subject to the labor standards provisions of the applicable statutes referenced by § 5.1 is entered into without the incorporation of the clauses required by § 5.5, the agency must, upon the request of the Administrator or upon its own initiative, either terminate and resolicit the contract with the required contract clauses, or incorporate the required clauses into the contract (or ensure they are so incorporated) through supplemental agreement, change order, or any and all authority that may be needed. Where an agency has not entered directly into such a contract but instead has provided Federal financial assistance, the agency must ensure that the recipient or sub-recipient of the Federal assistance similarly incorporates the clauses

required into its contracts. The method of incorporation of the correct wage determination, and adjustment in contract price, where appropriate, should be in accordance with applicable law. Additionally, the following requirements apply:

(A) Unless the Administrator directs otherwise, the incorporation of the clauses required by § 5.5 must be retroactive to the date of contract award or start of construction if there is no award.

(B) If this incorporation occurs as the result of a request from the Administrator, the incorporation must take place within 30 days of the date of that request, unless the agency has obtained an extension from the Administrator.

(C) The contractor must be compensated for any increases in wages resulting from incorporation of a missing contract clause.

(D) If the recipient refuses to incorporate the clauses as required, the agency must make no further payment, advance, grant, loan, or guarantee of funds in connection with the contract until the recipient incorporates the required clauses into its contract, and must promptly refer the dispute to the Administrator for further proceedings under § 5.13.

(E) Before terminating a contract pursuant to this section, the agency must withhold or cross-withhold sufficient funds to remedy any back wage liability resulting from the failure to incorporate the correct wage determination or otherwise identify and obligate sufficient funds through a termination settlement agreement, bond, or other satisfactory mechanism.

(F) Notwithstanding the requirement to incorporate the contract clauses and correct wage determination within 30 days, the contract clauses and correct wage determination will be effective by operation of law, retroactive to the beginning of construction, in accordance with § 5.5(e).

(2)

(i) Certified payrolls submitted pursuant to § 5.5(a)(3)(ii) must be preserved by the Federal agency for a period of 3 years after all the work on the prime contract is completed, and must be produced at the request of the Department of Labor at any time during the 3-year period, regardless of whether the Department of Labor has initiated an investigation or other compliance action.

(ii) In situations where the Federal agency does not itself maintain certified payrolls required to be submitted pursuant to § 5.5(a)(3)(ii), upon the request of the Department of Labor the Federal agency must ensure that such certified payrolls are provided to the Department of Labor. Such certified payrolls may be provided by the applicant, sponsor, owner, or other entity, as the case may be, directly to the Department of Labor, or to the Federal agency which, in turn, must provide those records to the Department of Labor.

(3) The Federal agency will cause such investigations to be made as may be necessary to assure compliance with the labor standards clauses required by § 5.5 and the applicable statutes referenced in § 5.1. Investigations will be made of all contracts with such frequency as may be necessary to assure compliance. Such investigations will include interviews with workers, which must be taken in confidence, and examinations of certified payrolls, regular payrolls, and other basic records required to be maintained under § 5.5(a)(3). In making such examinations, particular care

must be taken to determine the correctness of classification(s) of work actually performed, and to determine whether there is a disproportionate amount of work by laborers and of apprentices registered in approved programs. Such investigations must also include evidence of fringe benefit plans and payments thereunder. Federal agencies must give priority to complaints of alleged violations.

(4) In accordance with normal operating procedures, the contracting agency may be furnished various investigatory material from the investigation files of the Department of Labor. None of the material, other than computations of back wages, liquidated damages, and monetary relief for violations of § 5.5(a)(11) or (b)(5), and the summary of back wages due, may be disclosed in any manner to anyone other than Federal officials charged with administering the contract or program providing Federal assistance to the contract, without requesting the permission and views of the Department of Labor.

(b) ***Department of Labor investigations and other compliance actions.***

(1) The Administrator will investigate and conduct other compliance actions as deemed necessary in order to obtain compliance with the labor standards provisions of the applicable statutes referenced by § 5.1, or to affirm or reject the recommendations by the Agency Head with respect to labor standards matters arising under the statutes referenced by § 5.1.

(2) Federal agencies, contractors, subcontractors, sponsors, applicants, owners, or other entities, as the case may be, must cooperate with any authorized representative of the Department of Labor in the inspection of records, in interviews with workers, and in all other aspects of the investigations or other compliance actions.

(3) The findings of such an investigation or other compliance action, including amounts found due, may not be altered or reduced without the approval of the Department of Labor.

(4) Where the underpayments disclosed by such an investigation or other compliance action total $1,000 or more, where there is reason to believe that the contractor or subcontractor has disregarded its obligations to workers or subcontractors, or where liquidated damages may be assessed under CWHSSA, the Department of Labor will furnish the Federal agency an enforcement report detailing the labor standards violations disclosed by the investigation or other compliance action and any action taken by the contractor or subcontractor to correct the violations, including any payment of back wages or any other relief provided workers or remedial actions taken for violations of § 5.5(a)(11) or (b)(5). In other circumstances, the Department of Labor will furnish the Federal agency a notification summarizing the findings of the investigation or other compliance action.

(c) ***Confidentiality requirements.*** It is the policy of the Department of Labor to protect from disclosure the identity of its confidential sources and to prevent an unwarranted invasion of personal privacy. Accordingly, the identity of a worker or other informant who makes a written or oral statement as a complaint or in the course of an investigation or other compliance action, as well as portions of the statement which would tend to reveal the identity of the informant, will not be disclosed in any manner to anyone other than Federal officials without the prior consent of the informant. Disclosure of such statements is also governed by the provisions of the "Freedom of Information Act" (5 U.S.C. 552, see part 70 of this subtitle) and the "Privacy Act of 1974" (5 U.S.C. 552a, see part 71 of this subtitle).

[88 FR 57739, Aug. 23, 2023]

§ 5.7 Reports to the Secretary of Labor.

(a) ***Enforcement reports.***

(1) Where underpayments by a contractor or subcontractor total less than $1,000, where there is no reason to believe that the contractor or subcontractor has disregarded its obligations to workers or subcontractors, and where restitution has been effected and future compliance assured, the Federal agency need not submit its investigative findings and recommendations to the Administrator, unless the investigation or other compliance action was made at the request of the Department of Labor. In the latter case, the Federal agency will submit a factual summary report detailing any violations including any data on the amount of restitution paid, the number of workers who received restitution, liquidated damages assessed under the Contract Work Hours and Safety Standards Act, corrective measures taken (such as "letters of notice" or remedial action taken for violations of § 5.5(a)(11) or (b)(5)), and any information that may be necessary to review any recommendations for an appropriate adjustment in liquidated damages under § 5.8.

(2) Where underpayments by a contractor or subcontractor total $1,000 or more, or where there is reason to believe that the contractor or subcontractor has disregarded its obligations to workers or subcontractors, the Federal agency will furnish within 60 days after completion of its investigation, a detailed enforcement report to the Administrator.

(b) ***Semi-annual enforcement reports.*** To assist the Secretary in fulfilling the responsibilities under Reorganization Plan No. 14 of 1950, Federal agencies shall furnish to the Administrator by April 30 and October 31 of each calendar year semi-annual reports on compliance with and enforcement of the labor standards provisions of the Davis-Bacon Act and its related acts covering the periods of October 1 through March 31 and April 1 through September 30, respectively. Such reports shall be prepared in the manner prescribed in memoranda issued to Federal agencies by the Administrator. This report has been cleared in accordance with FPMR 101-11.11 and assigned interagency report control number 1482-DOL-SA.

(c) ***Additional information.*** Upon request, the Agency Head shall transmit to the Administrator such information available to the Agency with respect to contractors and subcontractors, their contracts, and the nature of the contract work as the Administrator may find necessary for the performance of his or her duties with respect to the labor standards provisions referred to in this part.

(d) ***Contract termination.*** Where a contract is terminated by reason of violations of the labor standards provisions of the statutes listed in § 5.1, a report shall be submitted promptly to the Administrator and to the Comptroller General (if the contract is subject to the Davis-Bacon Act), giving the name and address of the contractor or subcontractor whose right to proceed has been terminated, and the name and address of the contractor or subcontractor, if any, who is to complete the work, the amount and number of the contract, and the description of the work to be performed.

[48 FR 19540, Apr. 29, 1983, as amended at 88 FR 57734, Aug. 23, 2023]

§ 5.8 Liquidated damages under the Contract Work Hours and Safety Standards Act.

(a) The Contract Work Hours and Safety Standards Act requires that laborers or mechanics shall be paid wages at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in any workweek. In the event of violation of this provision, the contractor and any subcontractor shall be liable for the unpaid wages and in addition for liquidated damages, computed with respect to each laborer or mechanic employed in violation of the Act in the amount of $32 for each

calendar day in the workweek on which such individual was required or permitted to work in excess of forty hours without payment of required overtime wages. Any contractor of subcontractor aggrieved by the withholding of liquidated damages shall have the right to appeal to the head of the agency of the United States (or the territory of District of Columbia, as appropriate) for which the contract work was performed or for which financial assistance was provided.

(b) ***Findings and recommendations of the Agency Head.*** The Agency Head has the authority to review the administrative determination of liquidated damages and to issue a final order affirming the determination. It is not necessary to seek the concurrence of the Administrator but the Administrator shall be advised of the action taken. Whenever the Agency Head finds that a sum of liquidated damages administratively determined to be due is incorrect or that the contractor or subcontractor violated inadvertently the provisions of the Act notwithstanding the exercise of due care upon the part of the contractor or subcontractor involved, and the amount of the liquidated damages computed for the contract is in excess of $500, the Agency Head may make recommendations to the Secretary that an appropriate adjustment in liquidated damages be made or that the contractor or subcontractor be relieved of liability for such liquidated damages. Such findings with respect to liquidated damages shall include findings with respect to any wage underpayments for which the liquidated damages are determined.

(c) The recommendations of the Agency Head for adjustment or relief from liquidated damages under paragraph (a) of this section shall be reviewed by the Administrator or an authorized representative who shall issue an order concurring in the recommendations, partially concurring in the recommendations, or rejecting the recommendations, and the reasons therefor. The order shall be the final decision of the Department of Labor, unless a petition for review is filed pursuant to part 7 of this title, and the Administrative Review Board in its discretion reviews such decision and order; or, with respect to contracts subject to the Service Contract Act, unless petition for review is filed pursuant to part 8 of this title, and the Administrative Review Board in its discretion reviews such decision and order.

(d) Whenever the Agency Head finds that a sum of liquidated damages administratively determined to be due under section 104(a) of the Contract Work Hours and Safety Standards Act for a contract is $500 or less and the Agency Head finds that the sum of liquidated damages is incorrect or that the contractor or subcontractor violated inadvertently the provisions of the Contract Work Hours and Safety Standards Act notwithstanding the exercise of due care upon the part of the contractor or subcontractor involved, an appropriate adjustment may be made in such liquidated damages or the contractor or subcontractor may be relieved of liability for such liquidated damages without submitting recommendations to this effect or a report to the Department of Labor. This delegation of authority is made under section 105 of the Contract Work Hours and Safety Standards Act and has been found to be necessary and proper in the public interest to prevent undue hardship and to avoid serious impairment of the conduct of Government business.

[48 FR 19541, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 51 FR 13496, Apr. 21, 1986; 81 FR 43450, July 1, 2016; 83 FR 12, Jan. 2, 2018; 84 FR 218, Jan. 23, 2019; 87 FR 2334, Jan. 14, 2022; 88 FR 2215, Jan. 13, 2023; 89 FR 1815, Jan. 11, 2024]

§ 5.9 Suspension of funds.

(a) ***Suspension and withholding.*** In the event of failure or refusal of the contractor or any subcontractor to comply with the applicable statutes referenced by § 5.1 and the labor standards clauses contained in § 5.5, whether incorporated into the contract physically, by reference, or by operation of law, the Federal agency (and any other agency), may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, take such action as may be necessary to cause the suspension of the payment, advance, or guarantee of funds until such time as the violations are

discontinued and/or until sufficient funds are withheld as may be considered necessary to compensate workers for the full amount of wages and monetary relief to which they are entitled, and to cover any liquidated damages and pre-judgment or post-judgment interest which may be due.

(b) ***Cross-withholding.*** To satisfy a contractor's liability for back wages on a contract, in addition to the suspension and withholding of funds from the contract(s) under which the violation(s) occurred, the necessary funds also may be withheld under any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards and/or the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency.

(c) ***Cross-withholding from different legal entities.*** Cross-withholding of funds may be requested from contracts held by other entities that may be considered to be the same prime contractor as that term is defined in § 5.2. Such cross-withholding is appropriate where the separate legal entities have independently consented to it by entering into contracts containing the withholding provisions at § 5.5(a)(2) and (b)(3). Cross-withholding from a contract held by a different legal entity is not appropriate unless the withholding provisions were incorporated in full or by reference in that different legal entity's contract. Absent exceptional circumstances, cross-withholding is not permitted from a contract held by a different legal entity where the Davis-Bacon labor standards were incorporated only by operation of law into that contract.

[88 FR 57740, Aug. 23, 2023]

§ 5.10 Restitution, criminal action.

(a) In cases other than those forwarded to the Attorney General of the United States under paragraph (b) of this section where violations of the labor standards clauses contained in § 5.5 and the applicable statutes referenced by § 5.1 result in underpayment of wages to workers or monetary damages caused by violations of § 5.5(a)(11) or (b)(5), the Federal agency or an authorized representative of the Department of Labor will request that restitution be made to such workers or on their behalf to plans, funds, or programs for any type of bona fide fringe benefits within the meaning of 40 U.S.C. 3141(2)(B), including interest from the date of the underpayment or loss. Interest on any back wages or monetary relief provided for in this part will be calculated using the percentage established for the underpayment of taxes under 26 U.S.C. 6621 and will be compounded daily.

(b) In cases where the Agency Head or the Administrator finds substantial evidence that such violations are willful and in violation of a criminal statute, the matter will be forwarded to the Attorney General of the United States for prosecution if the facts warrant. In all such cases the Administrator will be informed simultaneously of the action taken.

[88 FR 57741, Aug. 23, 2023]

§ 5.11 Disputes concerning payment of wages.

(a) This section sets forth the procedure for resolution of disputes of fact or law concerning payment of prevailing wage rates, overtime pay, proper classification, or monetary relief for violations of § 5.5(a)(11) or (b)(5). The procedures in this section may be initiated upon the Administrator's own motion, upon referral of the dispute by a Federal agency pursuant to § 5.5(a)(9), or upon request of the contractor or subcontractor.

(b)

(1) In the event of a dispute described in paragraph (a) of this section in which it appears that relevant facts are at issue, the Administrator will notify the affected contractor and subcontractor, if any, by registered or certified mail to the last known address or by any other means normally assuring delivery, of the investigation findings. If the Administrator determines that there is reasonable cause to believe that either the contractor, the subcontractor, or both, should also be subject to debarment under the Davis-Bacon Act or any of the other applicable statutes referenced by § 5.1, the notification will so indicate.

(2) A contractor or subcontractor desiring a hearing concerning the Administrator's investigation findings must request such a hearing by letter or by any other means normally assuring delivery, sent within 30 days of the date of the Administrator's notification. The request must set forth those findings which are in dispute and the reasons therefor, including any affirmative defenses.

(3) Upon receipt of a timely request for a hearing, the Administrator will refer the case to the Chief Administrative Law Judge by Order of Reference, with an attached copy of the notification from the Administrator and the response of the contractor or subcontractor, for designation of an Administrative Law Judge to conduct such hearings as may be necessary to resolve the disputed matters. The hearings will be conducted in accordance with the procedures set forth in part 6 of this subtitle.

(c)

(1) In the event of a dispute described in paragraph (a) of this section in which it appears that there are no relevant facts at issue, and where there is not at that time reasonable cause to institute debarment proceedings under § 5.12, the Administrator will notify the contractor and subcontractor, if any, by registered or certified mail to the last known address or by any other means normally assuring delivery, of the investigation findings, and will issue a ruling on any issues of law known to be in dispute.

(2)

(i) If the contractor or subcontractor disagrees with the factual findings of the Administrator or believes that there are relevant facts in dispute, the contractor or subcontractor must advise the Administrator by letter or by any other means normally assuring delivery, sent within 30 days of the date of the Administrator's notification. In the response, the contractor or subcontractor must explain in detail the facts alleged to be in dispute and attach any supporting documentation.

(ii) Upon receipt of a response under paragraph (c)(2)(i) of this section alleging the existence of a factual dispute, the Administrator will examine the information submitted. If the Administrator determines that there is a relevant issue of fact, the Administrator will refer the case to the Chief Administrative Law Judge in accordance with paragraph (b)(3) of this section. If the Administrator determines that there is no relevant issue of fact, the Administrator will so rule and advise the contractor and subcontractor, if any, accordingly.

(3) If the contractor or subcontractor desires review of the ruling issued by the Administrator under paragraph (c)(1) or (2) of this section, the contractor or subcontractor must file a petition for review thereof with the Administrative Review Board within 30 days of the date of the ruling, with a copy thereof to the Administrator. The petition for review must be filed in accordance with part 7 of this subtitle.

(d) If a timely response to the Administrator's findings or ruling is not made or a timely petition for review is not filed, the Administrator's findings or ruling will be final, except that with respect to debarment under the Davis-Bacon Act, the Administrator will advise the Comptroller General of the Administrator's recommendation in accordance with § 5.12(a)(2). If a timely response or petition for review is filed, the findings or ruling of the Administrator will be inoperative unless and until the decision is upheld by the Administrative Law Judge or the Administrative Review Board.

[88 FR 57741, Aug. 23, 2023]

§ 5.12 Debarment proceedings.

(a) ***Debarment standard and ineligible list.***

(1) Whenever any contractor or subcontractor is found by the Secretary of Labor to have disregarded their obligations to workers or subcontractors under the Davis-Bacon Act, any of the other applicable statutes referenced by § 5.1, this part, or part 3 of this subtitle, such contractor or subcontractor and their responsible officers, if any, and any firm, corporation, partnership, or association in which such contractor, subcontractor, or responsible officer has an interest will be ineligible for a period of 3 years to be awarded any contract or subcontract of the United States or the District of Columbia and any contract or subcontract subject to the labor standards provisions of any of the statutes referenced by § 5.1.

(2) In cases arising under contracts covered by the Davis-Bacon Act, the Administrator will transmit to the Comptroller General the name(s) of the contractors or subcontractors and their responsible officers, if any, and any firms, corporations, partnerships, or associations in which the contractors, subcontractors, or responsible officers are known to have an interest, who have been found to have disregarded their obligations to workers or subcontractors, and the recommendation of the Secretary of Labor or authorized representative regarding debarment. In cases arising under contracts covered by any of the applicable statutes referenced by § 5.1 other than the Davis-Bacon Act, the Administrator determines the name(s) of the contractors or subcontractors and their responsible officers, if any, and any firms, corporations, partnerships, or associations in which the contractors, subcontractors, or responsible officers are known to have an interest, to be debarred. The names of such ineligible persons or firms will be published on SAM or its successor website, and an ineligible person or firm will be ineligible for a period of 3 years from the date of publication of their name on the ineligible list, to be awarded any contract or subcontract of the United States or the District of Columbia and any contract or subcontract subject to the labor standards provisions of any of the statutes referenced by § 5.1.

(b) ***Procedure.***

(1) In addition to cases under which debarment action is initiated pursuant to § 5.11, whenever as a result of an investigation conducted by the Federal agency or the Department of Labor, and where the Administrator finds reasonable cause to believe that a contractor or subcontractor has committed violations which constitute a disregard of its obligations to workers or subcontractors under the Davis-Bacon Act, the labor standards provisions of any of the other applicable statutes referenced by § 5.1, this part, or part 3 of this subtitle, the Administrator will notify by registered or certified mail to the last known address or by any other means normally assuring delivery, the contractor or subcontractor and responsible officers, if any, and any firms, corporations, partnerships, or associations in which the contractors, subcontractors, or responsible officers are known to have an interest of the finding.

(i) The Administrator will afford such contractor, subcontractor, responsible officer, and any other parties notified an opportunity for a hearing as to whether debarment action should be taken under paragraph (a) of this section. The Administrator will furnish to those notified a summary of the investigative findings.

(ii) If the contractor, subcontractor, responsible officer, or any other parties notified wish to request a hearing as to whether debarment action should be taken, such a request must be made by letter or by any other means normally assuring delivery, sent within 30 days of the date of the notification from the Administrator, and must set forth any findings which are in dispute and the basis for such disputed findings, including any affirmative defenses to be raised.

(iii) Upon timely receipt of such request for a hearing, the Administrator will refer the case to the Chief Administrative Law Judge by Order of Reference, with an attached copy of the notification from the Administrator and the responses of the contractor, subcontractor, responsible officers, or any other parties notified, for designation of an Administrative Law Judge to conduct such hearings as may be necessary to determine the matters in dispute.

(iv) In considering debarment under any of the statutes referenced by § 5.1 other than the Davis-Bacon Act, the Administrative Law Judge will issue an order concerning whether the contractor, subcontractor, responsible officer, or any other party notified is to be debarred in accordance with paragraph (a) of this section. In considering debarment under the Davis-Bacon Act, the Administrative Law Judge will issue a recommendation as to whether the contractor, subcontractor, responsible officers, or any other party notified should be debarred under 40 U.S.C. 3144(b).

(2) Hearings under this section will be conducted in accordance with part 6 of this subtitle. If no hearing is requested within 30 days of the date of the notification from the Administrator, the Administrator's findings will be final, except with respect to recommendations regarding debarment under the Davis-Bacon Act, as set forth in paragraph (a)(2) of this section.

(c) ***Interests of debarred parties.***

(1) A finding as to whether persons or firms whose names appear on the ineligible list have an interest under 40 U.S.C. 3144(b) or paragraph (a) of this section in any other firm, corporation, partnership, or association, may be made through investigation, hearing, or otherwise.

(2)

(i) The Administrator, on their own motion or after receipt of a request for a determination pursuant to paragraph (c)(3) of this section, may make a finding on the issue of interest.

(ii) If the Administrator determines that there may be an interest but finds that there is insufficient evidence to render a final ruling thereon, the Administrator may refer the issue to the Chief Administrative Law Judge in accordance with paragraph (c)(4) of this section.

(iii) If the Administrator finds that no interest exists, or that there is not sufficient information to warrant the initiation of an investigation, the requesting party, if any, will be so notified and no further action taken.

(iv)

(A) If the Administrator finds that an interest exists, the person or firm affected will be notified of the Administrator's finding (by certified mail to the last known address or by any other means normally assuring delivery), which will include the reasons therefore, and such person or firm will be afforded an opportunity to request that a hearing be held to decide the issue.

(B) Such person or firm will have 20 days from the date of the Administrator's ruling to request a hearing. A person or firm desiring a hearing must request it by letter or by any other means normally assuring delivery, sent within 20 days of the date of the Administrator's notification. A detailed statement of the reasons why the Administrator's ruling is in error, including facts alleged to be in dispute, if any, must be submitted with the request for a hearing.

(C) If no hearing is requested within the time mentioned in paragraph (c)(2)(iv)(B) of this section, the Administrator's finding will be final and the Administrator will notify the Comptroller General in cases arising under the DBA. If a hearing is requested, the ruling of the Administrator will be inoperative unless and until the Administrative Law Judge or the Administrative Review Board issues an order that there is an interest.

(3)

(i) A request for a determination of interest may be made by any interested party, including contractors or prospective contractors and associations of contractors, representatives of workers, and interested agencies. Such a request must be submitted in writing to the Administrator, Wage and Hour Division, U.S. Department of Labor, 200 Constitution Avenue NW, Washington, DC 20210.

(ii) The request must include a statement setting forth in detail why the petitioner believes that a person or firm whose name appears on the ineligible list has an interest in any firm, corporation, partnership, or association that is seeking or has been awarded a contract or subcontract of the United States or the District of Columbia, or a contract or subcontract that is subject to the labor standards provisions of any of the statutes referenced by § 5.1. No particular form is prescribed for the submission of a request under this section.

(4) The Administrator, on their own motion under paragraph (c)(2)(ii) of this section or upon a request for hearing where the Administrator determines that relevant facts are in dispute, will by order refer the issue to the Chief Administrative Law Judge, for designation of an Administrative Law Judge who will conduct such hearings as may be necessary to render a decision solely on the issue of interest. Such proceedings must be conducted in accordance with the procedures set forth in part 6 of this subtitle.

(5) If the person or firm affected requests a hearing and the Administrator determines that relevant facts are not in dispute, the Administrator will refer the issue and the record compiled thereon to the Administrative Review Board to render a decision solely on the issue of interest. Such proceeding must be conducted in accordance with the procedures set forth in part 7 of this subtitle.

[88 FR 57741, Aug. 23, 2023]

§ 5.13 Rulings and interpretations.

(a) All questions relating to the application and interpretation of wage determinations (including the classifications therein) issued pursuant to part 1 of this subtitle, of the rules contained in this part and in parts 1 and 3 of this subtitle, and of the labor standards provisions of any of the laws referenced in § 5.1 must be referred to the Administrator for appropriate ruling or interpretation. These rulings and interpretations are authoritative and those under the Davis-Bacon Act may be relied upon as provided for in section 10 of the Portal-to-Portal Act of 1947 (29 U.S.C. 259). Requests for such rulings and interpretations should be submitted via email to *dgceinquiries@dol.gov*; by mail to Administrator, Wage and Hour Division, U.S. Department of Labor, 200 Constitution Ave., NW, Washington, DC 20210; or through other means directed by the Administrator.

(b) If any such ruling or interpretation is made by an authorized representative of the Administrator of the Wage and Hour Division, any interested party may seek reconsideration of the ruling or interpretation by the Administrator of the Wage and Hour Division. The procedures and time limits set out in § 1.8 of this subtitle apply to any such request for reconsideration.

[88 FR 57743, Aug. 23, 2023]

§ 5.14 Variations, tolerances, and exemptions from parts 1 and 3 of this subtitle and this part.

The Secretary of Labor may make variations, tolerances, and exemptions from the regulatory requirements of this part and those of parts 1 and 3 of this subtitle whenever the Secretary finds that such action is necessary and proper in the public interest or to prevent injustice and undue hardship. Variations, tolerances, and exemptions may not be made from the statutory requirements of any of the statutes listed in § 5.1 unless the statute specifically provides such authority.

§ 5.15 Limitations, variations, tolerances, and exemptions under the Contract Work Hours and Safety Standards Act.

(a) ***General.*** Upon his or her own initiative or upon the request of any Federal agency, the Secretary of Labor may provide under section 105 of the Contract Work Hours and Safety Standards Act reasonable limitations and allow variations, tolerances, and exemptions to and from any or all provisions of that Act whenever the Secretary finds such action to be necessary and proper in the public interest to prevent injustice, or undue hardship, or to avoid serious impairment of the conduct of Government business. Any request for such action by the Secretary shall be submitted in writing, and shall set forth the reasons for which the request is made.

(b) ***Exemptions.*** Pursuant to section 105 of the Contract Work Hours and Safety Standards Act, the following classes of contracts are found exempt from all provisions of that Act in order to prevent injustice, undue hardship, or serious impairment of Government business:

(1) Contract work performed in a workplace within a foreign country or within territory under the jurisdiction of the United States other than the following: A State of the United States; the District of Columbia; Puerto Rico; the Virgin Islands; Outer Continental Shelf lands defined in the Outer Continental Shelf Lands Act (ch. 345, 67 Stat. 462); American Samoa; Guam; Wake Island; Eniwetok Atoll; Kwajalein Atoll; and Johnston Island.

(2) Agreements entered into by or on behalf of the Commodity Credit Corporation providing for the storing in or handling by commercial warehouses of wheat, corn, oats, barley, rye, grain sorghums, soybeans, flaxseed, rice, naval stores, tobacco, peanuts, dry beans, seeds, cotton, and wool.

(3) Sales of surplus power by the Tennessee Valley Authority to States, counties, municipalities, cooperative organization of citizens or farmers, corporations and other individuals pursuant to section 10 of the Tennessee Valley Authority Act of 1933 (16 U.S.C. 8311).

(c) ***Tolerances.***

(1) The "basic rate of pay" under section 102 of the Contract Work Hours and Safety Standards Act may be computed as an hourly equivalent to the rate on which time-and-one-half overtime compensation may be computed and paid under section 7 of the Fair Labor Standards Act of 1938, as amended (29 U.S.C. 207), as interpreted in part 778 of this title. This tolerance is found to be necessary and proper in the public interest in order to prevent undue hardship.

(2) Concerning the tolerance provided in paragraph (c)(1) of this section, the provisions of section 7(d)(2) of the Fair Labor Standards Act and § 778.7 of this title should be noted. Under these provisions, payments for occasional periods when no work is performed, due to vacations, and similar causes are excludable from the "regular rate" under the Fair Labor Standards Act. Such payments, therefore, are also excludable from the "basic rate" under the Contract Work Hours and Safety Standards Act.

(3) See § 5.8(c) providing a tolerance subdelegating authority to the heads of agencies to make appropriate adjustments in the assessment of liquidated damages totaling $500 or less under specified circumstances.

(4)

(i) Time spent in an organized program of related, supplemental instruction by laborers or mechanics employed under bona fide apprenticeship programs may be excluded from working time if the criteria prescribed in paragraphs (c)(4)(ii) and (iii) of this section are met.

(ii) The apprentice comes within the definition contained in § 5.2.

(iii) The time in question does not involve productive work or performance of the apprentice's regular duties.

(d) ***Variations.***

(1) In the event of failure or refusal of the contractor or any subcontractor to comply with overtime pay requirements of the Contract Work Hours and Safety Standards Act, if the funds withheld by Federal agencies for the violations are not sufficient to pay fully the unpaid wages and any back pay or other monetary relief due laborers and mechanics, with interest, and the liquidated damages due the United States, the available funds will be used first to compensate the laborers and mechanics for the wages to which they are entitled (or an equitable portion thereof when the funds are not adequate for this purpose); and the balance, if any, will be used for the payment of liquidated damages.

(2) In the performance of any contract entered into pursuant to the provisions of 38 U.S.C. 620 to provide nursing home care of veterans, no contractor or subcontractor under such contract shall be deemed in violation of section 102 of the Contract Work Hours and Safety Standards Act by virtue of failure to pay the overtime wages required by such section for work in excess of 40 hours in the

workweek to any individual employed by an establishment which is an institution primarily engaged in the care of the sick, the aged, or the mentally ill or defective who reside on the premises if, pursuant to an agreement or understanding arrived at between the employer and the employee before performance of the work, a work period of 14 consecutive days is accepted in lieu of the workweek of 7 consecutive days for the purpose of overtime compensation and if such individual receives compensation for employment in excess of 8 hours in any workday and in excess of 80 hours in such 14-day period at a rate not less than $1^{1}/_{2}$ times the regular rate at which the individual is employed, computed in accordance with the requirements of the Fair Labor Standards Act of 1938, as amended.

(3) Any contractor or subcontractor performing on a government contract the principal purpose of which is the furnishing of fire fighting or suppression and related services, shall not be deemed to be in violation of section 102 of the Contract Work Hour and Safety Standards Act for failing to pay the overtime compensation required by section 102 of the Act in accordance with the basic rate of pay as defined in paragraph (c)(1) of this section, to any pilot or copilot of a fixed-wing or rotary-wing aircraft employed on such contract if:

(i) Pursuant to a written employment agreement between the contractor and the employee which is arrived at before performance of the work.

(A) The employee receives gross wages of not less than $300 per week regardless of the total number of hours worked in any workweek, and

(B) Within any workweek the total wages which an employee receives are not less than the wages to which the employee would have been entitled in that workweek if the employee were paid the minimum hourly wage required under the contract pursuant to the provisions of the Service Contract Act of 1965 and any applicable wage determination issued thereunder for all hours worked, plus an additional premium payment of one-half times such minimum hourly wage for all hours worked in excess of 40 hours in the workweek;

(ii) The contractor maintains accurate records of the total daily and weekly hours of work performed by such employee on the government contract. In the event these conditions for the exemption are not met, the requirements of section 102 of the Contract Work Hours and Safety Standards Act shall be applicable to the contract from the date the contractor or subcontractor fails to satisfy the conditions until completion of the contract.

(Reporting and recordkeeping requirements in paragraph (d)(2) have been approved by the Office of Management and Budget under control numbers 1235-0023 and 1235-0018. Reporting and recordkeeping requirements in paragraph (d)(3)(ii) have been approved by the Office of Management and Budget under control number 1235-0018)

[48 FR 19541, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 61 FR 40716, Aug. 5, 1996; 82 FR 2226, Jan. 9, 2017; 88 FR 57743, Aug. 23, 2023]

§ 5.16 [Reserved]

§ 5.17 [Reserved]

§ 5.18 Remedies for retaliation.

(a) ***Administrator request to remedy violation.*** When the Administrator finds that any person has discriminated in any way against any worker or job applicant in violation of § 5.5(a)(11) or (b)(5), or caused any person to discriminate in any way against any worker or job applicant in violation of § 5.5(a)(11) or (b)(5), the Administrator will notify the person, any contractors for whom the person worked or on whose behalf the person acted, and any upper tier contractors, as well as the relevant contracting agency(ies) of the discrimination and request that the person and any contractors for whom the person worked or on whose behalf the person acted remedy the violation.

(b) ***Administrator directive to remedy violation and provide make-whole relief.*** If the person and any contractors for whom the person worked or on whose behalf the person acted do not remedy the violation, the Administrator in the notification of violation findings issued under § 5.11 or § 5.12 will direct the person and any contractors for whom the person worked or on whose behalf the person acted to provide appropriate make-whole relief to affected worker(s) and job applicant(s) or take appropriate remedial action, or both, to correct the violation, and will specify the particular relief and remedial actions to be taken.

(c) ***Examples of available make-whole relief and remedial actions.*** Such relief and remedial actions may include, but are not limited to, employment, reinstatement, front pay in lieu of reinstatement, and promotion, together with back pay and interest; compensatory damages; restoration of the terms, conditions, and privileges of the worker's employment or former employment; the expungement of warnings, reprimands, or derogatory references; the provision of a neutral employment reference; and the posting of a notice to workers that the contractor or subcontractor agrees to comply with the Davis-Bacon Act and Related Acts anti-retaliation requirements.

[88 FR 57743, Aug. 23, 2023]

Subpart B—Interpretation of the Fringe Benefits Provisions of the Davis-Bacon Act

Source: 29 FR 13465, Sept. 30, 1964, unless otherwise noted.

§ 5.20 Scope and significance of this subpart.

The 1964 amendments (Pub. L. 88-349) to the Davis-Bacon Act require, among other things, that the prevailing wage determined for Federal and federally assisted construction include the basic hourly rate of pay and the amount contributed by the contractor or subcontractor for certain fringe benefits (or the cost to them of such benefits). The purpose of this subpart is to explain the provisions of these amendments and make available in one place official interpretations of the fringe benefits provisions of the Davis-Bacon Act. These interpretations will guide the Department of Labor in carrying out its responsibilities under these provisions. These interpretations are intended also to provide guidance to contractors and their associations; laborers and mechanics and their organizations; and local, State, and Federal agencies. The interpretations contained in this subpart are authoritative and may be relied upon as provided for in section 10 of the Portal-to-Portal Act of 1947 (29 U.S.C. 259). The omission to discuss a particular problem in this subpart or in interpretations supplementing it should not be taken to indicate the adoption of any position by the Secretary of Labor with respect to such problem or to constitute an administrative interpretation, practice, or enforcement policy. Questions on matters not fully covered by this subpart may be referred to the Secretary for interpretation as provided in § 5.13.

[88 FR 57743, Aug. 23, 2023]

§ 5.21 [Reserved]

§ 5.22 Effect of the Davis-Bacon fringe benefits provisions.

The Davis-Bacon Act and the prevailing wage provisions of the statutes referenced in § 1.1 of this subtitle confer upon the Secretary of Labor the authority to predetermine, as minimum wages, those wage rates found to be prevailing for corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the area in which the work is to be performed. See the definitions of the terms "prevailing wage" and "area" in § 1.2 of this subtitle. The fringe benefits amendments enlarge the scope of this authority by including certain bona fide fringe benefits within the meaning of the terms "wages", "scale of wages", "wage rates", "minimum wages", and "prevailing wages", as used in the Davis-Bacon Act.

[88 FR 57744, Aug. 23, 2023]

§ 5.23 The statutory provisions.

Pursuant to the Davis-Bacon Act, as amended and codified at 40 U.S.C. 3141(2), the term "prevailing wages" and similar terms include the basic hourly rate of pay and, for the listed fringe benefits and other bona fide fringe benefits not required by other law, the contributions irrevocably made by a contractor or subcontractor to a trustee or third party pursuant to a bona fide fringe benefit fund, plan, or program, and the costs to the contractor or subcontractor that may be reasonably anticipated in providing bona fide fringe benefits pursuant to an enforceable commitment to carry out a financially responsible plan or program, which was communicated in writing to the affected laborers and mechanics. Section 5.29 discusses specific fringe benefits that may be considered to be bona fide.

[88 FR 57744, Aug. 23, 2023]

§ 5.24 The basic hourly rate of pay.

"The basic hourly rate of pay" is that part of a laborer's or mechanic's wages which the Secretary of Labor would have found and included in wage determinations prior to the 1964 amendments. The Secretary of Labor is required to continue to make a separate finding of this portion of the wage. In general, this portion of the wage is the cash payment made directly to the laborer or mechanic. It does not include fringe benefits.

§ 5.25 Rate of contribution or cost for fringe benefits.

(a) Under the amendments, the Secretary is obligated to make a separate finding of the rate of contribution or cost of fringe benefits. Only the amount of contributions or costs for fringe benefits which meet the requirements of the act will be considered by the Secretary. These requirements are discussed in this subpart.

(b) The rate of contribution or cost is ordinarily an hourly rate, and will be reflected in the wage determination as such. In some cases, however, the contribution or cost for certain fringe benefits may be expressed in a formula or method of payment other than an hourly rate. In such cases, the Secretary may in his discretion express in the wage determination the rate of contribution or cost used in the formula or method or may convert it to an hourly rate of pay whenever he finds that such action would facilitate the administration of the Act. See § 5.5(a)(1)(i) and (iii).

(c) Except as provided in this section, contractors must "annualize" all contributions to fringe benefit plans (or the reasonably anticipated costs of an unfunded benefit plan) to determine the hourly equivalent for which they may take credit against their fringe benefit obligation. The "annualization" principle reflects that DBRA credit for contributions made to bona fide fringe benefit plans (or the reasonably anticipated costs of an unfunded benefit plan) is allowed based on the effective rate of contributions or costs incurred for total hours worked during the year (or a shorter time period) by a laborer or mechanic.

(1) ***Method of computation.*** To annualize the cost of providing a fringe benefit, a contractor must divide the total cost of the fringe benefit contribution (or the reasonably anticipated costs of an unfunded benefit plan) by the total number of hours worked on both private (non-DBRA) work and work covered by the Davis-Bacon Act and/or Davis-Bacon Related Acts (DBRA-covered work) during the time period to which the cost is attributable to determine the rate of contribution per hour. If the amount of contribution varies per worker, credit must be determined separately for the amount contributed on behalf of each worker.

(2) ***Exception requests.*** Contractors, plans, and other interested parties may request an exception from the annualization requirement by submitting a request to the WHD Administrator. A request for an exception may be granted only if each of the requirements of paragraph (c)(3) of this section is satisfied. Contributions to defined contribution pension plans (DCPPs) are excepted from the annualization requirement, and exception requests therefore are not required in connection with DCPPs, provided that each of the requirements of paragraph (c)(3) is satisfied and the DCPP provides for immediate participation and essentially immediate vesting (*i.e.,* the benefit vests within the first 500 hours worked). Requests must be submitted in writing to the Division of Government Contracts Enforcement by email to *DBAannualization@dol.gov* or by mail to Director, Division of Government Contracts Enforcement, Wage and Hour Division, U.S. Department of Labor, 200 Constitution Ave. NW, Room S-3502, Washington, DC 20210.

(3) ***Exception requirements.*** Contributions to a bona fide fringe benefit plan (or the reasonably anticipated costs of an unfunded benefit plan) are excepted from the annualization requirement if all of the following criteria are satisfied:

(i) The benefit provided is not continuous in nature. A benefit is not continuous in nature when it is not available to a participant without penalty throughout the year or other time period to which the cost of the benefit is attributable; and

(ii) The benefit does not compensate both private work and DBRA-covered work. A benefit does not compensate both private and DBRA-covered work if any benefits attributable to periods of private work are wholly paid for by compensation for private work.

[29 FR 13465, Sept. 30, 1964, as amended at 88 FR 57744, Aug. 23, 2023]

§ 5.26 "* * * contribution irrevocably made * * * to a trustee or to a third person".

(a) ***Requirements.*** The following requirements apply to any fringe benefit contributions made to a trustee or to a third person pursuant to a fund, plan, or program:

(1) Such contributions must be made irrevocably;

(2) The trustee or third person may not be affiliated with the contractor or subcontractor;

(3) A trustee must adhere to any fiduciary responsibilities applicable under law; and

(4) The trust or fund must not permit the contractor or subcontractor to recapture any of the contributions paid in or any way divert the funds to its own use or benefit.

(b) ***Excess payments.*** Notwithstanding the above, a contractor or subcontractor may recover sums which it had paid to a trustee or third person in excess of the contributions actually called for by the plan, such as excess payments made in error or in order to cover the estimated cost of contributions at a time when the exact amount of the necessary contributions is not yet known. For example, a benefit plan may provide for definite insurance benefits for employees in the event of contingencies such as death, sickness, or accident, with the cost of such definite benefits borne by the contractor or subcontractor. In such a case, if the insurance company returns the amount that the contractor or subcontractor paid in excess of the amount required to provide the benefits, this will not be deemed a recapture or diversion by the employer of contributions made pursuant to the plan. (*See* Report of the Senate Committee on Labor and Public Welfare, S. Rep. No. 963, 88th Cong., 2d Sess., p. 5.)

[88 FR 57744, Aug. 23, 2023]

§ 5.27 "* * * fund, plan, or program".

The contributions for fringe benefits must be made pursuant to a fund, plan or program (sec. 1(b)(2)(A) of the act). The phrase "fund, plan, or program" is merely intended to recognize the various types of arrangements commonly used to provide fringe benefits through employer contributions. The phrase is identical with language contained in section 3(1) of the Welfare and Pension Plans Disclosure Act. In interpreting this phrase, the Secretary will be guided by the experience of the Department in administering the latter statute. (See Report of Senate Committee on Labor and Public Welfare, S. Rep. No. 963, 88th Cong., 2d Sess., p. 5.)

§ 5.28 Unfunded plans.

(a) The costs to a contractor or subcontractor which may be reasonably anticipated in providing benefits of the types described in the Act, pursuant to an enforceable commitment to carry out a financially responsible plan or program, are considered fringe benefits within the meaning of the Act (*see* 40 U.S.C. 3141(2)(B)(ii)). The legislative history suggests that these provisions were intended to permit the consideration of fringe benefits meeting these requirements, among others, and which are provided from the general assets of a contractor or subcontractor. (Report of the House Committee on Education and Labor, H. Rep. No. 308, 88th Cong., 1st Sess., p. 4; *see also* S. Rep. No. 963, p. 6.)

(b) Such a benefit plan or program, commonly referred to as an unfunded plan, may not constitute a fringe benefit within the meaning of the Act unless:

(1) It could be reasonably anticipated to provide the benefits described in the Act;

(2) It represents a commitment that can be legally enforced;

(3) It is carried out under a financially responsible plan or program;

(4) The plan or program providing the benefits has been communicated in writing to the laborers and mechanics affected; and

(5) The contractor or subcontractor requests and receives approval of the plan or program from the Secretary, as described in paragraph (c) of this section.

(c) To receive approval of an unfunded plan or program, a contractor or subcontractor must demonstrate in its request to the Secretary that the unfunded plan or program, and the benefits provided under such plan or program, are "bona fide," meet the requirements set forth in paragraphs (b)(1) through (4) of this section, and are otherwise consistent with the Act. The request must include sufficient documentation to enable the Secretary to evaluate these criteria. Contractors and subcontractors may request approval of an unfunded plan or program by submitting a written request in one of the following manners:

(1) By mail to the United States Department of Labor, Wage and Hour Division, Director, Division of Government Contracts Enforcement, 200 Constitution Ave. NW, Room S-3502, Washington, DC 20210;

(2) By email to *unfunded@dol.gov* (or its successor email address); or

(3) By any other means directed by the Administrator.

(d) Unfunded plans or programs may not be used as a means of avoiding the Act's requirements. The words "reasonably anticipated" require that any unfunded plan or program be able to withstand a test of actuarial soundness. Moreover, as in the case of other fringe benefits payable under the Act, an unfunded plan or program must be "bona fide" and not a mere simulation or sham for avoiding compliance with the Act. To prevent these provisions from being used to avoid compliance with the Act, the Secretary may direct a contractor or subcontractor to set aside in an account assets which, under sound actuarial principles, will be sufficient to meet future obligations under the plan. Such an account must be preserved for the purpose intended. (S. Rep. No. 963, p. 6.)

[88 FR 57744, Aug. 23, 2023]

§ 5.29 Specific fringe benefits.

(a) The act lists all types of fringe benefits which the Congress considered to be common in the construction industry as a whole. These include the following: Medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing, unemployment benefits, life insurance, disability and sickness insurance, or accident insurance, vacation and holiday pay, defrayment of costs of apprenticeship or other similar programs, or other bona fide fringe benefits, but only where the contractor or subcontractor is not required by other Federal, State, or local law to provide any of such benefits.

(b) The legislative history indicates that it was not the intent of the Congress to impose specific standards relating to administration of fringe benefits. It was assumed that the majority of fringe benefits arrangements of this nature will be those which are administered in accordance with requirements of section 302(c)(5) of the National Labor Relations Act, as amended (S. Rep. No. 963, p. 5).

(c) The term "other bona fide fringe benefits" is the so-called "open end" provision. This was included so that new fringe benefits may be recognized by the Secretary as they become prevailing. It was pointed out that a particular fringe benefit need not be recognized beyond a particular area in order for the Secretary to find that it is prevailing in that area. (S. Rep. No. 963, p. 6).

(d) The legislative reports indicate that, to insure against considering and giving credit to any and all fringe benefits, some of which might be illusory or not genuine, the qualification was included that such fringe benefits must be "bona fide" (H. Rep. No. 308, p. 4; S. Rep. No. 963, p. 6). No difficulty is anticipated in determining whether a particular fringe benefit is "bona fide" in the ordinary case where the benefits are those common in the construction industry and which are established under a usual fund, plan, or

program. This would be typically the case of those fringe benefits listed in paragraph (a) of this section which are funded under a trust or insurance program. Contractors may take credit for contributions made under such conventional plans without requesting the approval of the Secretary of Labor under § 5.5(a)(1)(iv).

(e) Where the plan is not of the conventional type described in paragraph (d) of this section, the Secretary must examine the facts and circumstances to determine whether fringe benefits under the plan are "bona fide" in accordance with requirements of the Act. This is particularly true with respect to unfunded plans discussed in § 5.28. Contractors or subcontractors seeking credit under the Act for costs incurred for such plans must request specific approval from the Secretary under § 5.5(a)(1)(iv).

(f) The act excludes fringe benefits which a contractor or subcontractor is obligated to provide under other Federal, State, or local law. No credit may be taken under the act for the payments made for such benefits. For example, payment for workmen's compensation insurance under either a compulsory or elective State statute are not considered payments for fringe benefits under the Act. While each situation must be separately considered on its own merits, payments made for travel, subsistence or to industry promotion funds are not normally payments for fringe benefits under the Act. The omission in the Act of any express reference to these payments, which are common in the construction industry, suggests that these payments should not normally be regarded as bona fide fringe benefits under the Act.

(g) For a contractor or subcontractor to take credit for the costs of an apprenticeship program, the following requirements must be met:

(1) The program, in addition to meeting all other relevant requirements for fringe benefits in this subpart, must be registered with the Department of Labor's Employment and Training Administration, Office of Apprenticeship ("OA"), or with a State Apprenticeship Agency recognized by the OA.

(2) The contractor or subcontractor may only take credit for amounts reasonably related to the costs of the apprenticeship benefits actually provided to the contractor's employees, such as instruction, books, and tools or materials. It may not take credit for voluntary contributions beyond such costs. Amounts the employer is required to contribute by a collective bargaining agreement or by a bona fide apprenticeship plan will be presumed to be reasonably related to such costs in the absence of evidence to the contrary.

(3) Costs incurred for the apprenticeship for one classification of laborer or mechanic may not be used to offset costs incurred for another classification.

(4) In applying the annualization principle to compute the allowable fringe benefit credit pursuant to § 5.25, the total number of working hours of employees to which the cost of an apprenticeship program is attributable is limited to the total number of hours worked by laborers and mechanics in the apprentice's classification. For example, if a contractor enrolls an employee in an apprenticeship program for carpenters, the permissible hourly Davis-Bacon credit is determined by dividing the cost of the program by the total number of hours worked by the contractor's carpenters and carpenters' apprentices on covered and non-covered projects during the time period to which the cost is attributable, and such credit may only be applied against the contractor's prevailing wage obligations for all carpenters and carpenters' apprentices for each hour worked on the covered project.

[29 FR 13465, Sept. 30, 1964, as amended at 88 FR 57745, Aug. 23, 2023]

§ 5.30 Types of wage determinations.

(a) When fringe benefits are prevailing for various classes of laborers and mechanics in the area of proposed construction, such benefits are includable in any Davis-Bacon wage determination. The examples contained in paragraph (c) of this section demonstrate how fringe benefits may be listed on wage determinations in such cases.

(b) Wage determinations do not include fringe benefits for various classes of laborers and mechanics whenever such benefits do not prevail in the area of proposed construction. When this occurs, the wage determination will contain only the basic hourly rates of pay which are prevailing for the various classes of laborers and mechanics. An illustration of this situation is contained in paragraph (c) of this section.

(c) The following illustrates examples of the situations discussed in paragraph (a) and (b) of this section:

Figure 1 to Paragraph (c)

CLASSIFICATION	RATE	FRINGES
Bricklayer	$21.96	$0.00
Electrician	$47.65	3%+$14.88
Elevator mechanic	$48.60	$35.825+a+b a. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day and the Friday after Thanksgiving. b. VACATIONS: Employer contributes 8% of basic hourly rate for 5 years or more of service; 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.
Ironworker, structural	$32.00	$12.01
Laborer: common or general	$21.93	$6.27
Operator: bulldozer	$18.11	$0.00
Plumber (excludes HVAC duct, pipe and unit installation)	$38.38	$16.67

Note 1 to paragraph (c): This format is not necessarily in the exact form in which determinations will issue; it is for illustration only.

[88 FR 57745, Aug. 23, 2023]

§ 5.31 Meeting wage determination obligations.

(a) A contractor or subcontractor performing work subject to a Davis-Bacon wage determination may discharge their minimum wage obligations for the payment of both straight time wages and fringe benefits by paying in cash, making payments or incurring costs for "bona fide" fringe benefits of the types listed in the applicable wage determination or otherwise found prevailing by the Secretary of Labor, or by a combination thereof.

(b) A contractor or subcontractor may discharge their obligations for the payment of the basic hourly rates and the fringe benefits where both are contained in a wage determination applicable to their laborers or mechanics in the following ways:

(1) By paying not less than the basic hourly rate to the laborers or mechanics and by making contributions for "bona fide" fringe benefits in a total amount not less than the total of the fringe benefits required by the wage determination. For example, the obligations for "Laborer: common or general" in § 5.30, figure 1 to paragraph (c), will be met by the payment of a straight time hourly rate of not less than $21.93 and by contributions of not less than a total of $6.27 an hour for "bona fide" fringe benefits; or

(2) By paying in cash directly to laborers or mechanics for the basic hourly rate and by making an additional cash payment in lieu of the required benefits. For example, where an employer does not make payments or incur costs for fringe benefits, they would meet their obligations for "Laborer: common or general" in § 5.30, figure 1 to paragraph (c), by paying directly to the laborers a straight time hourly rate of not less than $28.60 ($21.93 basic hourly rate plus $6.27 for fringe benefits); or

(3) As stated in paragraph (a) of this section, the contractor or subcontractor may discharge their minimum wage obligations for the payment of straight time wages and fringe benefits by a combination of the methods illustrated in paragraphs (b)(1) and (2) of this section. Thus, for example, their obligations for "Laborer: common or general" may be met by an hourly rate, partly in cash and partly in payments or costs for fringe benefits which total not less than $28.60 ($21.93 basic hourly rate plus $6.27 for fringe benefits).

[88 FR 57746, Aug. 23, 2023]

§ 5.32 Overtime payments.

(a) The act excludes amounts paid by a contractor or subcontractor for fringe benefits in the computation of overtime under the Fair Labor Standards Act, the Contract Work Hours and Safety Standards Act, and the Walsh-Healey Public Contracts Act whenever the overtime provisions of any of these statutes apply concurrently with the Davis-Bacon Act or its related prevailing wage statutes. It is clear from the legislative history that in no event can the regular or basic rate upon which premium pay for overtime is calculated under the aforementioned Federal statutes be less than the amount determined by the Secretary of Labor as the basic hourly rate (i.e. cash rate) under section 1(b)(1) of the Davis-Bacon Act. (See S. Rep. No. 963, p. 7.) Contributions by employees are not excluded from the regular or basic rate upon which overtime is computed under these statutes; that is, an employee's regular or basic straight-time rate is computed on his earnings before any deductions are made for the employee's contributions to

fringe benefits. The contractor's contributions or costs for fringe benefits may be excluded in computing such rate so long as the exclusions do not reduce the regular or basic rate below the basic hourly rate contained in the wage determination.

(b) The legislative report notes that the phrase "contributions irrevocably made by a contractor or subcontractor to a trustee or to a third person pursuant to a fund, plan, or program" was added to the bill in Committee. This language in essence conforms to the overtime provisions of section 7(d)(4) of the Fair Labor Standards Act, as amended. The intent of the committee was to prevent any avoidance of overtime requirements under existing law. See H. Rep. No. 308, p. 5.

(c)

(1) The act permits a contractor or subcontractor to pay a cash equivalent of any fringe benefits found prevailing by the Secretary of Labor. Such a cash equivalent would also be excludable in computing the regular or basic rate under the Federal overtime laws mentioned in paragraph (a). For example, the W construction contractor pays his laborers or mechanics $3.50 in cash under a wage determination of the Secretary of Labor which requires a basic hourly rate of $3 and a fringe benefit contribution of 50 cents. The contractor pays the 50 cents in cash because he made no payments and incurred no costs for fringe benefits. Overtime compensation in this case would be computed on a regular or basic rate of $3.00 an hour. However, in some cases a question of fact may be presented in ascertaining whether or not a cash payment made to laborers or mechanics is actually in lieu of a fringe benefit or is simply part of their straight time cash wage. In the latter situation, the cash payment is not excludable in computing overtime compensation. Consider the examples set forth in paragraphs (c)(2) and (3) of this section.

(2) The X construction contractor has for some time been paying $3.25 an hour to a mechanic as his basic cash wage plus 50 cents an hour as a contribution to a welfare and pension plan. The Secretary of Labor determines that a basic hourly rate of $3 an hour and a fringe benefit contribution of 50 cents are prevailing. The basic hourly rate or regular rate for overtime purposes would be $3.25, the rate actually paid as a basic cash wage for the employee of X, rather than the $3 rate determined as prevailing by the Secretary of Labor.

(3) Under the same prevailing wage determination, discussed in paragraph (c)(2) of this section, the Y construction contractor who has been paying $3 an hour as his basic cash wage on which he has been computing overtime compensation reduces the cash wage to $2.75 an hour but computes his costs of benefits under section 1(b)(2)(B) as $1 an hour. In this example the regular or basic hourly rate would continue to be $3 an hour. See S. Rep. No. 963, p. 7.

§ 5.33 Administrative expenses of a contractor or subcontractor.

(a) ***Creditable costs.*** The costs incurred by a contractor's insurance carrier, third-party trust fund, or other third-party administrator that are directly related to the administration and delivery of bona fide fringe benefits to the contractor's laborers and mechanics can be credited towards the contractor's obligations under a Davis-Bacon wage determination. Thus, for example, a contractor may take credit for the premiums it pays to an insurance carrier or the contributions it makes to a third-party trust fund that both administers and delivers bona fide fringe benefits under a plan, where the insurance carrier or third-party trust fund uses those monies to pay for bona fide fringe benefits and for the administration and delivery of such benefits, including evaluating benefit claims, deciding whether they should be paid, approving referrals to specialists, and other reasonable costs of administering the plan. Similarly, a contractor may also take credit for monies paid to a third-party administrator to perform tasks that are directly related to the administration and delivery of bona fide fringe benefits, including under an unfunded plan.

(b) ***Noncreditable costs.*** A contractor's own administrative expenses incurred in connection with the provision of fringe benefits are considered business expenses of the firm and are therefore not creditable towards the contractor's prevailing wage obligations, including when the contractor pays a third party to perform such tasks in whole or in part. For example, a contractor may not take credit for the costs of office employees who perform tasks such as filling out medical insurance claim forms for submission to an insurance carrier, paying and tracking invoices from insurance carriers or plan administrators, updating the contractor's personnel records when workers are hired or separate from employment, sending lists of new hires and separations to insurance carriers or plan administrators, or sending out tax documents to the contractor's workers, nor can the contractor take credit for the cost of paying a third-party entity to perform these tasks. Additionally, recordkeeping costs associated with ensuring the contractor's compliance with the Davis-Bacon fringe benefit requirements, such as the cost of tracking the amount of a contractor's fringe benefit contributions or making sure contributions cover the fringe benefit amount claimed, are considered a contractor's own administrative expenses and are not considered directly related to the administration and delivery of bona fide fringe benefits. Thus, such costs are not creditable whether the contractor performs those tasks itself or whether it pays a third party a fee to perform those tasks.

(c) ***Questions regarding administrative expenses.*** Any questions regarding whether a particular cost or expense is creditable towards a contractor's prevailing wage obligations should be referred to the Administrator for resolution prior to any such credit being claimed.

[88 FR 57747, Aug. 23, 2023]

Subpart C—Severability

Source: 88 FR 57747, Aug. 23, 2023, unless otherwise noted.

§ 5.40 Severability.

The provisions of this part are separate and severable and operate independently from one another. If any provision of this part is held to be invalid or unenforceable by its terms, or as applied to any person or circumstance, or stayed pending further agency action, the provision is to be construed so as to continue to give the maximum effect to the provision permitted by law, unless such holding is one of utter invalidity or unenforceability, in which event the provision is severable from this part and will not affect the remaining provisions.

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ISU SPECIAL REQUIREMENTS AND INFORMATION

PART 1 - SPECIAL REQUIREMENTS

1.01 BARRICADES

A. ISU will provide barricades during the initial closure of a construction site. However, once the Contractor mobilizes, ISU will remove the barricades, and Contractor shall replace them with his own. If additional barricades are required during the construction phase, Contractors shall provide them at their expense.

1.02 BURIED UTILITIES

A. All Direct Buried Utility Lines and Utility Duct Banks will be marked by use of the appropriate marker tape continuously installed a minimum of twelve (12) inches above said utility line or duct bank. Marker tape shall be a minimum of six (6) inches wide.

1.03 REMOVAL AND RE-INSTALLATION OF EQUIPMENT

A. The Owner is not responsible for the removal or re-installation of any equipment necessitated by this work.

B. All electrical disconnects and reconnects of equipment necessitated by this work shall be performed by a licensed bonded Electrical Contractor hired by the Contractor to perform this work. The Owner will assist in locating the power source but will not be responsible for the actual performance the electrical work.

1.04 PRIME CONTRACTOR RIGHT OF SALVAGE

A. The Owner has the first right of salvage of any items not slated for re-use on every Project.

B. Should the Owner waive their right for salvage for any item not slated for re-use or designated in for recycling; then these items become the property of the Prime Contractor.

C. The Prime Contractor at their discretion may grant to others the right to salvage items not slated for re-use and this may be used to comply with the recycling requirements as long as records are kept.

D. However; once an item has been placed in a dumpster or any other trash receptacle no one is allowed to enter a dumpster or search through a trash receptacle for the purpose of removing items for salvage while these trash containers are on the campus of Indiana State University.

E. The Prime Contractor shall protect these trash containers by use of a six (6) foot high chain link fence enclosure around the trash container(s) to prevent any person from gaining access to the trash containers for actions prohibited by this item.

1.05 CERTIFICATE OF INDUSTRIAL BOARD

A. The Contractor shall furnish a certificate of insurance from an insurance company acceptable to Indiana State University evidencing that the Contractor has complied with the Indiana Worker's Compensation Law.

1.06 COVID 19 REQUIREMENTS FOR ISU PROJECT WORK

A. Effective March 5, 2022 the wearing of masks is optional on the Campus of Indiana State University (ISU) and in ISU buildings. Contractor's employees will no longer be required to wear masks when working in occupied ISU buildings unless the occupant of the space where the work is being performed requests the Contractor's employees to wear a mask. The Contractor's employees shall have a mask available to put on if the occupant requests masks be worn in their space. The same applies to Vendors visiting the work space.

B. Any Contractor and Subcontractor's employees exposed to Covid 19 shall be required to comply with CDC and State of Indiana guidelines, whichever is more stringent, for quarantine/isolation and shall not return to work on the Project until medically cleared to

return to work. The effected Contractor and Subcontractor shall notify the Owner in writing of any Covid 19 incidents.

1.07 CONTRACTOR PUBLIC STATEMENTS

A. No person or entity that enters a contract with the University shall be permitted to make any public statement in such contracting party's official capacity as a contractor of the University except where such public statement: a. relates to the business or operation of the University, or to a University sponsored event; or b. has been approved by the Board of Trustees of the University. 620.2.11.1. Certain Public Statements. This Policy 620.2.11 Contractor Public Statements shall not in any way prohibit a contracting party's exercise of any protected expressive activity that is not made in such contracting party's official capacity as a contractor of the University.

1.08 CAMPUS TOBACCO POLICY

A. Effective in 2011 the following became the ISU smoking policy:
   1. The sale of tobacco products is prohibited on university-owned, operated, or leased property.
   2. The use of smoking tobacco products is prohibited on university-owned, operated, or leased property.
   3. The use of smoking tobacco products is permitted in privately owned vehicles and in designated smoking areas on campus.
   4. Any exceptions for the use of smoking tobacco products on university-owned, operated, or leased property must be approved by the President or Provost.
   5. Enforcement of this policy will depend on the cooperation of all faculty, staff, and students not only to comply with the policy, but also to encourage others to comply, in order to promote a healthy environment in which to work, study and live.
   6. Observation of violation of the policy should be reported to Public Safety at 812-237-5555. Follow up for violations of the policy should be referred to the appropriate administrative office for review and action for faculty through the office of Academic Affairs, for staff through Human Resources and to the Dean of Students for students.

B. Amendments to this policy for Contractors
   1. Delete item 5 in its entirety and replace with the following:
      "Enforcement of this policy will depend on the cooperation of the Contractors and their employees to comply with the policy and encourage others to comply in order to promote a healthy environment in which to work".
   2. Delete item 6 in its entirety and replace with the following:
      "Observation of violation of this policy should be reported to the Contractor's Project Superintendent and/or the Owner's Project Manager. Contractor's employees repeatedly violating this policy may be asked to leave the Campus of Indiana State University and not be allowed to continue work on the Project".
   3. Add the following item 7:
      "For major construction or renovation Projects (as determined solely by the Owner) the Owner shall designate a Contractor's smoking area near or within the boundaries of the job-site; unless the Prime Contractor(s) chooses to declare the entire Project job-site as non-smoking. Under no circumstances shall smoking be permitted within a building under construction or renovation.

C. Additionally on construction sites on university-owned, operated, or leased property the use of smokeless tobacco products is prohibited.

1.09 PARKING REGULATIONS

A. Beginning January 2018, construction employees will be required to park with a Construction Permit in Lot N (11th and Chestnut), Lot K (1st and Chestnut) or Lot I (3rd and Tippecanoe) when regular classes are in session. Contractors will be allowed to request an appropriate number of permits depending upon the project size for "core campus" parking. These permits should be used for carpooling or transporting employees to/from the construction and the construction parking lots. Contractors will also be allowed to have 2 foreman construction permits per project which will allow the foreman direct access to the construction project.

B. When regular classes are not in session (i.e. weekends, Fall Break, Winter Recess, and summer sessions [the Monday after commencement thru one week before move-in]) contractors and their employees will be allowed to park in any regular/open lot on campus with a construction permit unless the lot is reserved for an event.

1.10 ISU ENVIRONMENTAL CODE FOR CONTRACTORS

A. Prior to starting any work, Contractor shall provide to the Owner a written document containing emergency procedures in case of:
   1. Liquid spills or leaks
   2. Release of gases or toxic vapors
   3. Excessive smoke

B. This document shall contain but not be limited to:
   1. Emergency medical, fire, and police phone numbers including the ISU University Police.
   2. EPA phone numbers
   3. IDEM phone numbers
   4. Location of Material Safety Data Sheets.

C. Prior to using any chemical or hazardous material the contractor shall provide the Owner with a copy of Material Data Safety Sheets covering the chemical or hazardous material.

D. Contractor shall not burn or bury waste material on campus, or discharge any hazardous, or undesirable materials to sewers, or release toxic materials to the air.

E. Contractor shall provide adequate exhaust ventilation for work area when generation of air contaminants is likely, i.e., painting, handling flammable liquids, welding, cutting, applying adhesives, etc.

F. Contractor shall have at the job site Material Safety Data Sheets (MSDS) covering all chemicals and hazardous materials to be used in the work area. MSDS are to be available to workers and ISU personnel during normal working hours. Contractor shall use proper procedures based on MSDS when handling hazardous chemicals and materials.

G. Contractor shall provide vacuum breakers or backflow preventers at each location where he utilizes building water supply.

H. Any Contractor employee who deliberately interferes with environmental monitoring shall be removed from the project immediately.

I. Contractor shall prevent fumes from welding, cutting, etc. and dust generated by construction from entering areas outside the work area by erecting plastic film barriers, sealing openings and ducts, and installing exhaust fans as required.

J. Air contaminants in the work area shall not exceed OSHA regulations.

1.11 ISU SAFETY CODE FOR CONTRACTORS

A. General:
   1. All work performed by contractors shall be done in accordance with all applicable Federal, State and Local laws, codes, and regulations and recommendations of Factory Mutual Engineering and Research (FM).
   2. Any safety hazard or unsafe act recognized by the Owner shall be reported to the Contractor responsible for job coordination. The safety hazard shall be corrected in a timely manner dictated by the severity of the safety hazard or unsafe act.
   3. Contractors shall remove all rubbish from the job site daily.
   4. All construction materials shall be protected from wind damage. Materials shall be secured to prevent them from becoming airborne with subsequent injury to personnel or damage to property.

B. Communication:
   1. Contractor's job supervisors, or designated safety persons, must carry at all times a cellular phone to facilitate communication between the job site and the ISU University Police and Facilities Management Department. The cellular phones must remain on the job site during regular working hours. Contractor(s) shall report to the designated representative of ISU, or to ISU Police, any safety problem, code infraction, personal injury, or damage to ISU property. Report shall be made immediately after such occurrence.

C. Fire Protection:
   1. Contractors shall provide a type "ABC" fire extinguisher for each work crew.
   2. Extinguishers are to be kept within easy reach of each work crew and never farther than 10 feet from some worker. Inspection tags on extinguishers shall indicate the date of last inspection.
   3. Contractor's supervisor shall keep torch cutting operations to a minimum by instructing personnel to use power saws, pipe cutters, etc. It shall be the duty and responsibility of the Contractor performing any cutting or welding to comply with the safety provisions of the National Fire Codes (NFC) pertaining to such work.
   4. Contractor shall adhere to Factory Mutual Engineering and Research (FM) "Cutting and Welding" permit system. Permits are available through the Office of Environmental Safety's Fire Specialist Office at 812-237-4020.
   5. Prime Contractor shall provide a one hour fire watch at the end of each workday when any cutting or welding occurred to assure that no possibility of fire exists from any work performed that day.

D. Safety Program: Prior to starting any work the Contractor shall submit to ISU a written safety program for the project including but not limited to:
   1. Occupational Health & Environmental Controls
      a. Personal Protective Equipment
      b. Fire Protection & Prevention
      c. Hand & Power Tools
      d. Ladders & Scaffolds
      e. Motor Vehicles and Mechanized Equipment
      f. Accident Prevention
      g. Safety Inspections
      h. OSHA Inspections

2. Instruct all of his personnel as to location of emergency telephone(s).
3. Instruct all his personnel as to location of fire alarm (pull) stations.
4. Instruct all of his personnel to follow FM "Cutting and Welding Permit Systems" and emphasize the need to advise ISU's representative 24 hours prior to doing any welding, cutting, brazing, etc.
5. Instruct all his personnel to advise ISU representative prior to doing any welding, cutting, or brazing on or near a roof structure.
6. Instruct all personnel as to location on the job site of a copy of OSHA 29 CFR, Part 1926.
7. Instruct all of his personnel as to location of first aid supplies.

E. Flammable Storage:
   1. Flammable or combustible liquids (paints, thinners, asphalt, gasoline, and tar or similar materials) shall be stored and handled as per NFPA 30, 4-5.5, and OSHA Construction Standard 1926.152. Quantities of flammable paints, etc., inside building work areas shall not exceed the amount to be used in one day.
   2. Containers of Class I liquids that are stored outside of an inside liquid storage area shall not exceed a capacity of 1 gallon, except safety cans shall be permitted up to 2 gallon capacity. Not more than 10 gallons of class I and class II liquids combined shall be stored in a single fire area outside of an approved storage cabinet or an inside liquid storage area unless in safety cans. Not more than 25 gallons of class I and class II liquids combined shall be stored in a single fire area in safety cans outside of an inside fluid storage area or an approved storage cabinet. Not more than 60 gallons of class IIIA liquids shall be stored outside of an inside liquid storage area or outside an approved storage cabinet.
   3. Rags saturated with flammable liquids shall be placed in approved cans and removed from the work site at the end of the work shift.

F. Site Control: Contractor shall be responsible for securing the job site at all times and have personnel on call 24 hours per day for emergencies. Contractors shall protect their equipment and materials and ISU property from theft. Contractors shall secure doors, and openings including roof openings.

G. Prior to a multiple day shutdown the Contractors shall:
   1. Remove all debris and leave the premises broom clean.
   2. Shut off all unnecessary electric power and water supplies.
   3. Remove all flammable liquids from the work site.
   4. Secure small tools in gang boxes.
   5. Leave drives open for emergencies.

H. Temporary Electrical Service:
   1. Temporary electrical service shall be provided by a licensed, bonded electrical contractor.
   2. All extension cords shall be protected from abrasion and traffic. Multiple lengths of extension cord shall be connected with waterproof twistlock type connectors. Any electrical service over 115 volts shall be marked accordingly. All electrical power supplied from building service or portable generators shall have ground fault protection as part of the circuit.
   3. Portable generators or welders driven by internal combustion engines shall not be located inside the building. Positioning of this equipment outside the building shall be such that engine exhaust shall not enter the workplace or adjacent buildings.

I. OSHA Reporting:
   1. Contractors shall complete an OSHA 106 form on all reportable occupational injuries and illnesses for each of their job locations on the ISU campus. This requires posting the information from the initial accident report on a master log (OSHA 200) form within six working days after the accident occurs. This form must be kept available for OSHA Compliance Safety and Health Office and ISU review.
   2. See OSHA Regulations 29 CFR Part 1904, "Recording and Reporting Occupational Injuries and Illnesses"

1.12 FIRE SUPPRESSION SYSTEM REGULATIONS

A. Prior to closing any fire suppression system valve or in any way making a fire suppression system inoperable the Contractor shall contact the Fire Specialist's Office at 812-237-4020 to obtain a FM Global Red Tag so the impairment to the system may be reported.

B. When the work is complete the Contractor shall immediately contact the Fire Safety Specialist to report the work is complete so the red tag may be removed and FM Global notified that the system has been returned to normal operation.

1.13 ELECTRICAL SAFETY REGULATIONS

A. OSHA *Control of Hazardous Energy Lockout/Tagout Regulations* apply to all work performed on the Campus of Indiana State University. These Regulations are available for review on the OSHA Internet Website at **http://www.osha.gov/SLTC/controlhazardousenergy/index.html** . Any individual who removes another's lock or tag shall be ordered to leave Indiana State University and shall be disqualified from any future work at Indiana State University.

B. High fault currents, in excess of 45kA, exist at certain points on electrical systems at Indiana State University. Employing Contractors shall make their employees working on campus electrical systems aware that this condition exists.

C. No individual shall be permitted to install or service any energized circuit, equipment or apparatus where voltages greater than 100 volts to ground is present unless another individual is present.

D. No individual shall be permitted to operate or service any main or feeder main overcurrent protection device, whether group mounted or individually mounted, unless another individual is present.

E. Deliberately shorting a branch circuit to ground to locate a branch feeder breaker is strictly prohibited.

F. Any individual observed in violation of Regulations "C", "D" or "E" may be asked to immediately leave the workplace and/or their employer may be fined based on the following scale. Violations may apply to one or multiple employees.

• 1st violation	Notice of Violation Warning Placed in Employing Firm's Work Record File
• 2nd violation	$100.00
• 3rd violation	$250.00
• All subsequent violations	$500.00 per incident

G. **Repeated violations may be cause to disqualify the individual and/or employing firm from any other future work on the campus of Indiana State University.**

1.14 FIRE ALARM SYSTEM COORDINATION WITH PROJECT WORK

A. An automatic fire detection system may in operation in areas of work. Prior to start of Work the Contractor shall verify with the Owner if devices are present in the Work area.

B. Contractor shall coordinate with Owner for the shut down and reactivation of automatic fire detection devices in work areas based on the following procedures.
   1. Prior to 2:30pm on the day before work is scheduled the Contractor shall contact either Pat Teeters at 812-237-8187 (Office) or 812-230-6141 (Cellular) to request fire alarm devices be disabled. If no answer, call Brad Welker at 812-237-8109 (alternate contacts). The Contractor shall provide exact work location, the time the devices are required to be disabled by and a means by which to contact the Contractor the next day, i.e. pager or cellular phone number. It is permissible to leave a "voice mail" of the required information.
   2. Prior to starting work the next day the Contractor shall contact Pat Teeters (preferred contact) or Brad Welker (alternate contact) to verify if the required devices are disabled. Please listen carefully to the voice mail announcement for information in the event of no answer.
   3. Prior to leaving the job-site at the end of workday or by 2:30pm the Contractor shall contact one of the aforementioned individuals to report clearance to reactivate the devices for the evening and what, if any, devices require disabling for the following workday.

C. Failure to follow these procedures may result in fines being levied on the Contractor based on the following schedule.
   - 1st failure to call and schedule in advance – Warning.
   - Any subsequent failure to call and schedule in advance – $10.00 per occurrence
   - 1st failure to call resulting in activation of fire alarm system – Warning or $100.00, dependent on situation as determined by the Owner.
   - Any subsequent failure to call resulting in activation of fire alarm system - $100.00 per occurrence.

1.15 INSPECTION

A. At the conclusion of the entire work encompassed in this contract, written notice requesting inspection shall be submitted to the Owner at least ten (10) days prior to the anticipated inspection date.

1.16 PAYMENT AND FINAL ACCEPTANCE

A. Anticipated Draw Schedule

   1. For any Project in excess of $500,000.00 the Contractor shall submit an anticipated monthly drawdown schedule.
   2. This schedule shall be submitted within fourteen (14) calendar days after Award of Contract to:
      The Office of the Senior Vice President for Finance and Administration
      Rankin Hall Suite 210
      Terre Haute, IN 47809

B. Applications for Payments shall be submitted on AIA Application for Payment form G702 with Continuation Sheet G703 (or on a form approved by the Owner). While no set date is required for Applications for Payment, the application shall be submitted on a regular monthly basis for labor and materials permanently installed in the work, for material stored on site and for properly insured materials stored off-site under the following conditions:

   1. For purposes of making periodic estimates, the Contractor shall furnish an itemized breakdown of his contract amount, distributed according to different classes of work. In making application for payments, the Contractor shall show, each period, the percentages of completion of each class.

2. Contractor shall send three (3) copies for each Application for Payment. In lieu of submitting “hard” copies it is permissible to scan and e-mail the pay applications. See 1.17 B of this Section for list of e-mail recipients.
3. The Owner will make partial payment to the Contractor on the basis of a duly certified, approved estimate of the work performed during the preceding calendar month by the Contractor within 15 days after receipt by the Owner.
4. Payment will be made on balance due on labor and materials installed permanently in the work to within 90% of estimated value, and not to exceed 90% of the value of materials delivered to the site which are not subject to damage by exposure to the elements.
5. Stored materials and equipment offsite: The Owner will make payment for materials and equipment store offsite under the following conditions.
    a. The Contractor requests in writing to the Architect/Engineer/Owner for payment on offsite stored materials and equipment.
    b. The Architect/Engineer/Owner is given access to the offsite storage facility for purposes of inspection and verification of the stored materials and equipment. Any material or equipment not properly stored or protected shall not be approved for payment.
    c. The Contractor shall provide to the Architect/Engineer/Owner a current Certificate of Insurance on the remote storage facility. This insurance shall remain in force for the duration of the storage of the stored materials and equipment at the remote location.
6. The Owner, if conditions in its opinion warrant, has the right to withhold, in addition to retained percentages, such an amount or amounts from the payment to the Contractor as may be necessary to pay just unpaid claims for labor and services rendered and materials furnished in connection with the work.
7. The Owner will not approve for payment on any estimate, the value on any materials which, in his opinion, does not meet the contract requirements.
8. At the conclusion of installation and satisfactory inspection by the Owner, the work shall be acceptable for payment of an amount equal to ninety-five (95%) percent of the total contract amount.
9. Reduction or Limitation of Retainage:
    a. At the sole written discretion of Indiana State University, if acceptable progress is made, at fifty percent (50%) completion of the Contract Sum the remaining Retainage may be reduced to 0%.
    b. Any subsequent Change Orders after the reduction of Retainage shall have 5% Retainage withheld.
10. **Requests for compensation, for previously approved Change Orders omitted from an Application for Payment, received sixty (60) calendar days after Owner receipt of the Final Application for Payment (Release of Retainage) shall not be honored.**
11. Final payment will be due and payable the later of sixty-one (61) days from date of receipt of the Final Application for Payment or after the Contractor has completed all punch list items, certified that all Subcontractors and Suppliers have been paid, and all claims, including the Contractor’s, have been resolved. Before issuance of the final payment, the Contractor shall furnish an affidavit (Final Waiver of Lien) as evidence that there are no claims on account of the Contract, outstanding liens of claims for materials furnished, or labor performed on the work. The final payment shall constitute the acceptance of the work by the Owner, except as to work thereafter found to be defective. The date of such payment shall be regarded as the date of final acceptance of the work.
12. Warranty: The Warranty Period shall be per AIA A201-2007 Article 3 Paragraph 3.5 as amended by Specification Section 00 20 11 Amendments to General Conditions.

C. ACH Payments

1. In an effort to expedite Contractor payments Indiana State University requests the Contractor set up an ACH account for Project Payments. Contact Catherine Procarione in the ISU Office of the Controller at 812-237-3525 to set up this account.
2. If the Contractor currently has an ACH Account with Indiana State University it is not necessary to set up an account for each Project. It is solely the responsibility of the Contractor to maintain accurate Banking information on file with the ISU Office of the Controller.

D. Special provisions regarding Retainage and Escrow:

1. The laws of the State of Indiana (IC 5-16-5.5-3 as amended) contain certain provisions regarding retainage, bonds and payment of Contractors and Subcontractors. The Contracts and Subcontracts entered into pursuant to these instructions to Bidders shall be governed by those provisions with respect to Contracts in excess of $200,000 entered into between a Contractor and the Indiana State University Board of Trustees.
2. These provisions require, among other things, that the amounts retained by the Owner from the contractor pursuant to retainage provisions be placed in an escrow agreement to be executed by the Contractor. Pursuant to these provisions, the successful Bidder shall be required to execute an escrow agreement between the Contractor and the Owner.
3. This escrow agreement shall have no application to payment withheld by the Owner pursuant to provisions of the Construction Contract intended to protect the Owner from loss on account of defective work not remedied; claims filed on reasonable evidence; failure of the Contractor to make payments when due to subcontractors or for material or labor; reasonable doubt that the contract can be completed for the balance then unpaid; damage to another contract; failure or refusal of the Contractor to prosecute the work in strict compliance with the above process schedule; or similar provision.
4. In addition, each successful Bidder will be required to comply with all applicable provisions of the statute referred to above with respect to each of his Subcontractors (as the term 'Subcontractor' is defined in the statute referred to above).
5. The Contractor shall contact Kathy Abernathy in the Office of the Senior Vice President for Finance and Administration at (812)-237-3554 to set-up this escrow account.
6. Should a Contractor fail to execute an Escrow Agreement between the Contractor and the Owner (Indiana State University Board of Trustees) the Contractor waives all claims for any interest the Contractor would have accrued had an Escrow Agreement been executed.

1.17 CONTRACTOR'S BID

A. Contractor shall submit Bid for Base Bid and any Alternate Bids as listed in Section 00 20 00.

1.18 INVOICING

A. All invoices and/or Certificates of Payment must be addressed to:

Indiana State University
Department of Facilities Management
951 Sycamore Street
Terre Haute, IN 47809
Attention: Bryan Duncan
And sent via the Architect/Engineer
arcDESIGN, PC
201 North Delaware Street Suite B
Indianapolis, Indiana 46204
Attn: Greg Miller

B. It is permissible to submit applications for payment electronically via e-mail. E-mail copies of the Application for Payment to:
   1. Pat Teeters patrick.teeters@indstate.edu
   2. Greg Miller gmiller@arcdesign.us
   3. Bryan Duncan bryan.duncan@indstate.edu

Do not sent Applications for Payment to the ISU Accounts Payable Office

C. A Partial Wavier of Lien shall be submitted with every Application for Payment until the final Application for Payment (Release of Retainge) when a Final Waiver of Lien shall be submitted.

1.19 SITE LOCATION(S)

A. **Chestnut Building, 749 Chestnut Walk, Terre Haute. Indiana 47809**

1.20 PROJECT CONTACT

A. All questions regarding this Project shall be addressed to:

Greg Miller
arcDESIGN, PC
201 North Delaware Street Suite B
Indianapolis, Indiana 46204
Phone 317-559-1044 Cell 317-445-4373 E-mail gmiller@arcdesign.us

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 00 30 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The project is located on the campus of Indiana State University at the Chestnut Building, 749 Chestnut Walk, Terre Haute, Indiana 47809.

1.02 RELATED SECTIONS

A. Division 00 Sections
B. Division 01 Sections
C. All Division 02-33 Sections as applicable

1.03 SCOPE OF WORK – BASE BID

A. The following, but not limited to, is included in the Base Bid Package:

1. Renovation of the Chestnut Building to house the Early Childhood Education Center
2. Modifications and alterations to existing cast-in-place concrete structural system including but not limited to a new elevator shaft for a new machine-room-less elevator.
3. Modifications to exterior wall construction on floors one and two for new glazing systems
4. New automatic fire suppression system and fire alarm system on all floors
5. New and or modified HVAC, electrical, plumbing, and telecommunications systems
6. Site improvements for new outdoor play areas, service entrance, and main entrance from parking area

B. Procedures
1. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the Base Bid into the Project.
2. Include as part of the Base Bid miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of the Base Bid.

1.04 SCOPE OF WORK – ALTERNATES

A. The following, but not limited to, is included in the Alternate(s)
1. Alternate No. 1: High STC Walls (Add): Base Bid” Provide Wall Type S4.1i at classroom demising walls indicated. Alternate Bid: Provide high STC Wall Type S4.4i at classroom demising walls indicated in lieu of wall type S4.1i included in the base bid.
2. Alternate No. 2: Kitchen Equipment (Add): Base Bid: Provide No Kitchen Equipment indicated. Alternate Bid: Provide an alternate bid to provide all Kitchen Equipment indicated.
3. Alternate No. 3: Exterior Entrance Canopy (Add): Base Bid: No new canopy or architectural lettering to the existing wall at the new south entrance. Alternate Bid: Provide a new manufactured canopy with architectural lettering to the existing wall at the new south entrance.
4. Alternate No.4: Second Floor Glazing Systems (Add): Base Bid: Provide new glazed aluminum curtainwall systems with operable windows as indicated. Alternate Bid: Provide an alternate bid to provide glazed aluminum storefront systems with operable windows in lieu of curtainwall systems.
5. Alternate No. 5: Crib Dividers (Add): Base Bid: No work. Alternate Bid: Provide Infant Room Crib Dividers and mounting systems indicated.

6. Alternate No.6: Residential Appliances (Add): Base Bid: No work. Alternate Bid: Provide all clothes washers, clothes dryers, and non-kitchen equipment refrigerators indicated.
7. Alternate No.7: Replace Domestic Water Heater (Add): Base Bid: No work. Alternate Bid: Replace existing domestic water heater and steam-to-water heat exchanger with a hot water storage tank and an instantaneous steam-to-water heat exchanger.
8. Alternate No.8: Remove Abandoned Chiller (Add): Base Bid No work. Alternate Bid: Remove abandoned chiller and all associated piping, electrical, concrete pad, etc. Patch floor.
9. Alternate No.9: Fencing: Base Bid (Add): Provide black vinyl coated chain-link fencing indicated at outdoor areas. Alternate Bid: Provide Decorative Metal fencing in lieu of base bid black vinyl coated chain-link fencing.
10. Alternate No.10: Outdoor Storage Shed (Add): Base Bid: No work. Alternate Bid: Provide concrete pad and “mini barn” outdoor play equipment storage structure.
11. Alternate No. 11: Replace Parking Lot 21 Lighting. Base Bid: install a new feeder to refeed existing lighting. Alternate Bid: Replace existing lighting with new and feed with feeder installed with Base Bid.

B. The cost or credit for each Alternate is the net addition to or deduction from the Contract Sum to incorporate Alternate into the Work. No other adjustments are made to the Contract Sum.
C. Procedures
   1. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the Alternate into the Project.
   2. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of Alternate.
   3. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each Alternate. Indicate if Alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to Alternates.
   4. Execute accepted Alternates under the same conditions as other work of the Contract.
D. Selection and Award of Alternates: The Owner reserves the right to selectively accept or reject Alternates at their discretion and is under no obligation to accept any Alternates.

1.05 BID SUBMISSION REQUIREMENTS

A. Bids shall be submitted on the included Bid Form (Section 00 20 00) and will be reviewed and accepted or rejected at the Owner's option.
B. All Bids shall be held for a period of One Hundred Twenty (120) Calendar days after submission of the Bid.

1.06 RELATED WORK SPECIFIED ELSEWHERE

A. The Prime Contractor shall be aware, and shall make his subcontractors aware that the requirements in the sections of Divisions 00 and 01 pertain to all the work and they are binding on each section of these specifications as if they were repeated in each section in their entirety.
B. The Prime Contractor shall be responsible for understanding the scope and intent of the work in all sections of these Specifications
C. The Prime Contractor is responsible for review of all sections of the Specifications and all Drawings to confirm any additional areas of responsibility.

D. All Contractors are responsible for their area of work which might show up only on a drawing from another series or Specification section.

1.07 CONTRACTS

A. Work shall be performed under one Prime Contract.

1.08 PRIME CONTRACTOR'S DUTIES

A. Project Supervision: see Section 00 20 20 item 1.09 for requirements

B. Except as specifically noted, provide and pay for:
   1. Labor, materials and equipment
   2. Tools, construction equipment and machinery
   3. Other facilities and services necessary for proper execution and completion of work

C. Pay legally required State and Federal Taxes.

D. Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches in such a manner as to cause a minimum of conflict or delay. Contractor shall coordinate his work in advance with all other trades and report immediately any difficulty which can be anticipated.

E. The Contract Documents shall be carefully studied by the Contractor during the course of construction. Any errors in layout or errors of omission which are discovered shall be referred immediately to the Architect/Engineer for interpretation or correction.

F. Secure and pay for, as necessary for proper execution and completion of work, and as applicable at time of receipt of bids:

   1. Permits
   2. Licenses

G. Give required notices.

H. Comply with codes ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.

I. Promptly submit written notice to Architect/Engineer of observed variances of Contract Documents from legal requirements.

J. Enforce strict discipline and good order among employees.

K. Coordinate delivery and installation dates with Architect/Engineer and Owner and incorporate into Construction Schedule.

L. Prepare and update Construction Schedule.

M. Notify and receive approval from the Owner at least 48 hours in advance for utility connections, or shut-off. Coordinate these operations with the Owner, through the Architect/Engineer, and complete the work in the minimum amount of time.

N. Notify the Architect/Engineer in writing when work is completed and keep the Architect/Engineer informed of the progress of the work. No work shall be closed or covered until it has been inspected and approved. Should work not inspected be covered, uncover all such work so that it can be properly inspected and after such inspection, properly repair and replace all of the work at no additional cost to the Owner.

O. Where the Contract Documents require any work to be tested, the Architect/Engineer shall be notified sufficiently in advance so that he may observe such tests.

P. Contractor shall submit a copy of any permits he has secured before starting work on this project unless otherwise stated by Owner.

Q. Where the Contract Documents require the use of AIA Documents including, but not limited to, G702 Application and Certificate for Payment and G703 Continuation Sheet.

R. For Projects in excess of $150,000.00 submit with each Application for Payment the Owner's Mandatory Tier II Spend Report using the ISU Business Diversity Spend Reporting Form for Construction/Renovation/Facilities Repair Projects per instructions on the Section 00 10 41 Tier II Spending Reporting Form.
S. Coordinate the submission of certified payroll records weekly and deliver to the Owner as required by the Copeland Act and Davis-Bacon and Related Acts.

1.09 OTHER REQUIREMENTS

A. Nightly the Prime Contractor shall secure the construction site to discourage unauthorized individuals from accessing the site. Special effort to secure the site shall be made on Friday evenings.
B. While the site shall be kept orderly at all times, weekly the Prime Contractor shall clean-up the construction site of:
   1. Any accumulated trash and rubbish.
   2. Dirt, dust, mud, etc. associated with the construction process.
   3. Salvaged materials not slated for re-use and excess materials not slated for use.
C. Weed and grass control: The Prime Contractor shall maintain weeds or grasses to less than 6" in height where applicable

PART 2 – NOT USED
PART 3 – NOT USED

END OF SECTION 01 10 00

ALLOWANCES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Certain materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Lump-sum allowances.
   2. Unit-cost allowances.
   3. Contingency allowances.
   4. Testing and inspecting allowances.
   5. Quantity allowances.

C. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
   2. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.03 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.04 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.05 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.06 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure.
C. Costs of services not required by the Contract Documents are not included in the allowance.
D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.07 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance # 1: A $8,200.00 allowance shall be included in the Base Bid for the A/E to create record drawings. These drawings shall be based on the Contractors field mark-ups of the Construction Documents. The Contractor is solely responsible to provide accurate mark-ups for the creation of these record drawings. Should it be discovered that errors exist in the record drawings the Contractor shall pay for the re-creation of accurate record drawings at no additional cost to the Owner.
B. Allowance # 2: A $200,000.00 Allowance shall be included in the Base Bid for Unforeseen Conditions and General Construction Contingency. It is solely at the discretion of the Architect/Engineer/Owner what costs may be applied to this Allowance. Any unused Allowance monies shall be returned to the Owner at Project closeout by Change Order.
C. Allowance # 3: A $15,000 Allowance shall be included in the Base Bid to provide custom wall graphics in the Stair #3 Area. It is solely at the discretion of the Architect / Owner what costs may be applied to this Allowance. Any unused Allowance monies shall be returned to the Owner at Project closeout by Change Order.

END OF SECTION 01 23 60

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Schedule of Values
B. Application for Payment
C. Change procedures
D. Alternates
E. Substantial Completion
F. Final Completion

1.02 SCHEDULE OF VALUES

A. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet or similar form.
B. Submit Schedule of Values electronically in PDF format within 15 calendar days after date of the Award Letter.
C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds and insurance, and other overhead costs.
D. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
E. Include within each line item, a direct proportional amount of Contractor's overhead and profit.
F. Revise schedule if additional Alternates are Awarded after the initial Award by adding these Alternates as separate line items broken down in detail as was provided in the initial approved Schedule of Values.
G. Revise schedule to list approved Change Orders, broken down in detail as was provided in the initial approved Schedule of Values.
H. Submit "Consent of Surety to Schedule of Values" with Schedule of Values.

1.03 APPLICATIONS FOR PAYMENT

A. Submit four (4) copies of each application on AIA Form G702- Application and Certificate for Payment and AIA G703 - Continuation Sheet or similar.
B. Content and Format: Utilize most current approved Schedule of Values for listing items in each Application for Payment.
C. Payment Period: As indicated in the Contract Documents.
D. Waiver of Liens.
E. Include Certified Payroll forms if required by Owner.

1.04 CHANGE PROCEDURES

A. The Architect/Engineer will advise of minor changes in the Work not involving and adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, 2007 Edition, Paragraph 7.4 by issuing supplemental instructions on AIA Form G710 or ISU Form SI/FCC-12.
    1. The Architect/Engineer may issue a Request for Proposal (RFP) which includes A detailed description of a proposed change, with supplementary or revised Drawings and

Specifications if required. Contractor shall prepare and submit an estimate within10 calendar days, listing if:

a. A change in Contract Time for executing the change is requested.
b. A stipulation of any overtime work required
c. The period of time during which the requested price will be considered valid, but not less than 21 calendar days.

B. The Contractor may propose changes by submitting a request for change, Change Proposal (CP), to the Architect/Engineer, describing the proposed change and its full effect on the Work.
   1. Include a statement describing:
      a. The reason for the change.
      b. The effect on the Contract Sum/Price and Contract Time with full documentation.
      c. A statement describing the effect on Work by separate or other Contractors.
      d. A stipulation of any overtime work required.
      e. The period of time during which the requested price will be considered valid, but not less than 21 calendar days.

C. RFP and CP Pricing
   1. Project Supervision costs:
      a. Section 00 20 20 Item 1.09 states in part:
         “The Prime Contractor shall maintain on the Project site a competent Project Superintendent at all times any work is being performed; either by the Prime Contractor’s workers or any Subcontractor’s workers.”
      b. There shall be no costs included in the pricing of a RFP or CP for Project Superintendent’s Supervision Hours while the work is being performed unless the Work included in the RFP/CP pricing will occur at a time not with-in the normal scheduled Project hours of construction.
   2. Contractor Mark-up and Allowable Charges
      a. Section 00 20 11 2.07 Subparagraph 3.3.3.7, 3.3.3.8 and 3.3.3.9 states:
         “.7 Extra Work shall be performed for the cost of the labor payroll plus 15% of the labor payroll and the cost of the material plus 5% of the material cost. Said markup fees are intended to compensate for the cost of payroll taxes, insurance of all kinds, all taxes of the Contractor, including State Taxes, Federal Income Tax, Unemployment, and FICA Taxes, as well as all other overhead costs, expenses, and carrying charges whatsoever, including the profit to be derived from such additional Work. Labor payroll is defined as the actual hourly labor cost plus any fringes payable as listed on the wage rate schedule(s) provided as required by the Bidding Documents.
         .8 In case such Work is performed by a Subcontractor or a lower tier Contractor with the Owner’s consent, the Work shall be marked up as indicated in 7.3.3.7 by the Contractor actually performing the Work. Each succeeding Contractor may mark up their direct labor and material costs as indicated in 7.3.3.7. Otherwise each succeeding Contractor, including the Prime Contractor, may add 5% for handling/ coordination. Additional mark-ups of a Subcontractor’s costs shall not be permitted.

".9 Costs for bond premiums are allowable provided documentation from the Bonding Company is included detailing the added bond cost premium, the current bond total and the new bond total."

b. Labor charges subject to the 15% mark-up shall be based on the actual labor payroll defined as the actual hourly labor cost plus any fringes payable as listed on the wage rate schedule(s) provided as required by the Bidding Documents.". The Wage Rate Schedule, submitted as required by the Contract Documents, shall be used to determine if the hourly labor rate used for pricing and labor mark-up is correct.

c. Insurance, Taxes and similar shall not be included in the RFP or CP pricing since, per 3.3.3.7, "Said markup fees are intended to compensate for the cost of payroll taxes, insurance of all kinds, all taxes of the Contractor, including State Taxes, Federal Income Tax, Unemployment, and FICA Taxes, as well as all other overhead costs, expenses, and carrying charges whatsoever, including the profit to be derived from such additional Work".

3. All RFP and CP pricing shall be submitted in enough detail for the Architect/Engineer and Owner to properly evaluate the proposed pricing. These pricing details extend to the lower tier Subcontractor's pricing as well. The Architect/Engineer and Owner may request additional pricing breakdown if in their opinion insufficient pricing detail was provided for evaluation. The Contractor shall promptly provide the additional pricing detail.

D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Architect/Engineer and Owner.

E. Construction Change Directive: Architect/Engineer may issue a directive, on AIA Form G713 or ISU Form CCD-18 Construction Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

F. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

G. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.05 ALTERNATES

A. Alternate Bid prices shall be held for one hundred twenty (120) days from date of Bid.

B. Alternate Bids may be used as the basis for Award of Contract.

C. The Owner may Award none, some or all Alternates submitted.

D. The Owner is under no obligation to accept any Alternates submitted.

E. Accepted Alternates shall be listed as separate line items on the Schedule of Values broken down as directed by the Architect/Engineer/Owner.

1.06 SUBSTANTIAL COMPLETION

A. The substantial completion date shall be as listed in Section 001010 INSTRUCTIONS TO BIDDERS. The substantial completion date may be adjusted as allowed by the Contract Documents or as mutually agreed upon in writing by the Owner and Contractor.

B. **Should a Contractor list an early substantial completion date on their Project Schedule or any Project Document, this early substantial completion date shall not be permitted to be used as a claim for additional compensation for the Contractor's failure to meet their early substantial completion date.**

C. Warranty: The Warranty Period shall commence at substantial completion per AIA A201-2007 Article 3 Paragraph 3.5 as amended by Specification Section 00 20 11 AMENDMENTS TO GENERAL CONDITIONS.

1.07 FINAL COMPLETION

A. The Contractor's final Application for Payment (Release of Retainage) shall not be approved for payment until all punch list items are complete, all claims (Contractor and Subcontractor) have been resolved and all conditions of Section 01 77 00 PROJECT CLOSEOUT have been met.

B. Requests for compensation, for previously approved Change Orders omitted from an Application for Payment, received sixty (60) calendar days after receipt of the Final Application for Payment (Release of Retainage) shall not be honored.

C. Final payment will be due and payable the late of sixty-one (61) days from date of receipt of the Final Application for Payment or after the Contractor has completed all punch list items, certified that all Subcontractors and Suppliers have been paid, and all claims, including the Contractor's, have been resolved. Before issuance of the final payment, the Contractor shall furnish an affidavit (Final Waiver of Lien) as evidence that there are no claims on account of the Contract, outstanding liens of claims for materials furnished, or labor performed on the work. The final payment shall constitute the acceptance of the work by the Owner, except as to work thereafter found to be defective. The date of such payment shall be regarded as the date of final acceptance of the work.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 01 25 00

COORDINATION AND MEETINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Coordination.
B. Field engineering.
C. Preconstruction meeting.
D. Progress meetings.
E. Field Record Drawings and Specifications

1.02 COORDINATION

A. Coordination scheduling, submittals, and Work of the various sections of the Project Manual to assure efficient and orderly sequence of installation of interdependent construction elements, with provision for accommodating items installed later.
B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
D. The Contractor shall provide coordination drawings for above-ceiling areas where at least two different services run in parallel or cross one another. Drawings are to be submitted, reviewed by the consultant team, and returned to the contractor prior to the start of any installation in these areas.
E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
F. Coordinate completion and cleanup of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.
G. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.03 FIELD ENGINEERING

A. Contractor to locate and protect survey control and reference points.
B. Control datum for survey is that established by Owner provided survey and/or shown on Drawings.
C. Verify set-backs and easements, confirm drawing dimensions and elevations.
D. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
E. Submit a copy of registered site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work is in conformance with the Contract Documents.

1.04 PRECONSTRUCTION MEETING

A. Architect/Engineer will schedule a meeting after Notice of Award.
B. Attendance Required: Owner, Architect/Engineer, Contractor and major subcontractors.

C. Agenda:
   1. Introductions.
      a. Official Project Name and Number (to appear on all Project correspondence)
      b. Designation of personnel representing the parties in Contract, Owner and the Architect/Engineer
   2. Status of required paperwork to ISU Purchasing Department.
   3. Distribution of Contract Documents.
   4. Submission of full list of sub-contractors and suppliers, schedule of values, proposed pay application schedule and proposed project schedule.
   5. Procedures and processing of submittals, substitutions, field decisions, proposal request, Change Orders, and Contract closeout procedures.
   6. Scheduling activities of a Testing Agency (if required).
   7. Use of premise by Owner and Contractor.
   8. Owner's requirements and partial occupancy.
   9. Construction facilities and controls provided by Owner.
   10. Temporary utilities.
   11. Survey and building layout.
   12. Security and housekeeping procedures.
   13. Procedures for testing.
   14. Procedures for maintaining record documents.

D. Architect/Engineer to record minutes and distribute copies within seven (7) days after meeting to participants, with copies to Architect/Engineer, Owner, and those affected by decisions made.

1.05 PROGRESS MEETINGS

A. Schedule and attend meetings throughout progress of the Work at maximum monthly intervals.

B. Architect/Engineer will make arrangements for meetings, prepare agenda with copies for participant and preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, and Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems which impede planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule
   13. Other business relating to Work.

E. Architect/Engineer to record minutes and distribute copies within seven (7) days after meeting to participants, with copies to the Owner, and those affected by decisions made.

1.06 FIELD PROJECT RECORD DOCUMENTS

A. Documents and Samples at the Site:
   1. General: The Prime Contractor shall maintain at the site for the Owner and A/E a record copy of the Drawings, Specifications, addenda, bulletins, Architect/Engineer's Supplemental Instructions, and Change Orders, in good order and marked currently to record changes and selections made during construction, and in addition reviewed Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Owner and the Architect/Engineer review.
   2. Posting:
      a. Record Drawings: Keep a complete record of the locations of all items indicating the Work as actually installed. Changes and deviations are to be indicated on the Record Contract Drawings. Give particular attention to concealed work which would be difficult to identify, measure, and record at a later date. The Subcontractor shall record concealed items, changes, and deviations under the direction of the Contractor as the Work progresses. The Contractor shall clearly identify all deviations from the Contract Documents.
      b. Record Specifications: Indicate the changes made by addendum, bulletin, Architect/Engineer's Supplemental Instructions, and Change Order. Indicate the manufacturer selected for all items whether specified proprietarily or generally.
      c. No review of record documents by the Architect/Engineer/Owner shall be a waiver of deviations from the Contract Documents or the submittals, or in any way relieve the Contractor from his responsibility to perform the Work in accordance with the Contract Documents.

PART 2 - NOT USED
PART 3 – NOT USED

END OF SECTION 01 31 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards.

B. To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for its review by the Architect/Engineer.

C. The Architect/Engineer's review of Contractor's material submittal shall not relieve the Contractor of responsibility for errors, omission, quantities, or capacities even though work is executed in accordance with the reviewed/approved submittal material.

D. The checking of the Contractor's Material Submittal is a gratuitous assistance and the Architect/Engineer does not thereby assume responsibility or liability for errors or omissions. Where such errors or omissions are discovered later, they shall be made good by the Contractor, irrespective of any review/approval by the Architect/Engineer since Contractor's Proposal assumes a complete, operable, and acceptable installation.

E. Work Included:

1. Submit, to the Architect/Engineer, shop drawings, project data and samples required by Specification sections electronically in PDF format.
2. Simultaneous to submitting to the Architect/Engineer, the Contractor shall submit to the Owner’s designated contacts a copy of all submittals provided to the Architect/Engineer in PDF Format.
3. All submittals shall be separated by CSI format and shall list the appropriate CSI 6-digit code on the PDF file name. Submittal packages which include items listed under different Specification sections shall be submitted as separate PDF Files. Multiple submittals at different times under the same Specification Section shall have file name extension added to indicate the number of the submittal, e.g. 26 51 00(1), 26 51 00(2), etc.
4. Designate in construction schedule dates for submission and dates reviewed shop drawings, project data and samples will be needed for each product in order to maintain the progress of construction as scheduled. Also indicate critical delivery dates of all items.
5. Any submittal that requires expedited review shall be noted on the submittal cover page with a “required by” review date listed. A Contractor’s failure to submit in a timely manner is not cause to request an expedited review.

1.02 PRODUCT HANDLING

A. Make all submittals of shop drawings, samples, requests for substitution, and other similar items, in strict accordance with the provisions of this section of these Specifications.

1.03 DEFINITIONS

A. Shop Drawings:

1. Original drawings, prepared by Contractor, subcontractor, supplier or distributor, which illustrate some portion of the work, showing fabrication, layout, setting or erection details.
   a. Prepared by a qualified detailer
   b. Identify details by reference to sheet and detail numbers shown on contract drawings.

B. Product Data:
   1. Manufacturer's standard schematic drawings:
      a. Scanned copies of schematic drawings from hard copy paper catalog pages are not acceptable. Obtain PDF files of schematic drawings from the Supplier/Manufacturer for submission.
      b. Modify drawings to delete information which is not applicable to project.
      c. Supplement standard information to provide additional information applicable to project.
   2. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
      a. Scanned copies of catalog sheets from hard copy paper catalog pages are not acceptable. Obtain PDF files of items from the Supplier/Manufacturer for submission.
      b. Clearly mark each item to identify pertinent materials, products, or models to be provided.
      c. Show dimensions and clearances required.
      d. Show performance characteristics and capabilities.
      e. Show wiring diagrams and controls.
   3. Material and Safety Data Sheets shall be furnished for all applicable Project Materials.

1.04 SUBMITTAL REVIEW TIME
A. Every effort will be made to return submittals within ten (10) calendar days or less.
B. This ten (10) days may require adjustment based on, but not limited to, the following:
   1. Complexity of the submittal
   2. Size of the job and number of items included in the submittal
   3. Number of submittals received at the same time or on the same day
C. Submittals received that do not clearly indicate the items being provided on the submittal will be returned marked “Rejected Resubmit” which will further delay the submittal return time.

PART 2 - PRODUCTS
2.01 SHOP DRAWINGS
A. Scale required: Unless otherwise specifically directed by the Architect/Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the work.
B. All shop drawings shall be submitted electronically in PDF Format to the Architect/Engineer with a simultaneous submission to the Owner’s designated recipients.
C. Accompany shop drawings with transmittal letter containing:
   1. Date and revision dates
   2. Project title and number
   3. The names of:
      a. Architect/Engineer
      b. Contractor
      c. Subcontractor
      d. Supplier
      e. Manufacturer
      f. Separate detailer when pertinent

4. Identification of product or material
5. Relation to adjacent structure or materials
6. Field dimensions, clearly identified as such
7. Specification section number
8. Applicable standards, such as ASTM number of Federal Specification
9. A blank space 2-1/2" x 3", for the Architect/Engineer's electronic stamp

D. Identification of deviations from Contract Documents

E. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents. Any materials submitted without the Contractor's stamp of approval will be returned to the Contractor with no action taken.

F. Reviewed shop drawings shall be returned to the Contractor and Owner's designated recipients electronically stamped as follows:
1. Reviewed
2. Reviewed as Noted
3. Rejected - Resubmit

G. The Owner shall submit their review comments to the Architect/Engineer. Official Review of shop drawings shall be by the Architect/Engineer only. The Contractor shall not proceed based on Owner comments only unless the Owner is the Architect/Engineer.

2.02 SUBMITTALS

A. All submittals for materials and equipment shall be made within forty (40) days of award of the contract and in no case shall any materials or equipment be delivered to the job site until submittals have been reviewed by the Architect/Engineer and Owner. This requirement will be a condition for approval of subsequent Applications for Payment.

B. All submittals shall be submitted electronically in PDF Format to the Architect/Engineer with a simultaneous submission to the Owner's designated recipients.

C. Submittals which reflect color samples shall be submitted in color.

D. Accompany submittals with transmittal letter containing:
1. Date and revision dates
2. Project title and number
3. The names of:
   a. Architect/Engineer
   b. Contractor
   c. Subcontractor
   d. Supplier
   e. Manufacturer
   f. Separate detailer when pertinent
4. Identification of product or material
5. Relation to adjacent structure or materials
6. Field dimensions, clearly identified as such
7. Specification section number
8. Applicable standards, such as ASTM number of Federal Specification
9. A blank space 2-1/2" x 3", for the Architect/Engineer's electronic stamp

E. Identification of deviations from Contract Documents

F. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field

measurements and compliance with Contract Documents. Any materials submitted without the Contractor's stamp of approval will be returned to the Contractor with no action taken.

G. Reviewed submittals shall be returned to the Contractor electronically stamped as follows:
   1. Reviewed
   2. Reviewed as Noted
   3. Rejected - Resubmit

H. The Owner shall submit their review comments to the Architect/Engineer. Official Review of submittals shall be by the Architect/Engineer only. The Contractor shall not proceed based on Owner comments only unless the Owner is the Architect/Engineer.

2.03 SAMPLES

A. Physical samples as defined by the General Conditions shall be furnished to the Architect/Engineer for approval prior to ordering or fabrication of any product.

B. Submit samples as specified in each of specification sections.

C. Submit an electronic transmittal or review sheet stamped by the Contractor with a blank space for the Architect/Engineer's electronic stamp.

2.04 SUBSTITUTIONS DURING CONSTRUCTION

A. The approved "Suppliers and Manufacturers List" is an essential part of the Contract. Substitutions of materials, equipment, etc. require the written approval of the Architect/Engineer and Owner. Substitutions during construction will only be considered when there is a proven benefit to the Owner. It is at the sole discretion of the Architect/Engineer and Owner to determine if the substitution is warranted.
   1. The Architect/Engineer and Owner will consider proposals for substitution of specified materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Architect/Engineer and Owner to evaluate the proposed substitution. Also, submit with request accurate cost data on the proposed substitution in comparison with the product specified, whether or not modification of the Contract Sum is to be a consideration.
   2. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Architect/Engineer and Owner.
   3. Requests for substitution, when forwarded by the Contractor to the Architect/Engineer and Owner, are understood to mean that the Contractor:
      a. Represents that they have personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
      b. Will provide the same guarantee for the substitution that they would for that specified;
      c. Certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under separate contracts and the Architect's redesign cost, and that he waives all claims for additional cost related to the substitution which subsequently become apparent;
      d. Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

B. See Section 00 10 10 INSTRUCTIONS TO BIDDERS Item 1.08 for requirements for substitutions prior to Bid.

PART 3 – NOT USED

END OF SECTION 01 32 00

01 40 00
QUALITY CONTROL

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Quality assurance - control of installation.
B. Tolerances
C. References.
D. Mockup.
E. Inspecting and testing laboratory services.
F. Manufacturer's field services and reports.

1.02 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturer's instructions, including each step in sequence.
C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Perform work by persons qualified to produce workmanship of quality.
F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.03 TOLERANCES

A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturer's tolerances. Should manufacturer's tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.04 REFERENCES

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.
C. Obtain copies of standards where required by product specification sections.
D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect/Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 INSPECTING AND TESTING LABORATORY SERVICES

A. See Section 01 41 00 for requirements for the selection of Inspection and Testing Laboratory Services Testing Agency (Agencies) and responsibility for payment for these services.
B. An independent firm will perform inspections, tests, and other services specified in individual specification sections and as required by the Architect/Engineer or the Owner.

C. Inspecting, testing, and source quality control may occur on or off the project site. Perform off-site inspecting or testing as required by the Architect/Engineer or the Owner.
D. Reports will be submitted by the independent firm to the Architect/Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
F. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
G. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
H. Testing or inspecting does not relieve Contractor to perform Work to contact requirements.
I. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for retesting will be paid by the Contractor.

1.06 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
B. Submit qualifications of observations. Observer subject to approval of Architect/Engineer.
C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.
D. Submit report in duplicate within 30 days of observations to Architect/Engineer for information.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 01 40 00

TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section describes testing and inspecting to be provided by the Contractor, plus cooperation required from the Contractor with the Owner's selected testing agency and others responsible for testing and inspecting the Work. This Section supersedes all references within the Contract Documents to Contractor provided testing.

B. Related Work:

1. Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 01 of these Specifications.
2. Requirements for testing may be described in various Sections of these Specifications.
3. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this Section.

C. Work not included:

1. Selection of testing laboratory: The Owner will select a prequalified independent testing laboratory.
2. Selection of construction soil engineer: The Owner will select a prequalified independent soil engineer to observe performance of Work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

1.02 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329.

B. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

C. Promptly process and distribute required copies of test reports and related instructions to assure necessary testing and replacement of materials with the least possible delay in progress of the Work.

PART 2 – PRODUCTS

2.01 PAYMENT FOR TESTING

A. Initial services of testing laboratory:

1. The Owner will pay for initial services requested by the Owner.
2. When initial tests indicate non-compliance with the Contract Documents, the costs of all tests associated with that non-compliance will be deducted by the Owner from the Contract Sum.

B. Initial services of Construction Soil Engineer:

1. The Owner will pay for initial services requested by the Owner, including but not necessarily limited to, observing performance of Work in connection with excavating, trenching, filling, backfilling and grading.

2. The Owner will pay for compaction tests performed by the construction soil engineer, but will deduct from the Contract Sum the costs for compaction tests performed to prove compliance with codes or ordinances.
3. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency, and costs thereof will be deducted by the Owner from the Contract Sum.

2.02 CODE COMPLIANCE TESTING

A. Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

2.03 CONTRACTOR'S CONVENIENCE TESTING

A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 – EXECUTION

3.01 COOPERATION WITH TESTING LABORATORY

A. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

3.02 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.03 SCHEDULES FOR TESTING

A. Establishing schedule:
1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
2. Provide testing laboratory with a minimum of 24 hours advance notice.
3. Provide all required time within the construction schedule.

B. Revising schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule: When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

END OF SECTION 01 41 00

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS

A. General: This section specifies procedural and administrative requirements for compliance with governing regulations and the codes and standards imposed upon the work. The requirements include the obtaining of permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.

B. "Regulations" is defined to include laws, statutes, ordinances and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the work regardless of whether they are lawfully imposed by governing authority or not.

C. Governing Regulations: Refer to General and Supplementary Conditions for requirement related to compliance with governing regulations.

1.03 DEFINITIONS

A. General Explanation: A substantial amount of specification language consists of definitions for terms found in other Contract Documents, including drawings. (Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated thereon). Certain terms used in Contract Documents are defined in this article. Definitions and explanations contained in this section are not necessarily either complete or exclusive, but are general for the work to the extent that they are not stated more explicitly in another element of the Contract Documents.

B. General Requirements: The provisions or requirements of Division 00 and Division 01 sections apply to entire work of Contract and, where so indicated, to other elements which are included in project.

C. Indicated: The term "indicated" is a cross-reference to graphic representations, notes or schedules in the specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled" and "specified" are used in lieu of "indicated", it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted", mean "directed by Architect/Engineer", "requested by Architect/Engineer", and similar phrases. However, no such implied meaning will be interpreted to extend Architect's/Engineer's responsibility into the Contractor's area of construction supervision.

E. Approve: Where used in conjunction with Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract Documents.

F. Project Site: The term "project site" is defined as the space available to the Contractor for performance of the work, wither exclusively or in conjunction with others performing other work as part of the project. The extent of the project site is shown on the drawings, and may or may not be identical with description of the land upon which project is to be built.

G. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations, as applicable in each instance.
H. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
I. Provide: Except as otherwise defined in greater detail, term "provide" means to furnish and install, complete and ready for intended use, as applicable in each instance.
J. Installer: The term "installer" is defined as the entity (person or firm) engaged by the Contractor, its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a requirement that installers be expert in the operations they are engaged to perform.
K. Testing Laboratories: The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere; and to report and, if required, interpret results of those inspections or tests.

1.04 PROJECT MANUAL FORMAT AND CONTENT EXPLANATION

A. General: This article is provided to help the user of these specifications more readily understand the format, language, implied requirements and similar conventions of content. None of the following explanations shall be interpreted to modify the substance of the contract requirements.
B. Production Methods: Portions of these specifications have been produced by the Architect's/Engineer's standard method of editing master specifications, and may contain minor deviations from traditional writing formats. Such deviations are a natural result of this production technique, and no other meaning shall be implied.
C. Project Manual Format: These specifications are organized based upon the Construction Specifications Institute's 33 Division format. The organization of these specifications into Divisions, Sections or Trade Headings generally conforms to recognized industry practice.
    1. Divisions are groupings of related or similar sections. The divisions are recognized as the construction industry consensus method of uniform specification organization.
    2. Sections: For convenience, "Sections" are considered as the basic units of work. The section title is descriptive only and not intended to limit the meaning or content of a section or to be completely descriptive of requirements specified therein.
    3. Section Numbering is used to facilitate cross-references in the Contract Documents. Sections are placed in the Project Manual in numeric sequence; however, the numeric sequence is not complete and the listing of the section in the "Index" at the beginning of the Project Manual must be consulted to determine the numbers and names of specifications sections in the Contract Documents.
D. Project Identification: The project number of the Contract Documents is the Bid Number recorded on the Project Manual Cover Sheet, in Section 00 10 00 Notice to Bidders and Section 00 20 00 Bid Form.
E. Page Numbering: Pages are numbered independently for each section. The section number is shown together with the page number at the bottom of each page to facilitate the location of text in the Project Manual.

F. Text Subordination: Portions of specification text are subordinated to other portions in the following manner:
   1. Certain sections may be subordinate to other sections or parts of other sections. When that occurs, the degree of subordination is described in those sections.
   2. Sub-articles, which are printed in upper/lower case lettering, are subordinate to Article titles.
   3. Paragraphs and lines of text are subordinate to sub-article titles.
   4. Paragraphs and lines of text that are indented from the left margin are subordinate to the preceding text that is either not indented, or is indented by a lesser amount.

G. Project Manual Content: This project specification has been produced employing certain conventions in the use of language as well as conventions regarding the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
   1. In certain circumstances, the language of the specifications and other Contract Documents is of the abbreviated type. It implies words and meanings that will be appropriately interpreted. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where the full context of the Contract Documents so indicates.
   2. Imperative language is generally used in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. At certain locations in the text, for clarity of reading, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by Contractor or, when so noted, by others.

H. Methods of Specifying: The techniques or methods of specifying requirements varies throughout the text.
   1. The method used for specifying one unit or work has no bearing on requirements for another unit of work.
   2. Methods of specifying may include the following, or any combination of the following:
      a. Prescriptive.
      b. Open-generic-descriptive.
      c. Performance.
      d. Proprietary.
      e. Compliance with reference standards.

I. Specialists Assignments: In certain instances, specification text requires or implies that specific elements of the work are to be assigned to specialists or expert entities, who must be engaged for the performance of the work. Such assignments are intended to establish which part or entity involved in a specific element of the work is considered as being sufficiently experienced in the indicated construction processes or operations to be recognized as "expert" in those processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of all contract requirements remains with the Contractor.

J. These requirements should not be interpreted to conflict with the enforcement of building codes and similar regulations governing the work. They are also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

K. Trades: Except as otherwise indicated, the use of titles such as "Carpentry" in specification text, is not intended to imply that the work must be performed by an accredited or unionized tradesperson of corresponding generic name (such as "carpenter"). It is also not intended to

imply that specified requirements apply exclusively to work by tradespersons of that corresponding generic name.

1.05 DRAWING SYMBOL

A. General: Except as otherwise noted indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., latest edition.

B. Mechanical/Electrical Drawings: Graphic symbols used on mechanical/electrical drawings are generally aligned with symbols recommend by ASHRAE. Where appropriate, these symbols supplemented by more specific symbols as recommended by other recognized technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Architect/Engineer for clarification before proceeding.

1.06 INDUSTRY STANDARDS

A. General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written into the Contract Documents, applicable standards of the construction industry have the same force and effect as if copied directly into the Contract Documents. Such industry standards are hereby made a part of the Contract Documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available for reference at the project site.

B. Referenced standards (standard referenced directly in Contract Documents) have precedence over non-referenced standards which are recognized in industry for applicability to work.

C. Non-referenced standards are hereby defined as not being applicable to the work, except as general requirement of whether the work complies with recognized construction industry standards.

D. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of Contract Documents.

E. Updated Standards: At the request of the Architect/Engineer, Contractor or governing authority, submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the Contract Documents and before the performance of the work affected. The Architect/Engineer will decide whether to issue the change order to proceed with the updated standard.

F. Conflicting Requirements: Where compliance with 2 or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

G. Minimum Quantities or Quality Levels: In every instance, the quantity or quality level shown or specified is intended to be the minimum for the work to be provided or performed. Unless otherwise indicated, the actual work may either comply exactly, within specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for the context of the requirements. Refer instances of uncertainty to the Architect/Engineer for decision before proceeding.

H. Copies of Standards: Contract Documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with recognized industry standards applicable to that part of the work. Copies of applicable standards are not bound with the Contract Documents.

I. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.

J. Although certain copies of standards needed for enforcement of the requirements may be required submittals, the Architect/Engineer reserves the right to require the Contractor to submit additional copies of these standards as necessary for enforcement of the requirements.

K. Abbreviations and Names: Where acronyms or abbreviations are used in the specifications or other Contract Documents they are defined to mean the industry recognized name of the trade association, standards generating organization, governing authority or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.

1.07 GOVERNING REGULATIONS/AUTHORITIES

A. General: The procedure followed by Architect/Engineer has been to contact governing authorities where necessary to obtain information needed for the purpose of preparing Contract Documents; recognized that such information may or may not be of significance in relation to Contractor's responsibilities for performing the work. Contact governing authorities directly for necessary information and decisions having a bearing on performance of work.

B. Trade Union Jurisdictions: The Contractor shall maintain, and shall require Prime Subcontractor to maintain, complete current information on jurisdictional matters, regulations actions and pending actions, as applicable to the work. Discuss new developments at appropriate project meetings at the earliest feasible dates, and record information of relevance along with the actions agreed upon. The manner in which Contract Documents have been organized and subdivided is not intended to be an indication of jurisdictional or trade union agreements. Assign and subcontract the work, and employ trades-men laborers, in a manner which will not unduly risk jurisdictional disputes of kind which could result in conflicts, delays, claims and losses in the performance of the work.

1.08 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 01 42 00

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PART 1 – GENERAL

1.01 CONTRACTOR'S USE OF PREMISES AND FACILITIES

A. Confine operations at site to areas permitted by:
   1. Construction Limits
   2. Contract Documents
   3. Written Owner Approval

B. Do not load structure with weight that will endanger structure or existing adjacent structures including any subsurface construction.

C. The Prime Contractor shall assume full responsibility for protection and safekeeping of product stored on premises.

D. The Prime Contractor shall move any stored products which interfere with operations of Owner or other Contractor.

E. The activities of the Prime Contractor, including his subcontractors, material suppliers, employees, and others engaged in the work, shall be strictly limited to the Owner's property. Under no circumstances shall parking, material storage, or other uses of adjacent private property be permitted. Locations of storage areas, field office, parking areas, and the like on the project site shall be only within the construction limits as indicated on the drawings or as approved by the Owner.

F. Use of Installed Work: Construction personnel may use toilet facilities, sink, and other fixtures and equipment installed in work only as expressly permitted by Architect/Engineer or Owner. Any privileges granted may be revoked if abused.

G. Construction personnel shall exercise care and shall provide whatever protective measures are required to assure that their particular portions of the work do not damage or alter portions of the work that have been previously installed, either partially or completely. All work so damaged or altered shall be repaired or replaced to the satisfaction of the Architect by the party whose work has been affected, and the expense thereof shall be borne by the party who caused the damage or alteration.

H. Protection of Floors: In interior areas used for construction or field "shops", protect floors from physical damage, oil drippings, and other staining which might impair bonding of new floor coverings, utilizing such methods as heavy polyethylene covering, sawdust or sand boxes, rigid insulation or the like.

1.02 FIELD OFFICE

A. The Prime Contractor and their Sub-Contractors shall be responsible for their own field office.

B. The Prime Contractor shall provide telephone service, including cellular phone for the on-site foreman, for the duration of the project.

C. Provide at all times fire extinguishers as required by applicable codes and regulations.

D. Post in a conspicuous space near the telephone, pertinent emergency phone numbers and notices as may be required by governing authorities and fire protection department.

1.03 SITE PROTECTION

A. Contractor shall adhere to Factory Mutual Engineering and Research (FM) "Cutting and Welding" permit system. Permits are available through the Office of Environmental Safety’s Fire Specialist Office at 812-237-4020.

B. Prime Contractor shall provide a one hour fire watch at the end of each workday when any cutting or welding occurred to assure that no possibility of fire exists from any work performed that day.

1.04 TEMPORARY ELECTRIC SERVICE

A. Responsibility: The Prime Contractor shall be allowed to utilize the Owner's electricity for all construction purposes. The Prime Contractor shall arrange for the distribution and continuance throughout the work and the removal at the completion of the work of temporary electrical service. All electrical installations shall be by a Licensed Bonded Electrical Contractor. All elements of such temporary electric service shall conform to the regulations of the National Electric Code, current edition, and OSHA. All temporary wiring shall include a green equipment grounding conductor, and the entire temporary electrical service shall have equipment grounding continuity; all outlets for the connection of portable equipment shall be of the GFCI type. The Contractor shall provide all necessary wiring. The Prime Contractor or their Sub Contractor shall provide extension cords, outlets, etc. required to extend temporary service from nearest outlets of adequate capacity for the power required to points of usage.

B. Distribution Wiring: The temporary distribution wiring shall be adequate to provide whatever is required for the operation of 120 volts, single-phase portable tools and equipment not exceeding one horsepower; the distribution wiring shall provide a receptacle within 50 feet of all portions of the building area.

C. Temporary Lighting: The Prime Contractor shall provide all wiring, light bulbs and fixtures necessary to furnish temporary lighting of one watt per sq. ft. of construction area, but provide a minimum of one light in each enclosed space. Keep such temporary lighting in operation during all working periods.

D. Supervision: The Prime Contractor shall maintain strict supervision over the use of the temporary electrical service and shall be responsible for damages incurred by misuse.

1.05 TEMPORARY WATER SERVICE

A. The Prime Contractor may use the Owner's existing water service for construction purposes. The Prime Contractor shall provide and maintain leak-free, all hoses, fitting, nozzles, and the like required to distribute water to points of usage. Maintain strict supervision over use and waste of water. Take care not to spill or run water in any part of the building. Repair, replace, or restore (whichever may be deemed necessary by the Architect/Engineer) at no additional cost to the Owner, all work, new or existing, including equipment, furnishings, machines, finished surfaces, and the like which may be damaged by water due to construction operations, and by the misuse of such temporary water service. At completion of the work remove all temporary water distribution items.

1.06 TEMPORARY TOILETS

A. The Prime Contractor shall provide approved temporary toilet facilities to maintain sanitary conditions. Provide number, type and maintenance of units as required by applicable laws.

1.07 TEMPORARY STORAGE

A. The Prime Contractor and each of their Sub-Contractors shall be responsible for their own temporary storage.

B. Provide secure areas as may be required for storage and protection of materials, tools and equipment.

1.08 SIGNS

A. Identification Signs: No signs or advertisements shall be permitted on the project site or on temporary structures, except those which are required to conform to the safety requirements of the Contract Documents or those which are expressly permitted by the Architect/Engineer or specified herein.

1.09 TEMPORARY BARRIERS

A. The Prime Contractor shall be responsible for seeing that all shafts and openings through the floors or roofs are adequately barricaded, marked, and lighted. They shall provide barriers,

markers, or other provisions, or all, at all conditions, such as items protruding from the work, which might cause injury to persons. The design, locations, and requirements of protective barricades shall be subject to approval of the Architect/Engineer, but the Contractor shall be responsible for their adequacy. When such conditions no longer exist, barriers and the like shall be removed.

1.10 SITE SECURITY

A. All temporary construction which may be required to maintain security of buildings or construction areas shall be provided by the Prime Contractor. At the end of each day's work, close all windows opened by construction personnel, and close all access doors to work areas. Work damaged in this regard shall be repaired or replaced to the satisfaction of the Architect/Engineer/Owner. Security guard service shall not be provided as a part of any Contract for this project for field office, storage sheds and storage areas, or for protection of construction tools, equipment, and materials. Such security may, at the Contractor's option, be provided at no additional cost to the Owner.

1.11 TRASH REMOVAL

A. The Prime Contractor shall remove from the Construction site, and legally dispose of, all rubbish resulting from the work under his contract. Rubbish shall be removed daily and not be allowed to accumulate, other than the trash placed in trash containers outside the building.

1.12 RESTORATION OF TEMPORARY FACILITIES

A. The Prime Contractor shall be responsible for his restoration of his own temporary facilities.
B. Storage area and project offices: At completion of the work, remove from the project site all evidence of temporary services, field office, temporary sheds, covers, pallets, excess materials, scrap materials, equipment tools, waste, debris, and other foreign materials. Restore to the Architect/Engineer's satisfaction such area to its condition which existed prior to starting construction work, utilizing whatever methods are appropriate. Repair and patch to match all drive and parking lot surfaces damaged by construction processes; subject to the Architect/Engineer's approval. Fill, grade and reseed all lawn areas and replace all trees, plants or shrubs damaged by the construction process.

1.13 TEMPORARY FENCING

A. The Prime Contractor shall provide all temporary fencing required to secure the site.
B. The fencing shall be sectionalized chain link panels at least 6’ in height. The use of plastic snow type fencing or caution tape for site protection is not allowed unless approved by the Owner.
C. Provide feet assemblies to tie the fencing system together and allow for sandbags or other weighs to be placed stabilizing the fencing.
D. Wire ties shall be installed half way up on adjacent panel ends to tie the panels together.
E. It is acceptable to install chain and padlocks at site entrance locations.

PART 2 – NOT USED
PART 3 – NOT USED

END OF SECTION 01 50 10

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PART 1 – GENERAL

1.01 MATERIALS HANDLING

A. Delivery: Deliver materials and equipment to Project Site in unopened, undamaged dry containers, wrappings, cartons, crates, sacks, or the like, clearly labeled as to product and materials, and with the manufacturer's name or trademark or both. Materials delivered in other than such condition may be rejected by the Architect/Engineer.

B. Storage: Suitably store materials and equipment in designated areas and in accordance with manufacturer's recommendations or in a manner approved by the Architect or both. Store such materials and equipment off the ground, totally protected from ground splash, mud, weather separation, intrusion of foreign materials, and other damage. Do not store materials, equipment, or tools on roofs, unless such materials are to be immediately installed during the current work day, and unless equipment and tools are being integrally used in the work. Do not store volatile materials such as solvents, gasoline, oil, fuels, and the like within the building. Immediately remove paper, rags, etc., which might become soaked with such materials when they must be taken into the building for use in the work. At the end of each work day, remove such "safety cans" of materials to their storage area outside the building. The Contractor shall, upon delivery of material and equipment to the project site, check to ascertain that all materials, parts, accessories, and other incidentals necessary for the installation of such materials and equipment have been delivered and received at the project site, so that no delays are caused in the work due to insufficient quantities of materials or missing parts.

1.02 INSTALLATIONS

A. Materials: Materials and equipment shall be new and undamaged and shall be installed as indicated on the drawings. They shall fit accurately into adjacent work and shall be plumb, level, and true-to-line. All materials and equipment shall be anchored securely and rigidly in place, maintaining alignment with adjacent work. Where installation methods and techniques are not specifically covered by the drawings or the specifications, normal first-class trade practices and manufacturer's instructions and recommendations shall govern, providing that they are approved by the Architect/Engineer.

B. "Not-In-Contract" Items: Materials, equipment, fixtures, devices and other items indicated on the drawings as "Not-In-Contract" or "N.I.C." shall in no way be a part of the Contract. Where such "Not-In-Contract" items are accompanied by an indication to be installed by the Contractor, the Contractor shall receive, store, protect, assemble, install, and connect such items in accordance with the best accepted practices of the trade or trades involved and with the provisions of the Specifications for similar items that are totally part of the Contract. The Contractor shall be responsible for obtaining such specific information for the installation and connection of such items.

C. Reinstalling Existing Items: Where existing materials, equipment, fixtures, devices, and other items are indicated on the drawings to be removed, or received, and reinstalled under the Contract, treat such existing items as if they were new and install such existing items as shown on the drawings, in accordance with the best accepted practices of the trade or trades involved and with provisions of the specifications for similar new items.

1.03 REMOVAL AND RE-INSTALLATION OF EQUIPMENT

A. The Owner is not responsible for the removal or re-installation of equipment necessitated by this work.

B. All electrical disconnects and reconnects of equipment necessitated by this work shall be performed by a licensed bonded Electrical Contractor hired by the Contractor to perform this work. The Owner will assist in locating the power source but will not be responsible for the

actual performance the electrical work.

1.04 ACCESSIBILITY

A. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. Minor deviations from the contract drawings may be made to allow for better accessibility, but changes of magnitude or which involve extra cost shall not be made without approval.

B. It is the Contractor's responsibility to provide access panels when serviceable parts of his installation are concealed by finished construction, unless access panels are specifically indicated on the Drawings or elsewhere in the Project Manual to be by others. Access panel data shall be submitted with the equipment Shop Drawings.

C. Ample space shall be allowed for removal of all parts that may require replacement or service in the future. The service area is to be indicated on Shop Drawings.

D. The Contractor shall extend all grease fittings to an accessible location.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 01 60 00

FIELD ENGINEERING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Survey and field engineering.
B. Quality control.
C. Submittals.
D. Project record documents.

1.02 RELATED SECTIONS

A. Information Available to Bidders: Owner's topographic survey.
B. General Conditions: Basic site engineering requirements.
C. Section 017700 - Contract Closeout: Project Record Documents.

1.03 QUALITY ASSURANCE

A. Employ a Land Surveyor registered in the State of Indiana and acceptable to Architect/Engineer, to perform survey work of this section.
B. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
C. Employ a Professional Engineer of the discipline required for specific service on Project, licensed in the State of Indiana.

1.04 SUBMITTALS FOR REVIEW

A. Submit name, address, and telephone number of Surveyor or Engineer before starting survey work.
B. On request, submit documentation verifying accuracy of survey work.
C. Submit a copy of registered site drawing and a certificate signed by the Land Surveyor or Engineer, that the elevations and locations of the Work are in conformance with Contract

1.05 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.
B. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.
C. Submit Record Documents under provisions of Section 01 77 00.

1.06 EXAMINATION

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect/Engineer of any discrepancies discovered.

1.07 SURVEY REFERENCE POINTS

A. Contractor to locate and protect survey control and reference points.
B. Control datum for survey is that established by Owner provided survey or as indicated on Drawings.
C. Project survey control points prior to starting site work; preserve permanent reference points during construction.
D. Promptly report to Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.08 SURVEY REQUIREMENTS

A. Provide field engineering services. Utilize recognized engineering survey practices.

B. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations and ground floor elevations.

D. Periodically verify layouts by same means.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 01 70 00

01 73 10
CUTTING AND PATCHING

PART 1 – GENERAL
1.01 SECTION INCLUDES
A. Requirements and limitations for cutting and patching of Work
1.02 RELATED SECTIONS
A. Section 01 10 00 - Summary of Work: Work by Owner or by separate contractors
B. Section 01 32 00 - Submittals and Substitutions
C. Section 01 60 00 - Materials and Equipment
D. Individual Product Specification Sections:
1. Cutting and patching incidental to work of the section
2. Advance notification to other sections of openings required in work of those sections
3. Limitations on cutting structural members
1.03 SUBMITTALS
A. Submit written request in advance of cutting or alteration which affects:
1. Structural integrity of any element of Project
2. Integrity of weather exposed or moisture resistant element
3. Efficiency, maintenance, or safety of any operational element
4. Visual qualities of sight exposed elements
5. Work of Owner or separate contractor
B. Include in request:
1. Identification of Project
2. Location and description of affected Work
3. Necessity for cutting or alteration
4. Description of proposed Work and Products to be used
5. Alternatives to cutting and patching
6. Effect on work of Owner
7. Date and time work will be executed
PART 2 – PRODUCTS
2.01 MATERIALS
A. Primary Products: Those required for original installation.
PART 3 – EXECUTION
3.01 RESPONSIBILITY
A. Each respective Contractor is responsible for the required cutting and patching to complete his work.
B. Each respective Contractor shall coordinate with the General Contractor and bear all costs associated with cutting and patching.
3.02 EXAMINATION
A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, assess conditions affecting performance of work.
C. Beginning of cutting or patching means acceptance of existing conditions.

3.03 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
B. Provide protection from elements for areas which may be exposed by uncovering work.
C. Maintain excavations free of water.

3.04 CUTTING

A. Execute cutting and fitting including excavation and fill to complete the Work.
B. Uncover work to install improperly sequenced work.
C. Remove and replace defective or non-conforming work.
D. Remove samples of installed work for testing when requested.
E. Provide openings in the Work for penetration of mechanical and electrical work.
F. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight-exposed surfaces.
G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.05 PATCHING

A. Execute patching to complement adjacent Work.
B. Fit Products together to integrate with other Work.
C. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
D. Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
E. Restore work with new Products in accordance with requirements of Contract Documents.
F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION 01 73 10

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 SUBSTANTIAL COMPLETION SUBMISSIONS

A. Record Drawings and Record Specifications:
   1. The Contractor shall provide the final Field Record Drawings and Specifications which have been maintained and updated during the duration of the Project to the Architect/Engineer for review. Submit documents in paper form of each Drawing and Specification Division of the Work.
   2. Certifications: The Prime Contractor and Subcontractors shall certify, by endorsement on the Record Drawings and Specifications that each of the revised sheets represents a complete and accurate record of the Work as executed.

B. Operations and Maintenance Data
   1. Assemble a manual in electronic PDF format on USB Flash Drive indexed by Division of work Sub indexed by Specification of work, presenting for the Owner's guidance full details for care and maintenance of visible surfaces and of equipment included in the Work for review by the A/E.
      a. Include a copy of the reviewed Architect/Engineer submittal and/or shop drawing. The Submittal and/or shop drawing shall be annotated by the Contractor indicating that the comments have been included in the document.
      b. Include manufacturer's literature relating to motors and other equipment, catalog cut, parts lists, wiring diagrams, instruction sheets, and other pertinent information which will be useful to the Owner in overall operation and maintenance.
      c. Include a list of installers and service representatives with company names and addresses, names of individuals to contact, and telephone numbers.
      d. Include manuals called for in other Sections of the Specifications, in this manual.
   2. Certifications: The Contractor shall certify, by endorsement of the manual, that the manual is complete and accurate.
   3. On Projects where the Owner is the Architect/Engineer, submit to the Owner for review.

C. Warranties
   1. Forms:
      a. Extended Warranties: Provide a copy of the manufacturer's extended warranty, fill it out completely, sign it, and have it countersigned by the installer and manufacturer if required by the Contract Documents.
      b. Manufacturers' Warranties: Manufacturer's warranty modified, when required to comply with requirements of the Contract Documents.
   2. Starting Date: The starting date for warranties is the Date of Substantial Completion of the Work.
   3. Submittal: At the time of Substantial Completion submit all warranties, including special warranties, required by the Contract Documents to the Architect/Engineer review.

D. Statement of Application
   1. Submit Owner prepared fully executed Certificate of Substantial Completion.

E. Service and Maintenance Contracts
   1. At the time of Substantial Completion submit executed contracts for extended service or maintenance required by the Contract Documents to the Architect/Engineer for review by the A/E.

2. Extended maintenance proposals where called for in the specification shall be submitted with the proposals for each trade at the time their portion of the work is bid. Furnish copies of the maintenance proposal to the Owner and Architect/Engineer for review prior to award of the subcontract for each portion of work.

1.02 FINAL CLEANING

A. Responsibility: The Prime Contractor is responsible for the final cleaning of the Project and for the coordination and direction of cleaning by all trades.

B. Materials:
   1. Use only cleaning materials recommended by the manufacturers of the surfaces to be cleaned.
   2. Use cleaning materials only on surfaces recommended by the cleaning materials manufacturers.

C. Execution:
   1. Employ experienced workers, or professional cleaners, for final cleaning.
   2. Clean all surfaces whether exposed to view or not.
   3. Remove trash, rubbish, waste materials, tools, and equipment from the site.
   4. Remove grease, dust, dirt, plaster, mortar, fingerprints, and other foreign materials from interior and exterior surfaces exposed to view, e.g., the surfaces of structural steel, miscellaneous metal, woodwork, plaster, masonry, concrete, mechanical and electrical equipment, piping, duct work, and conduit; polish surfaces so designated to shine finish.
   5. Clean the electrical closets, pipe and duct shafts, chases, furred spaces, and similar spaces which are generally unfinished. Leave these spaces free from rubbish, loose plaster, mortar droppings, waste construction materials, dirt, and dust.
   6. The Architect/Engineer is to review items which the Prime Contractor proposes removing labels before they are removed.
   7. Maintain cleaning until date of Substantial Completion or the date of partial occupancy of the building, whichever is earlier. Re-cleaning will not be required after the Work has been inspected and accepted, unless later operations of the Contractor make re-cleaning of certain portions necessary.

1.03 PREPARATION OF FINAL RECORD DRAWINGS AND RECORD SPECIFICATIONS

A. The Prime Contractor shall employ the Project A/E to re-draft, in CAD format, the paper copy Record Drawings onto the Bid Drawings to create the final Record Drawings.

B. The Prime Contractor shall employ the Project A/E to retype the paper Record Specifications to indicate all revisions to the Bid Specifications. Items changed shall be marked by a double strike through and revised language inserted in red letters.

C. An Allowance to cover the costs of the re-drafting of Drawings and revisions to the Specification will be provided and shall be included in the Prime Contractors Bid. Final Allowance cost payments will be based on actual documented A/E costs for their work. The Allowance payment will be adjusted accordingly. This Allowance shall be listed as a separate line item on the Schedule of Values.

1.04 FINAL CLOSEOUT

A. Final Closeout date shall be as listed in Section 00 10 10 1.01

B. At Final Closeout the Contractor shall submit to the Owner, via the Architect/Engineer if applicable:

1. One (1) hard copy of the reviewed and accepted O&M Manual in 3-ring binder(s)
2. One (1) copy on a USB Flash Drive of the complete Project Documentation in PDF format, except as noted in item “o” below, including but not limited to:
   a. Design Meeting Notes (the Contractor shall coordinate with the A/E to obtain)
   b. Pre-Bid meeting documents
   c. The Contractor’s Project Bidding Documents including Addenda.
   d. Award documentation
   e. Required submissions as detailed in the Award Letter
   f. Pre-Construction meeting documents and
   g. Progress meeting notes and Construction observation notes.
   h. All Change items, e.g. ASI, RFI, RFQ, CP, CO, etc., with documentation
   i. Pay Applications
   j. Reviewed and accepted O&M Manual,
   k. Warranties,
   l. Extended Service and Maintenance Contracts
   m. Record Specifications
   n. A scanned copy of the marked-up Record Drawings
   o. Record Drawings in both PDF and CAD format
3. The Prime Contractor shall retain the paper copies of the Record Drawings and Record Specifications for a minimum of seven (7) years in a safe location and produce these documents upon request by the Owner.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 01 77 00

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

B. Related Requirements:
   1. Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Section 01 56 39 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
   3. Section 01 73 00 "Execution" for cutting and patching procedures.
   4. Section 31 10 00 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse .

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site .
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property , for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or video templates.
   1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."
   2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
   3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
   6. Maintain adequate ventilation when using cutting torches.
   7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner .
   5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 13 52 MODIFIED BITUMINOUS SHEET WATERPROOFING for new roofing requirements.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Form-facing material for cast-in-place concrete.
   2. Shoring, bracing, and anchoring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following:
   1. Exposed surface form-facing material.
   2. Concealed surface form-facing material.
   3. Form ties.
   4. Waterstops.
   5. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
   1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
   2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
      a. Location of construction joints is subject to approval of the Architect.
   3. Indicate location of waterstops.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
   2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

a. For architectural concrete specified in Section 03 33 00 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

A. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Carlisle Coatings & Waterproofing Inc.
b. CETCO is a subsidiary of Minerals Technologies Inc.
c. Concrete Sealants Inc.
d. Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands).
e. J P Specialties, Inc.
f. Sika Corporation.

2.4 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes .

C. Limit concrete surface irregularities as follows:
1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.
1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
1. Provide and secure units to support screed strips.
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
   1. Determine sizes and locations from trades providing such items.
   2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:
   1. Construct joints true to line with faces perpendicular to surface plane of concrete.
   2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   3. Place joints perpendicular to main reinforcement.
   4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
      a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
   1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
   2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.

5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
   1. Install in longest lengths practicable.
   2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
   3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 03 30 00 "Cast-In-Place Concrete."
   4. Secure waterstops in correct position at 12 inches on center.
   5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
      a. Miter corners, intersections, and directional changes in waterstops.
      b. Align center bulbs.
   6. Clean waterstops immediately prior to placement of concrete.
   7. Support and protect exposed waterstops during progress of the Work.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
   1. Install in longest lengths practicable.
   2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
   3. Protect exposed waterstops during progress of the Work.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:
   1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
   2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.
1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

B. Material Test Reports: For the following, from a qualified testing agency:
1. Steel Reinforcement:
a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
2. Mechanical splice couplers.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. <Click here to insert sustainable design text for recycled content.>
   1. <Click to insert sustainable design text for regional materials.>

B. Reinforcing Bars: ASTM A615/A615M, Grade 60 , deformed.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
   1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
      a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
      b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
      c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
      d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
      e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
   1. Finish: Plain .

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
   1. Do not cut or puncture vapor retarder.
   2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
   1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
   2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
   2. Stagger splices in accordance with ACI 318.
   3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
   4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.
   1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
      a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
   2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
   3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
   4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement.
   2. Continue reinforcement across construction joints unless otherwise indicated.
   3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-ground.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.
1. Portland cement.
2. Aggregates.
3. Admixtures:
a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
4. Vapor retarders.
5. Liquid floor treatments.
6. Curing materials.
7. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.

3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
a. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:
1. Portland cement.
2. Aggregates.
3. Admixtures:

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M, Type I/II , gray .
   2. Fly Ash: ASTM C618, Class C or F.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Alkali-Silica Reaction: Comply with one of the following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
      b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
   2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

D. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A ; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Reef Industries, Inc.
      b. Stego Industries, LLC.
      c. W. R. Meadows, Inc.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ChemMasters, Inc.
      b. Dayton Superior Corporation.
      c. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
      d. Master Builders Solutions, brand of MBCC Group, a Sika company.
      e. Penetron USA, Inc.
      f. W. R. Meadows, Inc.

2.5 CURING MATERIALS

A. Water: Potable or complying with ASTM C1602/C1602M.

B. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ChemMasters, Inc.
      b. Dayton Superior Corporation.
      c. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
      d. W. R. Meadows, Inc.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
   3. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
   1. Use water-reducingorhigh-range water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

A. A : Refer to sheet S001.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.2 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
   4. Lap joints 6 inches and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.3 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

C. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view .

3.6 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.

3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
1. Cast-in inserts and accessories, as shown on Drawings.

2. Screed, tamp, and trowel finish concrete surfaces.

3.8 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
   2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
   3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
   1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
   2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
   3. If forms remain during curing period, moist cure after loosening forms.
   4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
      a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
      b. Continuous Sprinkling: Maintain concrete surface continuously wet.
      c. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
      d. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
         1) Recoat areas subject to heavy rainfall within three hours after initial application.
         2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
   1. Begin curing immediately after finishing concrete.
   2. Interior Concrete Floors:
      a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
         1) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.
      b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
         1) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:
   1) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
      a) Water.
      b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:
   1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.

e. Floors to Receive Urethane Flooring:
   1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
   2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
   3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
   4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:
   1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   2) Recoat areas subjected to heavy rainfall within three hours after initial application.
   3) Maintain continuity of coating, and repair damage during curing period.
   4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

g. Floors to Receive Curing and Sealing Compound:
   1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   2) Recoat areas subjected to heavy rainfall within three hours after initial application.
   3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES

A. Conform to ACI 117.

3.10 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
3. Rinse with water; remove excess material until surface is dry.
4. Apply a second coat in a similar manner if surface is rough or porous.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
   1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
   2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
   3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
      a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
         1) Project name.
         2) Name of testing agency.
         3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
         4) Name of concrete manufacturer.
         5) Date and time of inspection, sampling, and field testing.
         6) Date and time of concrete placement.
         7) Location in Work of concrete represented by samples.
         8) Date and time sample was obtained.
         9) Truck and batch ticket numbers.
         10) Design compressive strength at 28 days.
         11) Concrete mixture designation, proportions, and materials.
         12) Field test results.
         13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
         14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
      a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C143/C143M:
      a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
      b. Perform additional tests when concrete consistency appears to change.
   3. Slump Flow: ASTM C1611/C1611M:
      a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
      b. Perform additional tests when concrete consistency appears to change.
   4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .
      a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   5. Concrete Temperature: ASTM C1064/C1064M:
      a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
   6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
      a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   7. Compression Test Specimens: ASTM C31/C31M:
      a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
      b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
   8. Compressive-Strength Tests: ASTM C39/C39M.
      a. Test one set of laboratory-cured specimens at seven days and one set of two specimens at 28 days.
      b. Test one set of field-cured specimens at seven days and one set of two specimens at 28 days.
      c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.12 PROTECTION

A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 03 30 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
   2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi .
   2. Density Classification: Normal weight .

C. Concrete Building Brick: ASTM C55.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi .
   2. Density Classification: Normal weight.

2.3 CONCRETE LINTELS

A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Aggregate for Mortar: ASTM C144.
   1. White-Mortar Aggregates: Natural white sand or crushed white stone.
   2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C404.

G. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
   1. Interior Walls: Mill- Hot-dip galvanized, carbon steel.
   2. Wire Size for Side Rods: 0.148-inch diameter.
   3. Wire Size for Cross Rods: 0.148-inch diameter.
   4. Spacing of Cross Rods: Not more than 16 inches o.c.
   5. Provide in lengths of not less than 10 feet , with prefabricated corner and tee units.

2.6 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
   3. For reinforced masonry, use portland cement-lime mortar.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. For masonry below grade or in contact with earth, use Type M Type S.
   2. For reinforced masonry, use Type N.
   3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

E. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
   3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. Bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Bed webs in mortar in all courses of piers, columns, and pilasters.
   3. Bed webs in mortar in grouted masonry, including starting course on footings.
   4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches .

3.8 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
   2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.9 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 26 13 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Clay face brick.
   2. Through-Wall Flashing
   3. Accessories

B. Products Installed but Not Furnished under This Section:
   1. Steel lintels in masonry veneer.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type and color of brick and colored mortar.

1.3 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face:Facing brick complying with ASTM C216 .
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Type A: Brampton Brick, Slate Modular.
      b. Type B: As Selected By Owner
   2. Grade SW .
   3. Type FBX .
   4. Compressive Strength: 5800 - 8700 PSI.
   5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
   6. 24-Hour cold Water Absorption: 3% - 6%.
   7. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
   8. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
   9. Locations: As indicated on the drawings (Building Elevations) .

2.3 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Lehigh Hanson; HeidelbergCement Group; Lehigh Masonry Cement or comparable product by one of the following:
      a. Essroc; Brixment
      b. Holcim (US) Inc; Mortamix Masonry Cement
      c. Lafarge North America Inc.; Lafarge Masonry Cement

B. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Colored Masonry Cement:
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Lehigh Hanson; HeidelbergCement Group; Lehigh Custom Color Masonry Cement or comparable product by one of the following:
         1) Essroc; Brixment-in-Color
         2) Holcim (US) Inc; Rainbow Mortamix Custom Color Masonry Cement
         3) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement

C. Aggregate for Mortar: ASTM C144.

1. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Euclid Chemical Company (The); an RPM company; Accelguard 80
      b. GCP Applied Technologies Inc.; Morset

E. Water: Potable.

2.4 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

C. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
   2. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
   3. Fabricate wire connector sections from 0.187-inch- diameter, hot-dip galvanized, carbon-steel wire.
   4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
   5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and base for inserting wire tie.
      a. Products: Subject to compliance with requirements, provide the following:
         1) Hohmann & Barnard, Inc. DW-10HS

2.5 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to an .030" Type 304 Stainless Steel sheet to produce an overall thickness of not less than 0.040 inch.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Hohmann & Barnard, Inc; Mighty-Flash SA

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

C. Termination Bars: Provide termination bar at top of flashing to mechanically secure it to thebackup

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Weep/Vent Products: Use the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
    a. Products: Subject to compliance with requirements, provide the following:
        1) Hohmann & Barnard, Inc; QV Quadro-Vent

B. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Advanced Building Products Inc.; Mortar Break
    b. Hohmann & Barnard, Inc; Mortar Trap
    c. Wire-Bond; Cavity Net II

C. Metal Flashing Materials:
1. Drip Edge / Drip Plates: Type 304 Stainless Steel drip plate with hemmed edge for use in conjunction with through-wall flashing membrane and systems.
    a. Basis of Design: Hohman and Barnard DP drip plate.
2. End Dams: Type 304 Stainless Steel, 26 ga. pre-fabricated soldered inside corners, outside corners and end dams suitable for use with self-adhering through-wall flashing.
    a. Basis of Design: Hohman and Barnard Stainless Steel Corners and End Dams.

2.7 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Products: Subject to compliance with requirements, provide the following:
    a. PROSOCO, Inc; Sure Klean® 600

2.8 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use masonry cement mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement by weight.
   3. Application: Use pigmented mortar for exposed mortar joints.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch .

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Embed tie sections in masonry joints.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 3.5 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
   5. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of sheathing .

3.6 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
   4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
   1. Use specified weep/vent products to form weep holes.

2. Space weep holes 24 inches o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.7 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.8 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 26 13

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural steel.
2. Shear stud connectors, shop welded.
3. Shrinkage-resistant grout.

B. Related Requirements:
1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 05 31 00 "Steel Decking" for field installation of shear stud connectors through deck.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data:
1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Shop primer.
8. Etching cleaner.
9. Galvanized repair paint.
10. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator with a minimum of 10 years of experience with projects of a similar size and scope.

B. Installer Qualifications: A qualified Installer with a minimum of 10 years of experience with projects of a similar size and scope. .

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:
1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Option 2: Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.
a. Select and complete connections using ANSI/AISC 360 .
b. Use Allowable Stress Design; data are given at service-load level.

C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M .

B. Channels, Angles , M-Shapes : ASTM A36/A36M .

C. Plate and Bar: ASTM A36/A36M .

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36 .
   1. Configuration: Straight .
   2. Finish: Plain .

B. Threaded Rods: ASTM A36/A36M .
   1. Finish: Plain .

2.5 PRIMER

A. Steel Primer:
   1. Comply with Section 09 91 13 "Exterior Painting," Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings."

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened .

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates : Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
   1. Joint Type: Snug tightened .

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.

3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
      a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
         1) Liquid Penetrant Inspection: ASTM E165/E165M.

END OF SECTION 05 12 00

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof deck.
   2. Composite floor deck.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Roof deck.
   2. Composite floor deck.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:
   1. Welding certificates.
   2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:
   1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.

C. Field Quality-Control Submittals:
   1. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:
      a. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. New Millennium Building Systems, LLC.
   2. Vulcraft Group; Division of Nucor Corp.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
   1. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40 , G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard .
   2. Deck Profile: Type WR, wide rib .
   3. Profile Depth: As indicated .
   4. Design Uncoated-Steel Thickness: As indicated .
   5. Span Condition: As indicated .
   6. Side Laps: Overlapped .

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. New Millennium Building Systems, LLC.
   2. Vulcraft Group; Division of Nucor Corp.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
   2. Profile Depth: As indicated.
   3. Design Uncoated-Steel Thickness: 0.0358 inch .
   4. Span Condition: As indicated .

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.2 INSTALLATION OF ROOF DECK

A. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches , and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum .

C. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

D. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.3 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 3/4 inch, nominal.
   2. Weld Spacing:
      a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches apart, but not more than 18 inches apart.
      b. Space and locate welds as indicated.
   3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 3" , with end joints as follows:
   1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:
1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
a. Field welds will be subject to inspection.
2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Cold-formed steel framing materials.
   2. Exterior non-load-bearing wall framing.
   3. Vertical deflection clips.
   4. Single deflection track.
   5. Double deflection track.
   6. Post-installed anchors.
   7. Power-actuated anchors.

B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.
   1. Include structural analysis data signed and sealed by the qualified professional engineer licensed in the State of Indiana responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AllSteel & Gypsum Products, Inc.
   2. ClarkDietrich.
   3. MarinoWARE.
   4. Telling Industries.

5. The Steel Network, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
   1. Wall Studs: AISI S211.
   2. Headers: AISI S212.
   3. Lateral Design: AISI S213.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: ST50H As required by structural performance .
   2. Coating: G60 , A60 , AZ50 , or GF30 .

B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance .
   2. Coating: G60 .

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch .
   2. Flange Width: As required by design. .
   3. Section Properties: As required by design. .

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AllSteel & Gypsum Products, Inc.
      b. ClarkDietrich.
      c. MarinoWARE.
      d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch .
   2. Flange Width: As required by design. .
   3. Section Properties: As required by design. .

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. ClarkDietrich.
      b. MarinoWARE.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36 , threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C .

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design

load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As required by design but not more that 16 inches .

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to infill studs and anchor to building structure.
   4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As required by design but not more that 24 inches .

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to studs and anchor to building structure.
   4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Miscellaneous framing and supports.
2. Metal ladders.
3. Elevator pit sump covers.
4. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:
1. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Slotted channel framing.
5. Manufactured metal ladders.
6. Metal bollards.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated Design Submittals: For ladders , including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders .

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304 .

D. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

E. Rolled-Stainless Steel Floor Plate: ASTM A793.

F. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. IKG.
      b. Ohio Gratings, Inc.
      c. SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC.

G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

I. Zinc-Coated Steel Wire Rope: ASTM A741.
   1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

J. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
   1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Steel Prestressing Strand: ASTM A416/A416M, Grade 270, low-relaxation, seven-wire, with 0.9-lb/sq. ft. zinc coating.
   1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.

L. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches .
   2. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B , with G90 coating; 0.079-inch nominal thickness.

M. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

N. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

O. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

P. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

Q. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).

R. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semired brass).

S. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.

B. Post-Installed Anchors: .
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

C. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting."

B. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
   1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 , except for elevator pit ladders.
   2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:
   1. Space siderails 16 inches apart unless otherwise indicated.
   2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.

3. Rungs: 1-inch- diameter , steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung.
6. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.8 ELEVATOR PIT SUMP COVERS

A. Fabricate from 3/16-inch abrasive-surface floor plate with four 1-inch- diameter holes for water drainage and for lifting.

2.9 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe .
   1. Cap bollards with 1/4-inch- thick steel.

B. Fabricate sleeves for bollard anchorage from steel or stainless steel pipe with 1/4-inch- thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Prime steel bollards with zinc-rich primer.

2.10 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
   4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor shelf angles securely to existing construction with expansion anchors .

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.4 INSTALLATION OF ELEVATOR PIT SUMP COVERS

A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.5 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

3.6 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 05 51 13 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 Section Includes:

A. Concrete-filled metal pan stairs.

1.2 Related Sections:

A. Section 05 52 13 Pipe and Tube Railings for guards & railings at stairs, landings, adjacent walkways and modifications to existing railings in existing stair towers.

1.3 SUBMITTALS

A. Action Submittals:
1. Shop Drawings: Illustrate products, installation, and relationship to adjacent construction.

B. Informational Submittals:
1. Certificate of Compliance: Certification that installed products meet specified design requirements.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
1. Design stair assembly to support a uniform live load of 100 PSF and a concentrated load of 300 pounds, with maximum deflection of L/240 PSF.
2. Design guard rails and handrails to resist following without damage or permanent set:
a. 50 pounds per linear foot applied in any direction at top, transferred via attachments and supports to building structure.
b. Concentrated 200 pound load applied in any direction at any point along top, transferred via attachments and supports to building structure.
c. Maximum deflection under loading: L/120.
3. System design to be performed by qualified professional engineer licensed in State in which Project is located.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications:
1. Minimum 10 years' experience in design and fabrication of custom steel stairs and railings.
2. AISC Certified Fabricator.

B. Installer Qualifications: Firm specializing in work of this Section, with minimum 2 years' experience.

C. Fabricate stair assembly to NAAMM AMP 510, Commercial Class.

D. Fabricate guard rails and handrails in accordance with ASTM E985.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design product by Pacific Stair Corporation. www.pacificstair.com

B. Substitutions: Refer to Divisions 00 and 01.

2.2 MATERIALS

A. Steel:
1. Sections, Plates, Shapes, and Bars: ASTM A36/A36M.
2. Structural steel sheet: Hot-rolled, ASTM A1011, or cold-rolled, ASTM A1008/A1008M, Class 1.
3. Pipe: ASTM A53/A53M, Type S, minimum Standard Weight, Schedule 40.
4. Tube: Cold-rolled, ASTM A500, or hot-rolled, ASTM A501, Grade B, seamless where exposed
5. Sheet: ASTM A1008/A1008M.

B. Concrete: ASTM C94; minimum 3000 PSI compressive strength at 28 days.

2.3 FABRICATION

A. Fabricate stairs in accordance with approved Shop Drawings.

B. Welding to conform to AWS D1.1/D1.1M for steel shapes, plate, and tube and AWS D1.3/D1.3M for steel sheet.

C. Treads and Landings: Concrete Filled Steel Pan.

D. Risers: Fabricate stairs with closed risers.

E. Guard Rails and Handrails:
1. See Section 05 52 13 Pipe and Tube Railings for Guards, Handrails, wire mesh & perforated metal infill panels.

2.4 FINISHES

A. Ferrous Metal:
1. Shop prime painted except steel to be encased in concrete and surfaces to be welded.
2. Surface preparation: SSPC SP2 - Hand Tool Cleaning or SP3 - Power Tool Cleaning.
3. Primer color: Gray.

B. Ferrous Metal: Galvanized; ASTM A123/A123M, to 1.3 ounces per square foot.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install stairs in accordance with manufacturer's instructions and approved Shop Drawings.

B. Welding to conform to AWS D1.1/D1.1M for steel shapes, plate, and tube and AWS D1.3/D1.3M for steel sheet.

C. Installation Tolerances:
   1. Maximum variation from plumb: ¼ inch per story, noncumulative.
   2. Maximum offset from true alignment: ¼ inch.

END OF SECTION 05 51 13

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel railings.
2. Wire Mesh Infill Panels.
3. Perforated Metal Infill Panels.

B. Related Sections:
1. Section 05 51 13 Metal Pan Stairs for new metal pan stairs with cast in place concrete stairs.
2. Section 06 40 23 Interior Architectural Woodwork for wood rails & caps.
3. Section 09 91 23 Interior Painting for paint finishes at interior stairs.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Manufacturer's product lines of mechanically connected railings.
2. Handrail brackets.
3. Shop primer.
4. Bituminous paint.
5. Nonshrink, nonmetallic grout.
6. Anchoring cement.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish.

D. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer licensed in the State of Indiana responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated design professional engineer .

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," licensed in the State of Indiana, to design railings, including attachment to building construction.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
   1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Perforated-Metal Infill Panels:
   1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel, Type B, 0.1046" thick, 1/4" Round on 5/16" Staggered Centers, 58" Open Area .
      a. Basis-of-Design Product: Provide product with perforations matching product indicated on Drawings .

E. Woven-Wire Mesh Infill Panels: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.134-inch- diameter steel wire complying with ASTM A510.
   1. Basis-of-Design Product: Provide product with crimp pattern matching McNichols Square Carbon Steel, Cold Rolled, Woven-Intercrimp Weave, 1313 Crimp Style, .07500"x.07500" Square opening, 0.120" Thick (11 Gauge) Wire Diameter, 74% Open Area. .

2.4 FASTENERS

A. Fastener Materials:
   1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/ASTM F1941M, Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
   3. Aluminum Railing Components: Type 304 stainless steel fasteners.
   4. Stainless Steel Railing Components: stainless steel fasteners.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron center of handrail 2-1/2 inches from wall.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
1. For aluminum and stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."

F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

G. Intermediate Coats and Topcoats: Provide products that comply with Section 09 91 23 "Interior Painting."

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.6 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay .

D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

K. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from steel .
1. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch thick.
2. Orient perforated metal with pattern parallel to top rail .

L. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames.
1. Fabricate wire mesh and frames from same metal as railings in which they are installed.
2. Orient wire mesh with wires perpendicular and parallel to top rail .

M. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
   1. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
   2. Railings Indicated To Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
   3. Other Railings: SSPC-SP 3.

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Shop prime uncoated railings with primers specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" unless zinc-rich primer is indicated.
   2. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.
   1. Fit exposed connections together to form tight, hairline joints.
   2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
   3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
   4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
   1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Safety for Children: Ease, round over, or remove all sharp edges and remove weld splatter prior to paint finish.

3.2 ANCHORING POSTS

A. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Secure wall brackets to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.

C. Install railing gates level, plumb, and secure for full opening without interference.

D. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.4 CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 52 13

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking , cants, and nailers.
   3. Wood furring and grounds.
   4. Utility shelving.
   5. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece .
   3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Cants.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

2.5 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Do not splice structural members between supports unless otherwise indicated.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior standing and running trim.
   2. Interior stair railings & caps.
   3. Fire-retardant-treated wood material.
   4. Miscellaneous materials.
   5. Shop finishing of interior architectural woodwork.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Anchors.
   2. Adhesives.
   3. Shop finishing materials.
   4. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
   1. Include the following:
      a. Dimensioned plans, elevations, and sections.
      b. Attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
   4. Apply Program label to Shop Drawings.

C. Samples: For each exposed product and for each shop-applied color and finish specified.

1.3 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: certificates.

1.4 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and

maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom .

B. Hardwood Lumber:
1. Species: Clear Maple .
2. Cut: Plain sliced/plain sawn .
3. Wood Moisture Content: 5 to 10 percent.
4. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
5. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
   a. For veneered base, use hardwood lumber core, glued for width.
6. For base wider than available lumber, glue for width. Do not use veneered construction.
7. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

2.3 INTERIOR WOOD STAIR RAILINGS

A. Architectural Woodwork Standards Grade: Custom .

B. Wood for Transparent Finish:
1. Species and Cut:
   a. Railings: Hard maple, plain sawn .
2. Wood Moisture Content: 5 to 10 percent.

C. Finishes for Stair Parts:
1. Handrails: Transparent .

D. Handrail Brackets: Cast stainless steel with wall flange drilled for exposed anchor and tapped for concealed hanger bolt and with support arm for screwing to underside of rail. Size to provide 1-1/2-inch clearance between handrail and face of wall.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Julius Blum & Co., Inc.
   b. The Wagner Companies.

E. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels: one for fastening to back of rail and one for fastening to face of wall, assembled in overlapping fashion and fastened together at top and bottom with self-tapping screws. Size to provide 1-1/2-inch clearance between handrail and wall.

2.4 HARDWOOD SHEET MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
   1. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.5 FIRE-RETARDANT-TREATED WOOD MATERIALS

A. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
   2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
   3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
   4. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less in accordance with ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Arauco North America.
   b. Timber Products, Inc.
2. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
3. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1, except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.

D. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less in accordance with ASTM E84.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Roseburg.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
   1. Fire-Retardant Treatment: Complying with requirements; provide where blocking is indicated to receive interior architectural woodwork and or flush wood paneling .

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
   1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
   2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
   1. Ease edges to radius indicated for the following:
      a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
      b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
   1. Disassemble components only as necessary for shipment and installation.
   2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
   3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
      a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
      b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.8 SHOP FINISHING

A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

C. Transparent Finish:
   1. Architectural Woodwork Standards Grade: Custom .
   2. Finish System - 11: Polyurethane, Catalyzed.
   3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
   4. Staining: Match approved sample for color .
   5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
   6. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes in accordance with AWPA M4.

F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

H. Standing and Running Trim:
1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished .
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

I. Stairs: Securely anchor carriages to supporting substrates.
1. Install stairs with treads and risers no more than 1/8 inch from indicated position.
2. Secure with countersunk, concealed fasteners and blind nailing.

3. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.

J. Railings:
1. Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.
3. Wall Rails: Support rails on wall brackets securely fastened to wall framing.
a. Space rail brackets not more than 48" o.c.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
1. Inspection entity is to prepare and submit report of inspection.

END OF SECTION 06 40 23

SECTION 06 42 16 - FLUSH WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Shop finishing.
   2. Flush wood paneling (wood-veneer wall surfacing).
   3. Fire-retardant-treated materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For flush wood paneling.
   1. Include plans, elevations, sections, and attachment details.
   2. Apply Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and finish specified.

PART 2 - PRODUCTS

2.1 PANELING FABRICATORS

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of paneling and wood trim .

2.2 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) indicated for construction, finishes, installation, and other requirements.
   1. Provide inspections of fabrication and installation together with labels and certificates from certification program indicating that woodwork complies with requirements of grades specified.

2.3 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING)

A. Grade: Custom .

B. Wood Species and Cut: Clear Maple, Plain Sliced .

C. Veneer Matching Method:
   1. Adjacent Veneer Leaves: Pleasing (Random) match.

D. Panel-Matching Method:
   1. No matching is required between adjacent panels. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
   2. within each separate area.

E. Panel Core Construction: Fire-retardant particleboard or fire-retardant MDF.
   1. Thickness: As indicated on Drawings.

F. Fire-Retardant-Treated Paneling: Panels are to consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels are to have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. Assemble panels by gluing and concealed fastening.

2.4 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

B. Wood Moisture Content: 5 to 10 percent.

C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
   1. MDF: ANSI A208.2, Grade 130 .
   2. Particleboard: ANSI A208.1, Grade M-2 .
   3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.6 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.

C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site.

C. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items.

2.8 SHOP FINISHING

A. General: Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished paneling specified to be field finished. See Section 09 93 00 "Staining and Transparent Finishing" for material and application requirements.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.
   1. Backpriming: Apply two coats of sealer or primer, compatible with finish coats, to concealed surfaces of paneling.

D. Transparent Finish:
   1. Grade: Custom .
   2. Finish: System - 11, catalyzed polyurethane .
   3. Staining: Match approved sample for color .
   4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
   5. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Grade: Install paneling to comply with quality standard grade of paneling to be installed.

C. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
   1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch .

D. Anchor paneling to supporting substrate with blind nailing.

E. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.

F. See Section 09 93 00 "Staining and Transparent Finishing" for final finishing of installed paneling.

END OF SECTION 06 42 16

SECTION 06 61 16 - SOLID SURFACING FABRICATIONS

PART 1 - PART 1 – GENERAL

1.1 SUMMARY

A. Prism™ Solid Surface Sheet

1.2 SECTION INCLUDES

A. Solid Surface sheet wall paneling.

1.3 Related Sections:

A. Section 12 36 61.16 Solid Surfacing Countertops for Countertops and fabrications other than wall panels.

1.4 REFERENCES

A. American National Standards Institute (ANSI)

B. International Cast Polymer Alliance (ICPA)

C. National Fire Protection Association (NFPA)

1.5 SYSTEM DESCRIPTION

A. Provide solid surface sheet that conforms to the following requirements of regulatory agencies and the quality control of Inpro® Corporation.

B. Provide solid surface material that conforms to ANSI/ICPA SS-1 for workmanship and finish, structural integrity and material characteristics.

C. Fungal and Bacterial Resistance: Provide Prism™ Solid Surface that does not support fungal or bacterial growth as tested in accordance with ASTM G-21 and ASTM G-22.

D. Fire Performance Characteristics: Provide Prism™ Solid Surface Sheet conforming with the NFPA class A fire rating as determined by ASTM E-84.

1.6 SUBMITTALS

A. Product Data: Manufacturer’s printed product data for each type of sheet specified.

B. Samples: Color samples a minimum of 1.5" x 3" indicating color and pattern.

C. Manufacturer’s Installation Instructions: Printed installation instructions for each type of sheet specified.

1.7 DELIVERY STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite.

B. Inspect materials at delivery to assure that specified products have been received.

C. Store in original packaging in an interior climate controlled location away from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Products must be installed in an interior climate controlled environment.

1.9 WARRANTY

A. Standard Prism™ Solid Surface Limited 10 Year Warranty against material and manufacturing defects

PART 2 - PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturer: Inpro® Corporation: PO Box 406 Muskego, WI 53150 USA Telephone: 800.222.5556, Fax: 888.715.8407

B. Substitutions: Not permitted

C. Provide all Solid Surface Sheet from a single source.

2.2 MANUFACTURED UNITS

A. Solid Surface Sheet
   1. 1/4" thickness
      a. Sizes, width x length
         1) 48” wide x 84”, 96”, 108”, & 120” lengths
      b. Edge Options:
         1) Eased: At all exposed edges.

2.3 ACCESSORIES

A. Solid Surface Bonding Adhesive

B. Adhesive Cartridge Dispenser

C. Adhesive Mixing Tips

D. Silicone Adhesive/Sealant

E. Pick Resistant Color Coordinated Caulk (Sealant)

2.4 MATERIALS

A. Solid Surface: Prism™ Solid Surface material shall be manufactured from polyester/acrylic blended resins with natural filler material.

2.5 FINISHES

A. Select color from Inpro® Corporation Prism™ Solid Surface color palette.

2.6 FABRICATION

A. Fabricator should be familiar with the cutting, machining, sanding, polishing and seaming of solid surface materials.

B. Produce joints connecting components using manufacturer’s joint adhesive. Joints shall be inconspicuous in appearance.

C. Finish: Finish all surfaces uniformly.

PART 3 - PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which wall cladding will be installed.

3.2 PREPARATION

A. General: Prior to installation, clean area to remove dust, debris and loose particles.

3.3 INSTALLATION

A. General: Install components plumb and level, scribe adjacent finishes, in accordance with approved shop drawings and recommended installation instructions.

3.4 CLEANING

A. At completion of the installation, clean surfaces in accordance with the Inpro ® Decorative Surfaces clean-up and maintenance instructions.

END OF SECTION 06 61 16

PRODUCT MASTERSPEC LICENSED BY DELTEK, INC. TO CRANE COMPOSITES, INC.

SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Plastic sheet wall paneling (FRP).

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Obtain plastic paneling and trim that meets or exceeds the requirements of Factory Mutual, Research Class 4880 for Class 1 fire classification to a maximum height of 30 feet when installed per manufacturer's written instructions for mechanically attached wall panels. .

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. Panels shall be USDA accepted for incidental food contact.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites, Inc.; Fire-X GlassBord Surfaseal FRP series or comparable product by one of the following:
      a. Equal, submitted to and approved by Architect prior to bidding.
   2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   3. FM Approved: Factory Mutual Research Class 4880.
   4. Nominal Thickness: Not less than 0.09 inch .
   5. Wall Panel Size: 4 ft. by 9 ft. .

PRODUCT MASTERSPEC LICENSED BY DELTEK, INC. TO CRANE COMPOSITES, INC.

6. Surface Finish: Embossed pebble texture .
7. Scratch Resistance, ASTM D2583, Barcol Hardness: 30 .
8. Izod Impact Strength, ASTM D 256: , 7.0 ft lbs./in.
9. Color: As indicated on Drawings .

2.3 ACCESSORIES

A. Moldings: PVC pattern-matched to panel .

B. Mechanical Fasteners:
1. Stainless Steel. Others fasteners approved by Factory Mutual may be approved for use.
2. AMIFasteners nylon, pin-drive rivets (16" OC).

C. Adhesive: As recommended by plastic paneling manufacturer.

D. Sealant: Urethane seam sealant recommended by plastic paneling manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Corners: Plumb and straight.
2. Surfaces: Smooth, sound, and uniform.
3. Nails or Screw Fasteners: Countersunk.
4. Joints and Cracks: Filled flush and smooth with adjoining surfaces.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation in accordance with manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels .
1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges in accordance with manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling in accordance with manufacturer's written instructions.
   1. Do all cutting with carbide-tipped saw blades or drill bits, or cut with snips.
   2. Install panels plumb, level, square, flat, and in proper alignment.
   3. Install panels to be water resistant and washable.
   4. Install panels with manufacturer's recommended gap for panel field and corner joints.

B. Install panels in a full spread of adhesive.

C. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

D. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

END OF SECTION 06 64 00

SECTION 07 21 00 - THERMAL INSULATION(6)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Extruded polystyrene foam-plastic board insulation.
2. Mineral-wool blanket insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Extruded polystyrene foam-plastic board insulation.
2. Mineral-wool blanket insulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 75 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

E. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced : ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
   1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
   2. Press units firmly against inside substrates.
   3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
   1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
   2. Install insulation to fit snugly without bowing.

END OF SECTION 07 21 00

SECTION 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.
   1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of modified bituminous sheet air barrier.

B. Product test reports.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.
   1. Build integrated mockups of exterior wall assembly , 150 sq. ft. , incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
      a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
      b. Include junction with roofing membrane , building corner condition, and foundation wall intersection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. , when tested according to ASTM E 2357.

2.2 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing Inc; CCW-705
      b. GCP Applied Technologies Inc.; Perm-A-Barrier High Temperature Wall Membrane
      c. Henry Company; Blueskin SA
      d. Polyguard Products, Inc.; Polyguard 400 Sheet Air Barrier
      e. Soprema, Inc.; Sopraseal Stick 1100T.
      f. Tremco Incorporated; ExoAir 110/110LT
      g. W.R. Meadows, Inc; Air-Shield
   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Tensile Strength: Minimum 250 psi ; ASTM D 412, Die C.
      c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
      d. Puncture Resistance: Minimum 40 lbf ; ASTM E 154/E 154M.
      e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D 570.
      f. Vapor Permeance: Maximum 0.1 perm) ; ASTM E 96/E 96M, Desiccant Method.
      g. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541 as modified by ABAA.
      h. UV Resistance: Can be exposed to sunlight for 60 days according to manufacturer's written instructions.

2.3 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other

accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. HIGH PERFORMANCE SILL SEALER
1. 3/8" closed cell foam with three adhesive membrane areas for sealing off the cold joint between the foundation and construction framing and providing a transition seal between the under-slab vapor barrier and the the sheet air barrier applied to exterior walls.
a. Basis of Design: Protecto Wrap Triple Guard Energy Sill Sealer
2. Locations: Provide at all exterior wall locations.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.2 INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D 6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.
1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.
2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
   1. Apply sheets in a shingled manner to shed water.
   2. Roll sheets firmly to enhance adhesion to substrate.

D. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

E. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

G. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

H. Do not cover air barrier until it has been tested and inspected by testing agency.

I. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests: As determined by testing agency from among the following tests:
   1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers .

C. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

E. Prepare test and inspection reports.

3.4 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

END OF SECTION 07 27 13

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - PART 1 - GENERAL

1.1 1.1 SUMMARY

A. A. Section Includes:
1. 1. Wall panel assembly consisting of:
a. Metal Composite Material (MCM)
b. Installation System
c. Accessories
2. The extent of the wall panel assembly as indicated in these specifications and in the drawings.

1.2 DEFINITIONS

A. Metal Composite Material (MCM):
1. A factory manufactured panel consisting of metal skins bonded to a plastic core, as defined by the International Building Code (IBC) Section 1402.,

1.3 SYSTEM DESCRIPTION

A. A. Design Requirements:
1. 1. Barrier System:
a. Wall panel assembly shall be designed in accordance with manufacturer's guidelines to be sealed at all panel joints, intersections, dissimilar material abutments, and cutouts, thus providing a weathertight barrier system.
2. Expansion And Contraction:
a. Wall panel assembly shall be designed with provisions for thermal expansion and contraction of the component parts to prevent buckling, failure of joint seals, undue stress on fasteners or other detrimental effects due to accumulation of dead loads and various live loads.
3. Windload:
a. Meet the requirements of the latest adopted Local Building Code.

B. General Performance:
1. Wall panel assembly shall comply with performance requirements, as determined by the following testing performed by a qualified agency.

1.4 SUBMITTALS

A. Product Data:
1. Submit manufacturer's datasheet for specified product.
2. Submit manufacturer's installation guidelines for specified product.

B. Shop Drawings:

C. Submit shop drawings indicating project layout and elevations, fastening and anchoring methods, dimensions of individual components and profiles, detail and location of joints, sealants and gaskets, flashing and accessories.

D. Samples:
1. Submit two (2) samples 3" x 5" of each product specified.
2. Submit two (2) samples 3" x 5" of each finish specified.

E. Warranty:
1. Submit manufacturer's warranty meeting the requirements of this section.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer:
a. Manufacturer shall have a minimum of ten (10) years experience in the manufacture of this product, shall be an ISO 9001:2008 Registered Company, and shall be located within the United States of America.
2. Installer:
a. Installer shall be experienced in performing work of this section and in Company, and shall be located within the United States of America.

1.6 PROJECT CONDITIONS

A. Field Measurements:

B. Verify location and dimension of all elements related to the installation of the wall panel assembly. Indicate those measurements on the shop drawings.

C. Limitations:
1. Proceed with installation of the wall panel assembly only when existing site conditions comply with manufacturer's recommendations.

1.7 WARRANTY

A. A. Metal Composite Material (MCM):
1. 1. Panel:
a. The integrity of the panel bond will remain intact for a minimum of five (5) years from the Date Of Substantial Completion.
2. 2. Finish:
a. a. Polyvinylidene Fluoride (PVDF):
1) The finish will not have a Fade Differential of greater than 5E units.
a) Testing shall be in accordance with ASTM D2244.
2) The finish will not have a Chalk Rating of less than 8.
a) Testing shall be in accordance with ASTM D4214.
3) The finish will not check, peel, lose adhesion or fracture (other than minute fractures which may develop due to fabrication and which are acceptable by industry standards on the Date Of Substantial Completion).

4) Warranty period shall be thirty (30) years from the Date Of Substantial Completion.

b. Anodized:

1) 1) The finish will not check, peel, lose adhesion or fracture (other than minute fractures which may develop due to fabrication and which are acceptable by industry standards on the Date Of Substantial Completion).

2) Warranty period shall be twenty (20) years from the Date Of Substantial Completion.

B. Installation System:

1. Fabricator and/or installer standard form in which they agree to repair or replace
2. components of metal-faced composite wall panel assemblies that fail in materials or
3. workmanship within specified warranty period.
4. 2. Weathertight warranties or other such guarantees regarding installation shall be the
5. responsibility of the installing contractor.

C. Warranties or other such guarantees regarding accessories used during installation shall be the responsibility of the installing contractor.

PART 2 - PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. Citadel Architectural Products, Inc.; 3131-A North Franklin Road; Indianapolis, IN 46226 ph: (800) 446-8828; fax: (800) 247-2635; www.citadelap.com; info@citadelap.com

2.2 WALL PANEL ASSEMBLY

A. A. Metal Composite Material (MCM):

1. 1. Panel:
2. Envelope 2000® as manufactured by Citadel Architectural Products, Inc.
   a. Composition:
      1) Face: .024" (min) prefinished smooth aluminum
      2) Core: .105" thermoset phenolic resin
      3) Back: .010" primed smooth aluminum
   b. Thickness: 4mm (nominal)
   c. Weight: 1.25 lbs/ft²
   d. Tolerance:
      1) Thickness: ±1/32"
      2) Length / Width: +0, -1/8"
      3) Squareness: 1/64" per lineal ft
   e. Performance:
      1) Surface Burning Characteristics:
         a) Panel shall have a Class A rating with a Flame Spread Index
         b) less than 25, and a Smoke Developed Index less than 450.
         c) Testing shall be in accordance with ASTM E84.

2) Bond Integrity:
   a) Panel shall have a minimum peel strength of 34.5 lb-in/lb.
   b) Testing shall be in accordance with ASTM D1781.
3) Ignition Temperature:
   a) Panel shall have a minimum self-ignition temperature of 900° F.
   b) Testing shall be in accordance with ASTM D1929.
4) Impact Resistance:
   a) Panel shall not have a deformation measuring larger than 0.186" in
   b) diameter or 0.007" in depth after being struck by a falling ball at 24 in-lb.
   c) Testing shall be in accordance with ASTM D5420.
5) Rate Of Burning:
   a) Panel shall have a CC1 Classification indicating a burning extent
   b) of 1" (25.4mm) or less when tested at a nominal thickness of
   c) .060" (1.5mm) or thickness of intended use.
   d) Testing shall be in accordance with ASTM D635.
6) Tensile Strength:
   a) Panel shall have a mean value of 1650 lbs.
   b) Testing shall be in accordance with ASTM C297.
7) Finish:
   a) Polyvinylidene Fluoride (PVDF):
8) Type:
   a) Kynar 500® coating using 70% resin.
      (1) Finish shall be in conformance with AAMA 2605.
9) Color:
   a) As selected by Architect from manufacturer's color guide.
      (1) Custom color to match Architect's standard.
10) Composition:
   a) Two-Coat Colors:
   b) 0.2-mil primer coat, 0.8-mil color coat

B. Installation System:
1. Reveal (RV) System:
   a. Description: Field-assembled installation system consisting of metal composite material (MCM), trim moldings, silicone sealant, and accessories to provide a barrier system.
   b. Performance:
      1) Air Infiltration:
         a) Installation system shall not allow air infiltration in excess of 0.06 cfm/ft² at 1.57 psf.
         b) Testing shall be in accordance with ASTM E283.
      2) Structural Performance:
         a) Installation system shall have a design load of 35.0 psf applied in the positive and negative direction. There shall be no deflection in excess of L/175 of the span of any support member nor shall there be any failure of the system. At a structural test load equal to 1.5 times the specified design load, no support member shall have permanent

deformation in excess of 1/1000 of its span nor shall there be any failure of the system.

b) Testing shall be in accordance with ASTM E330.

3) 3) Water Penetration:

a) Installation system shall not have uncontrolled water penetration to the room side at a static air pressure differential of 15.0 psf.

b) Testing shall be in accordance with ASTM E331.

C. C. Accessories:

1. 1. Extrusions:
   a. Shall conform with ASTM B211 and the manufacturer's recommendations.
   b. Shall be applied in accordance with the panel manufacturer's installation guidelines
2. Sealants:
   a. Selected from the panel manufacturer's approved list of sealants.
   b. Shall be applied in accordance with both the panel manufacturer's installation guidelines and the sealant manufacturer's recommendations.
3. 3. Fasteners:
   a. Selected by contractor to suit project requirements.
   b. Shall be applied using the recommended fastener schedule in accordance with panel manufacturer's installation guidelines.
   c. Shall be coated to prevent corrosion and/or reaction with other materials.
   d. Shall be concealed except where unavoidable. Exposed fasteners shall be finished to match adjoining metal.
4. Flashing:
   a. Selected by contractor to suit project requirements.
   b. Shall be installed in such a manner to maintain the integrity of the wall system against moisture intrusion.

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate to receive the work of this section to verify that the conditions are acceptable for installation.

B.

1. Substrate to receive panels shall be even, smooth, sound, clean, dry, and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work.
2. Substrate to receive panels shall be in vertical and horizontal alignment with no more deviation than 1/4" in 20'.

C. Proceed with installation only after all unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Verify dimensions as required.

B. Protect adjacent work areas and finished surfaces to prevent damage.

C. might occur during the work of this section.

3.3 INSTALLATION

A. Wall panel assembly shall be installed in accordance with the manufacturer's written installation guidelines and the approved set of shop drawings.

B. Erect wall panel assembly level and true to the intended plane.

C. Maximum deviation from vertical and horizontal alignment of erected wall panel assembly shall be no more than 1/4" in 20'-0".

D. Maximum deviation in panel flatness shall be 0.6% of the assembled units.

E. Seal all joints as required using methods and materials as recommended by the panel manufacturer

3.4 CLEANING

A. Remove panel masking immediately after installation. Delay will result in difficulty with removal and possibly residue on the panel surface.

B. Remove temporary coverings and protection to adjacent work areas.

C. Remove and legally dispose of construction debris from project site.

END OF SECTION 07 42 13.23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manufactured reglets [**with counterflashing**].
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following
1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Sustainable Design Submittals:
1. <Click to insert sustainable design text for recycled content.>

C. Shop Drawings: For sheet metal flashing and trim.
1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

D. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is [**ANSI/SPRI/FM 4435/ES-1 tested**] [**and**] [**FM Approvals approved**].

B. Evaluation Reports: For copings and roof edge flashing, from [**an agency acceptable to authority having jurisdiction**] [**ICC-ES**] <**Insert evaluation agency>** showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Special warranty.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested [**and FM Approvals approved**], shop is to be listed as able to fabricate required details as tested and approved.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: [**20**] [**10**] <**Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to

weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with [**NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing"**] [**and**] [**SMACNA's "Architectural Sheet Metal Manual"**] requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. SPRI Wind Design Standard: Manufacture and install [**copings**] [**roof edge flashings**] tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: [**As indicated on Drawings**] <**Insert design pressure>**.

E. FM Approvals Listing: Manufacture and install [**copings**] [**roof edge flashings**] that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, [**Class 1-60**] [**Class 1-75**] [**Class 1-90**] [**Class 1-105**] [**Class 1-120**] <**Insert class>**. Identify materials with name of fabricator and design approved by FM Approvals.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: [**120 deg F , ambient; 180 deg F , material surfaces**] <**Insert temperature change>**.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
   1. <Click here to find, evaluate, and insert list of manufacturers and products.>
   2. Nonpatinated, Exposed Finish: Mill.
   3. Prepatinated Copper-Sheet Finish: [**Dark brown**] [**Verdigris**] <**Insert color>**, prepatinated in accordance with ASTM B882.

C. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with [**smooth, flat**] [**embossed**] surface.
   1. <Click to insert sustainable design text for recycled content.>
   2. As-Milled Finish: [**Mill**] [**One-side bright mill**] [**Standard one-side bright**] [**Standard two-side bright**].

3. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
4. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
5. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
6. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
    a. Color: [**Champagne**] [**Light bronze**] [**Medium bronze**] [**Dark bronze**] [**Black**] [**Match Architect's sample**] [**As selected by Architect from full range of industry colors and color densities**] <**Insert color>**.
    b. Color Range: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
7. Exposed Coil-Coated Finish:
    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
    b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
    c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
8. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] <**Insert color>**.
9. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

D. Stainless Steel Sheet: ASTM A240/A240M, [**Type 304**] [**Type 316**], dead soft, fully annealed; with [**smooth, flat**] [**embossed**] surface.
    1. <Click to insert sustainable design text for recycled content.>
    2. Finish: [**ASTM A480/A480M, No. 2D (dull, cold rolled)**] [**ASTM A480/A480M, No. 2B (bright, cold rolled)**] [**ASTM A480/A480M, No. 3 (coarse, polished directional satin)**] [**ASTM A480/A480M, No. 4 (polished directional satin)**] <**Insert finish>**.

E. Metallic-Coated Steel Sheet: Provide [**zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation**] [**or**] [**aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40**]; prepainted by coil-coating process to comply with ASTM A755/A755M.
    1. <Click to insert sustainable design text for recycled content.>

2. Surface: [**Smooth, flat**] [**Embossed**] [**and mill phosphatized for field painting**] [**and with manufacturer's standard clear acrylic coating on both sides**].
3. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
   b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
   c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
4. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] <**Insert color>**.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

F. Lead Sheet: ASTM B749 lead sheet.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D226**/**D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
   1. <Click here to find, evaluate, and insert list of manufacturers and products.>

C. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
   1. <Click here to find, evaluate, and insert list of manufacturers and products.>
   2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners [**, solder**], protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal [**or manufactured item**] unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal [**or manufactured item**].
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
   3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
   5. Fasteners for [**Zinc-Coated (Galvanized)**] [**Aluminum-Zinc Alloy-Coated**] Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

C. Solder:
   1. For Copper: ASTM B32, [**Grade Sn50, 50 percent tin and 50 percent lead**] [**with maximum lead content of 0.2 percent**].
   2. For Stainless Steel: ASTM B32, [**Grade Sn60**] [**Grade Sn96**], with acid flux of type recommended by stainless steel sheet manufacturer.
   3. For Zinc-Coated (Galvanized) Steel: ASTM B32, [**Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead**] [**with maximum lead content of 0.2 percent**].

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric [**polyurethane**] [**polysulfide**] [**silicone**] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated [**with factory-mitered and -welded corners and junctions**] [**and**] [**with interlocking counterflashing on exterior face, of same metal as reglet**].
   1. <Click here to find, evaluate, and insert list of manufacturers and products.>
   2. Material: [**Stainless steel, 0.0188 inch thick**] [**Copper, 16 oz./sq. ft.**] [**Aluminum, 0.024 inch thick**] [**Galvanized steel, 0.022 inch thick**].
   3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
   5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
   6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
   7. Accessories:
      a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
      b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
   8. Finish: [**Mill**] [**With manufacturer's standard color coating**] <**Insert finish>**.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
   1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
   4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard [**and by FM Global Property Loss Prevention Data Sheet 1-49**] for application, but not less than thickness of metal being secured.

G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. [**Rivet joints where necessary for strength.**]
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. [**Rivet joints where necessary for strength.**]

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:
1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- long sections.
3. Furnish flat-stock gutter brackets and [**flat-stock**] [**twisted**] gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than [**twice the gutter thickness**] [**dimension indicated on Drawings**] <**Insert dimension>**.

4. Fabricate expansion joints, expansion-joint covers, [**gutter bead reinforcing bars,**] and gutter accessories from same metal as gutters. [**Shop fabricate interior and exterior corners.**]
5. Accessories: [**Continuous, removable leaf screen with sheet metal frame and hardware cloth screen**] [**Wire-ball downspout strainer**] [**Valley baffles**].
6. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
   a. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   b. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   c. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
   d. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
   e. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.
7. Gutters with Girth 16 to 20 Inches: Fabricate from the following materials:
   a. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   b. Aluminum: [**0.040 inch**] <**Insert dimension>** thick.
   c. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   d. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   e. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.
8. Gutters with Girth 21 to 25 Inches: Fabricate from the following materials:
   a. Copper: [**20 oz./sq. ft.**] <**Insert value>**.
   b. Aluminum: [**0.050 inch**] <**Insert dimension>** thick.
   c. Stainless Steel: [**0.0250 inch**] <**Insert dimension>** thick.
   d. Galvanized Steel: [**0.034 inch**] <**Insert dimension>** thick.
   e. Aluminum-Zinc Alloy-Coated Steel: [**0.034 inch**] <**Insert dimension>** thick.
9. Gutters with Girth 26 to 30 Inches: Fabricate from the following materials:
   a. Copper: [**24 oz./sq. ft.**] <**Insert value>**.
   b. Aluminum: [**0.063 inch**] <**Insert dimension>** thick.
   c. Stainless Steel: [**0.0313 inch**] <**Insert dimension>** thick.
   d. Galvanized Steel: [**0.040 inch**] <**Insert dimension>** thick.
   e. Aluminum-Zinc Alloy-Coated Steel: [**0.040 inch**] <**Insert dimension>** thick.
10. Gutters with Girth 31 to 35 Inches: Fabricate from the following materials:
    a. Copper: [**24 oz./sq. ft.**] <**Insert value>**.
    b. Stainless Steel: [**0.0375 inch**] <**Insert dimension>** thick.
    c. Galvanized Steel: [**0.052 inch**] <**Insert dimension>** thick.
    d. Aluminum-Zinc Alloy-Coated Steel: [**0.052 inch**] <**Insert dimension>** thick.

B. Built-in Gutters:
1. Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
2. Fabricate in minimum 96-inch- long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
3. Fabricate gutters with built-in expansion joints [**and gutter-end expansion joints at walls**].
4. Accessories: [**Continuous, removable leaf screen with sheet metal frame and hardware cloth screen**] [**Bronze wire-ball downspout strainer**] [**Wire-ball downspout strainer**].
5. Fabricate from the following materials:
   a. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   b. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.

C. Downspouts: Fabricate [**round**] [**rectangular**] [**open-face**] downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from [**same material as downspouts and anchors**] <**Insert material>** . [**Shop fabricate elbows.**]
   1. Hanger Style: <**Insert description>**.
   2. Fabricate from the following materials:
      a. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
      b. Aluminum: [**0.024 inch**] <**Insert dimension>** thick.
      c. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
      d. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
      e. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.

D. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. [**Fasten gravel guard angles to base of scupper.**] Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.

E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes [**, exterior flange trim,**] [**and**] [**built-in overflows**]. Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.

F. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.040 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) [**and Fascia Cap**]: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. [**Shop fabricate interior and exterior corners.**]
   1. Fabricate from the following materials:
      a. Copper: [**20 oz./sq. ft.**] <**Insert value>**.
      b. Aluminum: [**0.050 inch**] <**Insert dimension>** thick.
      c. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
      d. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
      e. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.

B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and [**drill elongated holes for fasteners on**] interior leg. Miter corners, [**fasten and seal**] [**solder or weld**] watertight. [**Shop fabricate interior and exterior corners.**]
   1. Fabricate from the following materials:
      a. Copper: [**24 oz./sq. ft.**] <**Insert value>**.
      b. Aluminum: [**0.050 inch**] <**Insert dimension>** thick.
      c. Stainless Steel: [**0.0250 inch**] <**Insert dimension>** thick.
      d. Galvanized Steel: [**0.040 inch**] <**Insert dimension>** thick.
      e. Aluminum-Zinc Alloy-Coated Steel: [**0.040 inch**] <**Insert dimension>** thick.

C. Base Flashing: [**Shop fabricate interior and exterior corners.**]Fabricate from the following materials:
   1. Copper: [**20 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.040 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.

D. Counterflashing: [**Shop fabricate interior and exterior corners.**]Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   3. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   4. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.
   5. Lead: [**4 lb**] <**Insert weight>**.

F. Roof-Drain Flashing: Fabricate from the following materials:
   1. Copper: [**12 oz./sq. ft.**] <**Insert value>**.
   2. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.

B. Valley Flashing: Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   3. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   4. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.

C. Drip Edges: Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.

D. Eave, Rake [**, Ridge, and Hip**] Flashing: Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, [**jamb,**] and similar flashings to extend [**4 inches**] <**Insert dimension>** beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.032 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0156 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.022 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.022 inch**] <**Insert dimension>** thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:
   1. Copper: [**16 oz./sq. ft.**] <**Insert value>**.
   2. Aluminum: [**0.040 inch**] <**Insert dimension>** thick.
   3. Stainless Steel: [**0.0188 inch**] <**Insert dimension>** thick.
   4. Galvanized Steel: [**0.028 inch**] <**Insert dimension>** thick.
   5. Aluminum-Zinc Alloy-Coated Steel: [**0.028 inch**] <**Insert dimension>** thick.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
   1. Install in shingle fashion to shed water.
   2. Lap joints not less than 2 inches.

B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
   1. Lap horizontal joints not less than 4 inches.
   2. Lap end joints not less than 12 inches.

C. Self-Adhering, High-Temperature Sheet Underlayment:
   1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   2. Prime substrate if recommended by underlayment manufacturer.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
   5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
   6. Roll laps and edges with roller.
   7. Cover underlayment within 14 days.

D. Install slip sheet, wrinkle free, [**over underlayment**] [**directly on substrate**] <**Insert requirement>** before installing sheet metal flashing and trim.
   1. Install in shingle fashion to shed water.
   2. Lapp joints not less than 4 inches.

3.2 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners [**, solder**], protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of [**solder**] [**welds**] [**sealant**].
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
   6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of [**uncoated-aluminum**] [**and**] [**stainless steel**] sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of [**10 feet**] <**Insert dimension>** with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate [**wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws**] [**substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance**] <**Insert size requirement>**.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    d. Adjust setting proportionately for installation at higher ambient temperatures.
        1) Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder [**metallic-coated steel**] [**and**] [**aluminum**] sheet.
3. Do not pretin zinc-tin alloy-coated copper.
4. Do not use torches for soldering.

5. Heat surfaces to receive solder, and flow solder into joint.
   a. Fill joint completely.
   b. Completely remove flux and spatter from exposed surfaces.
6. Stainless Steel Soldering:
   a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
   b. Promptly remove acid-flux residue from metal after tinning and soldering.
   c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.

H. Rivets: Rivet joints in [**uncoated aluminum**] [**zinc**] where necessary for strength.

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:
1. Join sections with [**riveted and soldered joints**] [**or**] [**joints sealed with sealant**].
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, [**50 feet**] <**Insert dimension>** apart. Install expansion-joint caps.
7. Install continuous gutter screens on gutters with noncorrosive fasteners, [**removable**] [**hinged to swing open**] for cleaning gutters.

C. Built-in Gutters:
1. Join sections with [**riveted and soldered joints**] [**or**] [**joints sealed with sealant**].
2. Provide for thermal expansion.
3. Slope to downspouts.
4. Provide end closures and seal watertight with sealant.
5. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
   a. Lap sides minimum of 2 inches over underlying course.
   b. Lap ends minimum of 4 inches.
   c. Stagger end laps between succeeding courses at least 72 inches.
   d. Fasten with roofing nails.
   e. Install slip sheet over underlayment.
6. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, [**50 feet**] <**Insert dimension>** apart. Install expansion-joint caps.

D. Downspouts:
1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.

3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

E. Splash Pans:
1. Install where downspouts discharge on [**low-slope roofs**] <**Insert surface>**.
2. Set in [**asphalt roofing cement**] [**or**] [**elastomeric sealant**] compatible with the substrate.

F. Parapet Scuppers:
1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and [**solder**] [**or**] [**seal with elastomeric sealant**] to scupper.
3. Loosely lock front edge of scupper with conductor head.
4. [**Solder**] [**or**] [**seal with elastomeric sealant**] exterior wall scupper flanges into back of conductor head.

G. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below [**scupper**] [**or**] [**gutter**] discharge.

H. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements [**, sheet metal manufacturer's written installation instructions,**] and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at [**staggered 3-inch**] <**Insert spacing>** centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at [**24-inch**] [**16-inch**] <**Insert dimension>** centers.
b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at [**24-inch**] <**Insert dimension>** centers.

3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with [**elastomeric**] [**butyl**] sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, [**jamb,**] and similar flashings to extend [**4 inches**] <**Insert dimension>** beyond wall openings.

C. Reglets: Installation of reglets is specified in [**Section 03 30 00 "Cast-in-Place Concrete."**] [**Section 04 20 00 "Unit Masonry."**] [**Section <Insert Section number> "<Insert Section title> ."**]

3.6 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof-edge drainage systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For tests performed by a qualified testing agency.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 WARRANTY

A. Roofing-System Warranty: 20 years "

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90 . Identify materials with FM Approvals' markings.

2.2 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

D. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
   1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
   2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
   3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
   4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
   5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329.

B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

2.4 FINISHES

A. Coil-Coated Aluminum Sheet Finishes:
   1. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
   1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   2. Provide uniform, neat seams with minimum exposure of solder and sealant.
   3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
   4. Torch cutting of roof specialties is not permitted.
   5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum and stainless steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws .

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.2 INSTALLATION OF ROOF-EDGE SPECIALITIES

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.3 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
1. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 07 71 00

SECTION 07 81 00 - APPLIED FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sprayed fire-resistive materials.

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .
1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data:
1. Sprayed fire-resistive materials.
2. Substrate primers.
3. Bonding agent.
4. Metal lath.
5. Reinforcing fabric.
6. Reinforcing mesh.
7. Sealer.
8. Topcoat.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
1. Extent of fire protection for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of sprayed fire-resistive material after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of sprayed fire-resistive material.

C. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.

D. Preconstruction Test Reports: For fire protection.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
   1. Build mockup of each type of fire protection and different substrate and each required finish as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups of fire protection.
   1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
   1. Bond Strength: Test for cohesive and adhesive strength in accordance with ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   2. Density: Test for density in accordance with ASTM E605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, obtain sprayed fire-resistive material manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fire protection for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263 ; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Isolatek International; Cafco 300 or 400 or comparable product by one of the following:
      a. Carboline Company; a subsidiary of RPM International.
      b. GCP Applied Technologies Inc.
      c. Isolatek International.
   2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
   3. Bond Strength: Minimum 430-lbf/sq. ft. cohesive and adhesive strength based on field testing in accordance with ASTM E736.
   4. Density: Not less than density specified in the approved fire-resistance design, in accordance with ASTM E605.
   5. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch.
   6. Combustion Characteristics: ASTM E136.
   7. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 10 or less.
      b. Smoke-Developed Index: 10 or less.
   8. Compressive Strength: Minimum 10 lbf/sq. in. in accordance with ASTM E761.
   9. Corrosion Resistance: No evidence of corrosion in accordance with ASTM E937.

10. Deflection: No cracking, spalling, or delamination in accordance with ASTM E759.
11. Effect of Impact on Bonding: No cracking, spalling, or delamination in accordance with ASTM E760.
12. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours in accordance with ASTM E859.
13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in rating of 10 in accordance with ASTM D3274 when tested in accordance with ASTM D3273.
14. Finish: As selected by Architect from manufacturer's standard finishes . Apply separate, colored topcoat after finishing.
    a. Color: As selected by Architect from manufacturer's full range .

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:
1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E736.

C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, in accordance with fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Isolatek International.

H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
   1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.
      a. Manufacturers: Subject to compliance with requirements, provide products by the following:
         1) Isolatek International.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Verify that concrete work on steel deck is complete before beginning Work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.

D. Conduct tests in accordance with sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.

B. Clean substrates of substances that could impair bond of fire protection.

C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
   1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Metal Decks:
   1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
   2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.

E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.

F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Extend fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

L. Cure fire protection in accordance with sprayed fire-resistive material manufacturer's written instructions.

M. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fire protection to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish in accordance with manufacturer's written instructions for each finish selected.

3.4 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.5 PROTECTION

A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.6 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

B. Repair fire protection damaged by other work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Penetrations in floor-ceiling assemblies.
   2. Penetrations in roof-ceiling assemblies.
   3. Penetrations in walls and partitions.

B. Related Sections:
   1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

C. REFERENCES
   1. Underwriters Laboratories (UL) of Northbrook, IL “Fire Resistance Directory”.
      a. Through Penetration Firestop Systems (XHEZ)
      b. Fill, Void or Cavity Materials (XHHW)
      c. Firestop Devices (XHJI)
      d. Forming Materials (XHKU)
      e. Wall Opening Protective Materials (CLIV)
      f. Fire-Resistant Pipe-Protection Systems (HNKJ)
   2. All major building codes:
      a. International Building Code published by ICC.
   3. National Fire Protection Association (NFPA) “NFPA 101: Life Safety Code”.
   4. National Fire Protection Association (NFPA) “NFPA 70: National Electrical Code”.
   5. Factory Mutual Approvals (FM) “FM 4991: Standard for Approval of Firestop Contractors”.
   6. Underwriters Laboratories (UL) “UL Qualified Firestop Contractor Program”

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

C. System Drawings: Submit documentation from a qualified third-party testing agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

D. Product Certificates: Certificate of conformance signed by manufacturers of through-penetration firestop system products certifying that products comply with requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Provide through-penetration firestop systems that comply with the following requirements and those specified in “Performance Criteria” Article.
1. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop system products bear classification marking of qualified testing and inspection agency.

B. Engage an experienced installer who is certified, licensed, FM Approved in accordance with FM 4991, Certified by UL as a Qualified Contractor, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products per specified requirements. A manufacturer’s willingness to sell its firestopping products to Contractor or to an installer engaged by Contractor does not in itself confer qualifications on buyer.

C. Obtain firestop systems for each type of penetration or joint opening and construction condition indicated from a single manufacturer.

D. Conduct conference at Project site to comply with requirements in Division 01.

1.8 DELIVERY, STORAGE HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes.

1.9 PROJECT CONDITIONS

A. Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limitations recommended by manufacturer.

B. Do not install through-penetration firestop systems when substrates are wet due to rain, frost, condensation, or other causes.

C. Do not use materials that contain flammable solvents.

1.10 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration firestop systems.

C. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. PERFORMANCE REQUIREMENTS
1. Fire Test Requirements:

a. Underwriters Laboratories, Inc. (UL):
   1) UL 1479, “Fire Tests of Through Penetration Firestops”.
   2) UL 263, “Fire Tests of Building Construction and Materials”.
   3) UL 723, “Surface Burning Characteristics of Building Materials”.
   4) UL 1489. “Standard for Fire Tests of Fire Resistance Pipe Protection Systems Carrying Combustible Liquids”.
b. American Society of Testing and Materials ():
   1) ASTM E814, “Fire Tests of Penetration Fire Stops”.
   2) ASTM E119, “Fire Tests of Building Construction and Materials”.
   3) ASTM E84, “Surface Burning Characteristics of Building Materials”.
   4) ASTM E2174, “Standard Practice for On Site Inspection of Installed Fire Stops”.
   5) ASTM E1725, “Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components”.

2. Provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
3. When intumescent products are used, provide products that do not contain sodium silicate or any other water soluble intumescent ingredient in the formulation.
4. Provide firestop products that do not contain ethylene glycol.
5. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
6. Removal, cut-aways, or otherwise interrupted through wall or floor opening of pipe insulation in prohibited. Provide products appropriately tested for the thickness and type of insulation utilized.
7. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur. Such devices shall include:
   a. Capable of retrofit around existing cables
   b. Designed such that two or more devices can be ganged together
   c. Maintenance free such that no action is required to activate the smoke and fire sealing mechanism
8. When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.
9. Provide through-penetration firestop systems subjected to an air leakage test conducted in accordance with the Standards, UL 1479 for penetration firestop systems, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.
10. Provide a fire-rated grommet for all individual or small grouped cable applications up to 0.53 inch (14 mm).
11. Provide moisture-curing products where inclement weather or greater than transient water exposure is expected.

2.2 MANUFACTURERS

A. Subject to compliance with through-penetration firestop systems (XHEZ) and wall opening protective materials (CLIV) listed in Volume 2 of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
   1. Acceptable Manufacturer: Specified Technologies Inc., 210 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.comspecseal@stifirestop.com, Website: www.stifirestop.comwww.stifirestop.com.
   2. Substitutions: Not permitted.

B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.3 MATERIALS

A. General: Use only firestopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type or joint opening width and movement capabilities, annular space requirements, and fire-rating involved for each separate instance.

B. Intumescent Sealants: Single component intumescent latex formulations containing no water soluble intumescent ingredients capable of expanding a minimum 8 times. When installed in contact with CPVC piping systems, intumescent sealants shall be deemed compatible as determined by the respective CPVC manufacturer. The following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant
   2. Specified Technologies, Inc. (STI) SpecSeal Series LCI Intumescent Sealant

C. Endothermic Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series LC Endothermic Sealant

D. Firestop Devices: Factory-assembled steel collars lined with intumescent material capable of expanding a minimum 30 times sized to fit specific outside diameter of penetrating item, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSC Firestop Collars
   2. Specified Technologies, Inc. (STI) SpecSeal Series LCC Firestop Collars

E. Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings. Device’s must be maintenance free having a corresponding Evaluation Services Report from a Nationally Recognized Third Party Laboratory. Maintenance free is defined as requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings. The following products are acceptable:
   1. Specified Technologies Inc. (STI) EZ-Path Fire Rated Pathway

F. Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24 inches (610 mm), the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty Pads
   2. Specified Technologies, Inc. (STI) SpecSeal Series EP PowerShield Insert Pads

G. Firestop Putty: Intumescent, 100% solids, non-hardening, water resistant, butyl rubber-based putties containing no solvents or silicone compounds, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty

H. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film and capable of expanding a minimum 30 times, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series RED2 Wrap Strip
   2. Specified Technologies, Inc. (STI) SpecSeal Series BLU2 Wrap Strip

I. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame-retardant poly bag. Pillows shall require no modification such as cutting or shaving in order to maintain fire and leakage ratings. The following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSB Firestop Pillows

J. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSM Firestop Mortar

K. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag). Sealant shall be suitable for use in interior and exterior joint conditions. The following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal SIL300 Silicone Firestop Sealant
   2. Specified Technologies, Inc. (STI) SpecSeal SIL300 SL Self-Leveling Silicone Firestop Sealant’

L. Silicone Foam: Multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) Pensil 200 Silicone Foam

M. Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil capable of sustaining a minimum 2,500 lbs (1,134 kg) when subjected to load testing, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal CS Composite Sheet

N. Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket. Device shall allow for a concrete floor thickness of minimum 2-1/2

inches up to 36 inches without the use of field applied extension tubing.The following products are acceptable:

1. Specified Technologies, Inc. (STI) SpecSeal CID Cast-In Firestop Device

O. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts, the following products are acceptable:

1. Specified Technologies, Inc. (STI) SpecSeal FyreFlange Firestop Angles

P. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times with expansion beginning at 350°F (177°C) for use in blank openings, with bare metallic pipe, bare non-metallic pipe, and cable sleeves. The following products are acceptable:

1. Specified Technologies, Inc. (STI) SpecSeal Series FP Firestop Plug

Q. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing cable penetrations up to 0.53 in. (14 mm) diameter. Grommet shall be tested in single membrane or through-penetration conditions. The following products are acceptable:

1. Specified Technologies, Inc. (STI) EZ-Firestop Grommet (RFG1 or RFG2)

R. Protective Wrap: Endothermic Wrap incorporating foil scrim evaluated for protection of cable pathways, liquid fuel lines, as well as in through-penetration and membrane-penetration firestopping. Testing to incorporate protection of Electrical Metallic Tubing (EMT), Rigid Metallic Conduit (RMC), Cable Trays, single and/or multi containment liquid fuel lines. Wrap to have a maximum weight of no greater than 1.4 lbs/ft^2 and allow for the use of steel tie wire when installed around piping, conduits, and/or cable trays. The following products are acceptable:

1. Specified Technologies, Inc. (STI) E-Wrap™ Endothermic Wrap

PART 3 - EXECUTION

3.1 PREPARATION

A. Examination of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.

C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General Requirements: Install through-penetration firestop systems in accordance with “Performance Criteria” Article and in accordance with the conditions of testing and classification as specified in the published design.

B. Manufacturer’s Instructions: Comply with manufacturer’s instructions for installation of through-penetration firestop systems products.
   1. Seal all openings or voids made by penetrations to ensure an air and water-resistant seal.
   2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
   3. Protect materials from damage on surfaces subjected to traffic.

3.3 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.4 FIELD QUALITY CONTROL

A. Inspections: Owner shall engage a qualified independent inspection agency to inspect through-penetration firestop systems in accordance with ASTM E2174, “Standard Practice for On Site Inspection of Installed Fire Stops”.

B. Keep areas of work accessible until inspection by authorities having jurisdiction.

C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

D. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 ADJUSTING CLEANING

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Joints in or between fire-resistance-rated construction.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Requirements:
1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 07 95 13.13 "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
3. Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
4. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data:
1. Joints in or between fire-resistance-rated construction.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
         1) UL in its online directory "Product iQ."

2) Intertek Group in its "Directory of Building Products."
3) .

B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

2.3 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

B. Intumescent Gypsum Wall Framing Gaskets (Applied to Steel Tracks, Runners, and Studs prior to Framing Installation): Provide products with fire, smoke, and acoustical ratings that allow movement up to 100 percent compression and/or extension in accordance with UL 2079 or ASTM E1966; have an L Rating less than 1 cfm/ft. in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 in accordance with ASTM E90 or ASTM C919.

C. For aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least 2-1/2 by 5 inches, provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation. System to be tested in accordance with ASTM E2307 for up to 2-hour fire resistance and with ASTM E1233 for wind cycling equivalent to 108 mph wind for 500 cycles.

D. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hilti, Inc.
b. Specified Technologies Inc.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.4 ACCESSORIES

A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition occurs, such as the intersection of a gypsum wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's online directory "Product iQ" under product Category XHBN .

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Building Products" under product category Firestop Systems.

C. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: <**Insert drawing designation>**.
   1. UL-Classified Systems: HW- D - 0103 .
   2. Assembly Rating: 2 hours .
   3. Nominal Joint Width: 3/4" .
   4. Movement Capabilities: Class II - 25 percent compression or extension.
   5. L-Rating at Ambient: Less than 1 **cfm/ft. (cu. m/s x m)**.
   6. L-Rating at 400 Deg F (204 Deg C): Less than 1 **cfm/ft. (cu. m/s x m)**.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Latex joint sealants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. May National Associates, Inc.; a subsidiary of Sika Corporation.
b. Pecora Corporation.
c. Sika Corporation; Joint Sealants.
d. The Dow Chemical Company.
e. Tremco Construction Products Group.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. The Dow Chemical Company.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Sika Corporation; Joint Sealants.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Acrylic Latex: Acrylic latex, siliconized acrylic latex, or acetoxy silicone sealant ASTM C 834, Type OP, Grade NF.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Pecora Corporation.
      b. Sherwin-Williams Company (The).
      c. Tremco Construction Products Group.

2.6 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Adfast.
      b. Alcot Plastics Ltd.
      c. BASF Corporation.
      d. Construction Foam Products; a division of Nomaco, Inc.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove laitance and form-release agents from concrete.
   2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior standard steel doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Steelcraft; Allegion plc; K-Series frames or comparable product by one of the following:
1. Curries, AADG, Inc.; ASSA ABLOY Group.
2. Republic Doors and Frames; a Allegion brand.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. .
1. Doors:
a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
d. Edge Construction: Model 2, Seamless .
e. Core: Polyurethane .
2. Frames:
a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.

b. Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Knocked down .

2.3 FRAME ANCHORS

A. Jamb Anchors:
1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.5 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond

edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding , or by rigid mechanical anchors.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 .
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
   3. Floor Anchors: Secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   4. Solidly pack mineral-fiber insulation inside frames.
   5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
   6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .
   2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
   3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

C. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Fire-Protective flush wood veneer-faced Mineral Core doors for transparent finish at existing stairwell door frames.
3. Factory finishing flush wood doors and frames.
4. Factory fitting flush wood doors to frames and factory machining for hardware.
5. Field fitting flush wood mineral core doors to existing frames and field machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Apply Program label to Shop Drawings.

C. Samples: For factory-finished doors and factory-finished door frames.

1.3 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in .

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.
   1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.3 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors :
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Eggers Industries.
      b. Masonite Architectural.
      c. Oshkosh Door Company.
      d. VT Industries Inc.
   2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty .
   3. Performance Grade:
      a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
      b. ANSI/WDMA I.S. 1A Extra Heavy Duty: public toilets janitor's closets assembly spaces exits and and where indicated on Drawings.
   4. ANSI/WDMA I.S. 1A Grade: Custom.
   5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
      a. Species: White Maple.
      b. Cut: Plain-sliced .
      c. Match between Veneer Leaves: Slip match.
      d. Assembly of Veneer Leaves on Door Faces: Running match.
      e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
      f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
   6. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A .
      a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
         1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.

7. Core for Non-Fire-Rated Doors:
    a. ANSI A208.1, Grade LD-1 particleboard.
        1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
            a) 5-inch top-rail blocking, in doors indicated to have closers.
            b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
            c) 5-inch midrail blocking, in doors indicated to have exit devices.
        2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 11 "Door Hardware (Descriptive Specification."
    b. Glued wood stave.
    c. WDMA I.S. 10 structural composite lumber.
        1) Screw Withdrawal, Face: 475 lb.
        2) Screw Withdrawal, Edge: 475 lb.
    d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
8. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
    a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
        1) 5-inch top-rail blocking.
        2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
        3) 5-inch midrail blocking, in doors indicated to have armor plates.
        4) 5-inch midrail blocking, in doors indicated to have exit devices.
9. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
    1. Wood Species: Same species as door faces .
    2. Profile: Flush rectangular beads .
    3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

2.5 FABRICATION

A. Factory machine doors for hardware that is not surface applied.
    1. Locate hardware to comply with DHI-WDHS-3.
    2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
    3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

B. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

C. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.
1. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
1. ANSI/WDMA I.S. 1A Grade: Custom.
2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
3. Staining: Match Architect's sample .
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin .

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 08 71 11 "Door Hardware (Descriptive Specification)."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.
a. Secure with countersunk, concealed fasteners and blind nailing.

b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
   1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:
1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
   a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
   a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
   b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
   c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
   d. Comply with NFPA 80 for fire-rated doors.
5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Mud Flanges for use in gypsum board ceilings :
1. Basis-of-Design Product: Subject to compliance with requirements, provide MIFAB, Inc; MDW or comparable product by one of the following:
a. ACUDOR Products, Inc.
b. Babcock-Davis.
c. JL Industries; Activar Construction Products Group, Inc.
d. Karp Associates, Inc.
e. Larsen's Manufacturing Company.
f. Milcor by Duravent; Duravent Group.
g. Nystrom, Inc.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Optional Features: .
4. Locations: Ceiling .
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch , 16 gage , factory primed .
6. Frame Material: Same material and thickness as door .
7. Latch and Lock: Cam latch, screwdriver operated .

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:
1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.4 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Aluminum-framed storefront systems.
   2. Aluminum-framed storefront systems with operable vents.
   3. Aluminum-framed entrance door systems.
   4. Aluminum Sill Flashing and Stools.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   4. Include point-to-point wiring diagrams showing the following:
      a. Power requirements for each electrically operated door hardware.
      b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

B. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

B. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings .

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches .
   2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces

edge clearance between framing members and glazing or other fixed components to less than 1/8 inch .

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

D. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

F. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.3 STOREFRONT SYSTEMS

A. Products: Subject to compliance with requirements, provide the following:

1. Basis of Design: Kawneer; 451T with High-Perfomance Sills
2. Acceptable Manufacturers:
   a. Kawneer
   b. Tubelite Thermal Block with Univent 1375 AW Insert Vent Operable Windows and high performance sills.
   c. YKK YES 45 FT - Thermally Broken Storefront with YES SSG TUH Operable Windows and High Performance Sills.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken .
2. Glazing System: Retained mechanically with gaskets on four sides .
3. Glazing Plane: Center .
4. Finish: .
5. Fabrication Method: Field-fabricated stick system.

6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Accessories: Continuous trim matching storefront material and finish in shapes indicated on the drawings.

2.4 ENTRANCE DOOR SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Basis of Design: Kawneer North America, an Arconic company, 500 series standard entrances.
2. YKK 50D Wide Stile Commercial Entrance System
3. Tubelite Standard Wide Stile Entrances

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width .
   a. Bottom Rail: 10" minimum for ADA entrance requirements.
3. Glazing Stops and Gaskets: Square , snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

2.6 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
   1. Color: Match structural sealant.

2.7 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:
   1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
   2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads , finished to match framing system , fabricated from 300 series stainless steel.

B. Sealants:
   1. Dow Dowsil 795 Silicone Building Sealant - Anodized Aluminum.
      a. Durometer: 25 Shore A
      b. Tensile Strength: 125 PSI
      c. Elongation: 450%
      d. Tear: 20 lbs/inch.
   2. Backer Rod: Closed-cell, non-absorbent, moisture resistant backer rod compatible with sealant indicated by manufacturer for use in aluminum storefront systems as indicated on the drawings.
      a. Density: 1.5 per ASTM D1622
      b. Tensile Strength: 24 psi min per ASTM D1623
      c. Water Absorption: 0.03 gm/cc per ASTM C1016

d. Classification: Type 3 (ASTM D5249), Type C (ASTM C1330)
e. Diameter: Sized for compression into joints for widths indicated.
    1) Provide 5/8" rod diameter at 3/8"-1/2" design joints or as indicated by manufacturer's written requirements.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
    1. Profiles that are sharp, straight, and free of defects or deformations.
    2. Accurately fitted joints with ends coped or mitered.
    3. Physical and thermal isolation of glazing from framing members.
    4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
    5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
    6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
    1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
    2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker; Dark Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing according to sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Set glazing with proper orientation so that coatings face exterior or interior as specified.

D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

E. Apply structural sealant to completely fill cavity, according to sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.

F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

G. Allow structural sealant to cure according to manufacturer's written instructions.

H. Clean and protect glass as indicated in Section 08 80 00 "Glazing."

3.6 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.7 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.8 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazed aluminum curtain walls with operable vents.

1.2 RELATED SECTIONS

A. Section 01 23 50 "Alternates" for Alternate Bids affecting the work of this section.

B. Section 08 41 13 "Aluminum Framed Entrances and Storefronts" for glazed aluminum storefronts and entrance doors.

C. Section 08 80 00 "Glazing" for insulated glazing units and insulated metal panels glazed into aluminum curtain wall frames.

D. Section 07 62 00 "Sheet Metal Flashing and Trim" for sheet metal flashings installed with glazed aluminum curtain walls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Assembly Warranty: Installer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings .

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch , whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch , whichever is smaller .

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
   a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4-inch for spans of greater than 11 feet 8-1/4 inches or 1/175 times span, for spans of less than 11 feet 8-1/4 inches .

E. Structural: Test according to ASTM E 330/E 330M as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

2.2 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; 1600 System 1 & 2 (structural silicone glazed and captured or comparable product by one of the following:
1. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.
2. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken .
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front .
4. Finish: Color anodic finish .
5. Fabrication Method: Field-fabricated stick system .
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: ASTM C 509 or ASTM C 864. Manufacturer's standard .
   1. Color: Black .

C. Glazing Sealants: As recommended by manufacturer.

2.4 MATERIALS

A. Sheet and Plate: ASTM B 209 .

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 .

C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

D. Structural Profiles: ASTM B 308/B 308M.

E. Steel Reinforcement:
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.5 OPERABLE UNITS

A. Substitutions: Approved by Architect by Addendum prior to bidding. Window systems meeting the requirements of Section 08 51 13 Aluminum Windows must be approved in writing for use in the curtainwall system.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior .
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Components curved to indicated radii.

D. Fabricate components to resist water penetration as follows:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method .

F. Factory-Assembled Frame Units:
1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion.
3. Preparation includes, but is not limited to, cleaning and priming surfaces.
4. Seal joints watertight unless otherwise indicated.
5. Install glazing to comply with requirements in Section 08 80 00 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color: Dark bronze .

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.3 INSTALLATION OF WINDOWS IN CURTAIN WALLS

A. Comply with Section 08 51 16 Aluminum Windows and Curtain Wall manufacturer's written instructions.

END OF SECTION 08 44 13

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section includes Kawneer Architectural Aluminum Windows including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of window units.
   1. Types of aluminum windows include:
      a. Kawneer Series 8225TL Thermal Windows
      b. Project-In and Project-Out Windows
      c. 2-1/4" (57.2 mm) frame depth, with 0.090" (2.3 mm) wall thickness
      d. AW-PG90-AP

B. See related sections for proprietary operable vents manufactured by acceptable storefront and curtainwall manufacturers.

C. Design Intent: Operable vents in storefronts and curtainwalls shall be by the same manufacturer as the curtainwall or storefront system.

D. Related Sections:
   1. 072700 “Air Barriers”
   2. 07 92 00 “Joint Sealants”
   3. 084113 “Aluminum-Framed Entrances and Storefronts”
   4. 084413 “Glazed Aluminum Curtain Walls”

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. General Performance: Aluminum-framed window system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Window System Performance Requirements:
   1. Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS)
      a. Performance Class and Grade: AW-PG90-AP

2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283 at a minimum window size of 36" x 60" (914 x 1524 mm). The air infiltration rate shall not exceed 0.10 cfm/ft2 at a static air pressure differential of 6.24 psf (300 Pa).
3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 547 and ASTM E 331 at a minimum window size of 36" x 60" (914 x 1524 mm). There shall be no leakage as defined in the test method at a static air pressure differential of 12 psf (574 Pa).
4. Uniform Load Deflection: A minimum static air pressure difference of 90 psf (4310 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member.
5. Uniform Load Structural Test: A minimum static air pressure difference of 135 psf (6465 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. The unit shall be evaluated after each load.
6. Component Testing: Window components shall be tested in accordance with procedures described in ANSI AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
7. Energy Efficiency:
    a. Thermal transmittance simulation results using NFRC 100 or AAMA 507 are based on a Center of Glass (COG) U-factor of 0.24 Btu/(hr·ft2·°F) and a warm-edge spacer.
        1) Project-Out: U-Factor not more than .48 BTU/hr/sf/°F or ____ BTU/hr/sf/°F per AAMA 507 or NFRC100 when using project specified glass.
        2) Project-In: U-Factor not more than .45 BTU/hr/sf/°F or ____ BTU/hr/sf/°F per AAMA 507 or NFRC100 when using project specified glass.
8. Condensation Resistance Test (CRF): When tested in accordance with AAMA 1503, the condensation resistance factor (CRF) shall not be less than:
    a. Project-In: (CRFf) not less than 56 with clear glass.
        1) Project-In: (CRFg) not less than 55 with clear glass.
9. Windborne-Debris-Impact-Resistance Performance: Shall be tested in accordance with ASTM E 1886 and information in ASTM E 1996 and TAS 201/203.
    a. Large – Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade (Project-Out with 0.125" wall thickness).
    b. Small – Missile Impact: For aluminum-framed systems located above 30 feet (9.1m) of grade (Project-Out with 0.125" wall thickness).
10. Forced Entry Resistance: All windows shall conform to ASTM F588, Grade 10.
11. Thermal Barrier Tests: Testing shall be in general accordance with AAMA 505 Dry Shrinkage and Composite Thermal Cycling test procedure, AAMA TIR-A8, Structural Performance of Composite Thermal Barrier systems.

C. Environmental Product Declarations (EPD): Shall have a Type III product specific EPD created from a Product Category Rule specific to North America.

1.5 Submittals

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum windows and components required.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements.” Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination.”

1.7 Project Conditions

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

B. Insulating Glass: Warranted to be free from defects (excluding breakage) for a period of five (5) years.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
1. Kawneer Company Inc.
2. Series 8225TL Thermal Windows - Project-In and Project-Out
3. 2-1/4" (57.2 mm) frame depth, with 0.090" (2.3 mm) wall thickness
4. AW-PG90-AP

B. Subject to compliance with requirements, provide a comparable product by the following if other than Kawneer Storefronts or Curtain Walls are used:
1. Manufacturer / Product: Tubelite Univent 1375 AW Insert Vent Operable Windows
2. Manufacturer / Product: YKK YES SSG TUH Operable Windows.

C. Substitutions: Refer to Substitutions Section for procedures and submission requirements.
1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
a. Substitutions must be compatible with Section 08 44 13 Glazed Aluminum Curtainwalls and systems indicated.
2. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
3. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for window system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum windows for a period of not less than ten (10) years. (Company Name)
4. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
5. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall and storefront system manufacturer for strength, corrosion resistance, and application of required finish, and complying with ASTM B 221: 6063-T6, 6105-T5, or 6061-T6 alloy and temper. Wall thickness at any location for the main frame to be not less than 0.070" (1.78 mm).

B. Thermal Barrier: The thermal barrier shall be Kawneer IsoLock® with a nominal 3/8" (9.5 mm) separation consisting of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum.

C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 Window System

A. Series 8225TL Thermal Windows - Project-In and Project-Out

2.4 Glazing

A. Glass and Glazing Materials: Refer to Division 08 Section “Glazing” for glass units and glazing requirements applicable to glazed aluminum window units.

B. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer’s standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type glazing beads with an interior gasket in accordance with AAMA 702 or ASTM C864.

2.5 Hardware

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash weight and dimensions.

B. Projected Windows Typical Hardware:
   1. Locking:
      a. Cast White Bronze Cam Locks (Standard)
      b. Access Control Locks
      c. Hook Lock Handle
   2. Hinging:
      a. 4-Bar Hinges (Standard)
      b. Limit Stop

C. Exterior Panning and Interior Trims: Extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated. Seal exterior joints with manufacturer's standard sealant to assure water-tight joints.
   1. Exterior Panning and Trims: All panning profiles shall be a minimum thickness of 0.062" (1.57 mm) to match the profiles as shown the drawings. Any profile variations shall be submitted to the architect and/or owner for approval 10 days prior to bid date. All panning shall be factory fabricated for field assembly. All corner joinery shall be factory cut. Joinery at the sill shall be coped and butt-type construction. All preparations for assembly shall be completed by the window manufacturer. Upon assembly, panning frame joints shall be back-sealed to prevent moisture penetration.
   2. Interior Trims: The interior face trim minimum wall thickness shall be 0.062" (1.57 mm). The face trim shall snap-fit onto concealed mounting clip. Exposed fasteners shall not be accepted. The mounting clip shall be extruded aluminum of 6063-T6 alloy and temper. The minimum wall thickness shall be 0.062" (1.57 mm). The trim clips shall be provided in 4" (101.6 mm) lengths and spaced a maximum of 18" (457.2 mm) center to center.

2.6 Accessories

A. Optional Insect Screens: Extruded aluminum frames, 6063-T6 alloy and temper, joined at corners: 18 x 16 mesh aluminum screen cloth; frames finished to match aluminum windows; splines shall be extruded vinyl, removable to permit rescreening.

2.7 Fabrication

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Window Frame Joinery: Screw-Spline, Factory sealed frame and vent corner Joints

C. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

D. Fabricate aluminum windows that are re-glazable without dismantling sash or framing.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections,

as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093" (2.4 mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section “Glazing” and with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section “Glazing” and glazing system indicated. Provide glazing stops to match frame.

2.8 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
1. Kawneer Permanodic® AA-M10C21A44, AAMA 611, Architectural Class I Color Anodic Coating (Color Dark Bronze).

PART 3 - EXECUTION

3.1 Examination

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight window installation.
1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install aluminum framed window system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum framed window system and components to drain condensation, water penetrating joints, and moisture migrating within system to the exterior.

E. Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

3.3 Field Quality Control

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
1. Testing Methodology: Testing Standard shall be per AAMA 502 including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 for Water Penetration Test.
a. Air Infiltration Test: Conduct test in accordance with ASTM E 783 at a minimum uniform static test pressure of 1.57 psf (75 Pa) for CW or 6.24 psf (300 Pa) for AW. The maximum allowable rates of air leakage for field testing shall not exceed 1.5 times the project specifications.
b. Water Infiltration Test: Water penetration resistance tests shall be conducted in accordance with ASTM E 1105 at a static test pressure equal to 2/3 the specified water test pressure.
2. Testing Extent: Architect shall select window units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer’s representative present.
3. Test Reports: Shall be prepared according to AAMA 502.

3.4 Adjusting, Cleaning, And Protection

A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 51 13

SECTION 08 7 100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section ''Rough Carpentry''
3. Division 06 Section ''Finish Carpentry''
4. Division 07 Section ''Joint Sealants'' for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. ''Metal Doors and Frames''
   b. ''Flush Wood Doors''
   c. ''Stile and Rail Wood Doors''
   d. ''Interior Aluminum Doors and Frames''
   e. ''Aluminum-Framed Entrances and Storefronts''
6. Division 26 ''Electrical'' sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 ''Electronic Safety and Security'' sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 ''Recommended Practices for Keying Systems'' as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Final approved hardware schedule edited to reflect conditions as installed.
d. Final keying schedule
e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. Fire door assemblies, in compliance with NFPA 80.
   b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Architect and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.

b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:
   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
   b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
   a. Comply with governing accessibility regulations cited in ''REFERENCES'' article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.
      3) Requirements for access control.
      4) Address for delivery of keys.

2. Pre-installation Conference
   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks: 10 years
        2) Exit Devices: 10 years
        3) Closers: 30 years
        4) Automatic Operators: 1 year
    b. Electrical Warranty
        1) Locks: 3 years
        2) Exit Devices: 3 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: ''No Substitute.''

1. Where ''No Substitute'' is noted, submittals and substitution requests for other products will not be considered.

B. Approval of alternate manufacturers and/or products other than those listed as ''Scheduled Manufacturer'' or ''Acceptable Manufacturers'' in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

C. Approval of products from manufacturers indicated in ''Acceptable Manufacturers'' is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Ives 5BB series

2. Acceptable Manufacturers and Products:
   a. Hager BB1191/1279 series
   b. McKinney TB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Select
   b. Hager

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage L9000 series

2. Acceptable Manufacturers and Products:
   a. Oak 1ML series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-3/5-inch x 3/5 inch with 180-degree visibility. Provide messages color-coded using ANSI Z535 Safety Red with full text and/or symbols, as scheduled, for easy visibility. When applicable allows for lock status indication on both sides of the door.

3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to ''KEYING'' article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:
    a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
    b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
    c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
    d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
    e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
    a. Lever Design: 06N.

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
    a. Von Duprin 99/33A series

2. Acceptable Manufacturers and Products:
    a. No Substitute

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to ''KEYING'' article, herein.
3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.

9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.08 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage/Von Duprin PS900 Series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
   a. 12/24 VDC Output, field selectable.
   b. Class 2 Rated power limited output.
   c. Universal 120-240 VAC input.
   d. Low voltage DC, regulated and filtered.
   e. Polarized connector for distribution boards.
   f. Fused primary input.
   g. AC input and DC output monitoring circuit w/LED indicators.
   h. Cover mounted AC Input indication.
   i. Tested and certified to meet UL294.
   j. NEMA 1 enclosure.
   k. Hinged cover w/lock down screws.
   l. High voltage protective cover.

2.09 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Best

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.10 KEYING

A. Scheduled System:

1. Existing factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
   a. Replaceable Construction Cores.
      1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
         a) 3 construction control keys
         b) 12 construction change (day) keys.
      2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:
   a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      1) Master Keying system as directed by the Owner.
   b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
   d. Identification:
      1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
      2) Identification stamping provisions must be approved by the Architect and Owner.
      3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
      4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.

5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

e. Quantity: Furnish in the following quantities.
1) Permanent Control Keys: 3.
2) Master Keys: 6.
3) Change (Day) Keys: 2 per core
4) Key Blanks: Quantity as determined in the keying meeting.

2.11 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
a. LCN 4040XP series

2. Acceptable Manufacturers and Products:
a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4010/4110/4020 series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Record 6100 series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Provide automatic operator units complying with 2022 California Building Code Section 11B-404.2.9, Exception 2.
3. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

4. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
5. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
6. Provide drop plates, brackets, and adapters for arms as required for details.
7. Provide actuator switches and receivers for operation as specified.
8. Provide weather-resistant actuators at exterior applications.
9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to ''KEYING'' article, herein.
10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 1-1/2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
   a. Glynn-Johnson

2. Acceptable Manufacturers:
   a. Rixson
   b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Zero International

2. Acceptable Manufacturers:

a. National Guard
b. Reese

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.19 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Rockwood
   b. Trimco

B. Requirements:

1. Provide ''push-in'' type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.20 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Schlage

2. Acceptable Manufacturers:
   a. GE-Interlogix
   b. Sargent

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.21 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Weatherstripping: Clear Anodized Aluminum
8. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.

L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section ''Joint Sealants.''

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

109851 OPT0374149 Version 2

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 01

For use on Door #(s):
011 014

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	PANIC HARDWARE	99-L-BE-06		626	VON
			BALANCE OF HARDWARE BY DOOR MFR			B/O

Hardware Group No. 02

For use on Door #(s):
013 015 016 017 018 021

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PANIC HARDWARE	99-L-BE-06		626	VON

Hardware Group No. 03

For use on Door #(s):
100A 100B 200A 200B 300A 300B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-BE-F-06		626	VON
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 04

For use on Door #(s):
101A 106A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-99-EO		626	VON
1	EA	PANIC HARDWARE	CD-99-NL-OP-110MD		626	VON
2	EA	LOCK DOWN HARDWARE	LDH100		626	TRI
1	EA	RIM CYLINDER	1E72		626	BES
3	EA	MORTISE CYLINDER	1E74		626	BES
2	EA	90 DEG OFFSET PULL	8190EZHD 8" STD		630-316	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	AUTO OPERATOR	6100 SERIES		689	REC
1	EA	PA MOUNTING PLATE	4040XP-18PA (AS REQ'D)		689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT (AS REQ'D)		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 (AS REQ'D)		689	LCN
1	EA	ACTUATOR, TOUCH	8310-853T		630	LCN
1	EA	DUAL ACTUATOR	8310-855		630	LCN
2	EA	MOUNT BOX	8310-867F			LCN
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	DOOR SWEEP, BRUSH W/ DRIP	8198AA		AA	ZER
1	EA	THRESHOLD, 1/2"	655A		A	ZER
2	EA	DOOR CONTACT	679 SERIES		BLK	SCE
1		NOTE	WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

OPERATION: DOOR NORMALLY CLOSED AND UNLOCKED. ACTIVATING EITHER ACTUATOR WILL CAUSE THE AUTOMATIC OPERATOR TO CYCLE THE DOOR (PANIC DEVICE LATCH MUST BE DOGGED/RETACTED). DOOR CONTACT MONITORS THE POSITION OF THE DOOR FREE EGRESS AT ALL TIMES.

Hardware Group No. 05

For use on Door #(s):
101B 106B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY			628	IVE
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10		✓	689	VON
1	EA	REMOVABLE MULLION	KR4954			689	VON
1	EA	PANIC HARDWARE	CD-99-EO			626	VON
1	EA	ELEC PANIC HARDWARE	QEL-99-NL-OP-110MD 24 VDC		✓	626	VON
2	EA	LOCK DOWN HARDWARE	LDH100			626	TRI
1	EA	RIM CYLINDER	1E72			626	BES
2	EA	MORTISE CYLINDER	1E74			626	BES
2	EA	90 DEG OFFSET PULL	8190EZHD 8" STD			630-316	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH			689	LCN
1	EA	AUTO OPERATOR	6100 SERIES		✓	689	REC
2	EA	PA MOUNTING PLATE	4040XP-18PA (AS REQ'D)			689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT (AS REQ'D)			689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 (AS REQ'D)			689	LCN
1	EA	ACTUATOR, TOUCH	8310-853T			630	LCN
1	EA	MOUNT BOX	8310-867F				LCN
1	EA	WALL STOP	WS406/407CVX			626	IVE
1	EA	MULLION SEAL	8780NBK PSA			BK	ZER
1	EA	CREDENTIAL READER	BY DIV 28		✓		B/O
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC (COORDINATE WITH ACCESS CONTROL)		✓	LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND MOMENTARILY ENABLE THE EXTERIOR ACTUATOR. ACTIVATING THE ENABLED EXTERIOR ACTUATOR WILL CAUSE THE AUTOMATIC OPERATOR TO CYCLE THE DOOR. THE INTERIOR ACTUATOR WILL BE ENABLED AT ALL TIMES. ACTIVATING THE INTERIOR ACTUATOR WILL MOMENTARILY RETRACT THE PANIC DEVICE LATCH AND CAUSE THE AUTOMATIC OPERATOR TO CYCLE THE DOOR. DOOR TO REMAIN LOCKED UPON LOSS OF POWER. DOOR CONTACT MONITORS THE POSITION OF THE DOOR. FREE EGRESS AT ALL TIMES.

Hardware Group No. 06

For use on Door #(s):
102B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	PANIC HARDWARE	CD-99-NL		626	VON
1	EA	LOCK DOWN HARDWARE	LDH100		626	TRI
1	EA	RIM CYLINDER	1E72		626	BES
1	EA	MORTISE CYLINDER	1E74		626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
2	EA	FILLER PLATE	EPT-1		PRI	DON
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP, BRUSH W/ DRIP	8198AA		AA	ZER
1	EA	THRESHOLD, 1/2"	655A		A	ZER
1	EA	DOOR CONTACT	679 SERIES		BLK	SCE

PREP DOOR AND FRAME FOR EPT FOR FUTURE ACCESS CONTROL.

DOOR CONTACT MONITORS THE POSITION OF THE DOOR.

Hardware Group No. 07

For use on Door #(s):

103	104	107	115A	116A	117A
120B	209A	210A	210B	211A	212A
213A	214A	305A	308A	308B	310A
310B					

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	PASSAGE SET	L9010 06N		626	SCH
1	EA	WALL STOP	WS406/407CVX		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 08

For use on Door #(s):
108

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	STOREROOM LOCK	L9080BDC 06N		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 09

For use on Door #(s):
109 110 122 201 202 313
314

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	PRIVACY W/DEADBOLT W/ OUTSIDE INDICATOR	L9440 06N L583-363 OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 10

For use on Door #(s):

111	112	113	114	115	116
117	209	212	212	213	214

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK W/ INSIDE INDICATOR	L9050BDC 06N L583-363 IS-LOC		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4021 TEL		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	FINGER GUARD	51A-180 48"		A	ZER
1	EA	FINGER GUARD	951A 48"		A	ZER
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 11

For use on Door #(s):

118	123	210C	309A	309B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC 06N L583-363		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	WALL STOP	WS406/407CVX		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 12

For use on Door #(s):
119A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	EU MORTISE LOCK	L9092BDCEU 06N CON 12/24 VDC		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP, BRUSH W/ DRIP	8198AA		AA	ZER
1	EA	THRESHOLD, 1/2"	655A		A	ZER
1	EA	CREDENTIAL READER	BY DIV 28			B/O
1	EA	DOOR CONTACT	679 SERIES		BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC (COORDINATE WITH ACCESS CONTROL)		LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING A VALID CREDENTIAL TO THE READER WILL MOMENTARILY UNLOCK THE LOCK ALLOWING ACCESS. DOOR TO REMAIN LOCKED UPON LOSS OF POWER. DOOR CONTACT MONITORS THE POSITION OF THE DOOR. FREE EGRESS AT ALL TIMES.

Hardware Group No. 13

For use on Door #(s):
119B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	STOREROOM LOCK	L9080BDC 06N	626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM	626	BES
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP ST1630	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 14

For use on Door #(s):
120A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC 06N L583-363		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 15

For use on Door #(s):
121 203 205 208 315

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	STOREROOM LOCK	L9080BDC 06N		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 16

For use on Door #(s):
204

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC 06N L583-363		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	OH STOP	100S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 17

For use on Door #(s):

206A 206B 305B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK W/ INSIDE INDICATOR	L9050BDC 06N L583-363 IS-LOC		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4041 DEL EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	FINGER GUARD	51A-90 48"		A	ZER
1	EA	FINGER GUARD	951A 48"		A	ZER
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 18

For use on Door #(s):

207

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC 06N L583-363		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 19

For use on Door #(s):
305C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK W/ INSIDE INDICATOR	L9050BDC 06N L583-363 IS-LOC		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4041 DEL EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	FINGER GUARD	51A-180 48"		A	ZER
1	EA	FINGER GUARD	951A 48"		A	ZER
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 20

For use on Door #(s):
307 311

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D) `		652	IVE
1	EA	STOREROOM LOCK	L9080BDC 06N		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 21

For use on Door #(s):
308 310

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	OFFICE/ENTRY LOCK W/ INSIDE INDICATOR	L9050BDC 06N L583-363 IS-LOC		626	SCH
1	EA	PERMANENT CORE	KEYED TO/MATCH EXISTING SYSTEM		626	BES
1	EA	SURFACE CLOSER	4041 DEL		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
1	EA	FINGER GUARD	51A-90 48"		A	ZER
1	EA	FINGER GUARD	951A 48"		A	ZER
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 22

For use on Door #(s):
431 432

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 (NRP AS REQ'D)		652	IVE
1	EA	PUSH PLATE	8200 6" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 23

For use on Door #(s):

X100B	X108A	X108B	X108C	X109A	X109B
X117	X200A	X200B	X269	X271	X279
X300A	X300B	X301	X303	X304	X305
X312A	X312A	X312B	X312B	X400A	X400B
X401	X402	X403	X404	X405	X406
X407	X408	X409	X409A	X411	X411A
X412	X413	X413A	X413B	X416A	X416B
X417A	X417B	X417C	X418	X419	X420
X421	X422	X423	X424	X425	X426
X426A	X426B	X427	X428	X1704	

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		EXISTING DOOR, FRAME AND HARDWARE TO REMAIN		

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass for glazed aluminum curtain walls, aluminum storefronts, and aluminum entrance doors,doors,interior borrowed lites,storefront framing .
2. Glazing sealants and accessories.
3. One-way glazing film (at borrow lites indicated).

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the following:
   1. Vitro Architectural Glass.

2.2 PERFORMANCE REQUIREMENTS

A. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction . Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

E. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

F. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual."

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
   1. Sealing System: Dual seals.
   2. Perimeter Spacer: Polypropylene-covered stainless steel in color selected by Architect .
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Technoform Glass Insulation NA, Inc.
         2) Thermix; a brand of Ensinger USA.

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant:
   1. Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
      a. Manufacturers: Subject to compliance with requirements, undefined:
         1) Dow Corning Corporation.
         2) GE Construction Sealants; Momentive Performance Materials Inc.
         3) Pecora Corporation.
         4) Sika Corporation.
         5) Tremco Incorporated.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:
1. EPDM with a Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended by sealant or glass manufacturer.

C. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended by sealant or glass manufacturer.

D. Edge Blocks:
1. EPDM with a Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended by sealant or glass manufacturer.

E. One-Way Glazing Film:
1. One-Way Mirror Window Film that turns clear, tempered glass into one-way vision glass.
2. Basis of Design: 3M Privacy Series One-Way Mirror Window Film.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.3 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.4 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.5 INSULATING GLASS SCHEDULE

A. GLASS TYPE: TG-1 1/4" Clear Tempered Safety Glass.
1. Overall Unit Thickness: 1/4" (6mm).
2. Locations: All interior glazing at borrow lites and non-rated interior doors.

B. Glass Type : IG-1 Low-E-coated, tinted insulating glass.
1. Basis-of-Design Product:
a. Oldcastle Building Envelope Vitro Solarban 60 on Vitro Solar Bronze Low-E #2.
2. Overall Unit Thickness: .1 inch (25 mm)
3. Minimum Thickness of Each Glass Lite: 6 mm .
4. Outdoor Lite: Tinted heat-strengthened float glass.
5. Tint Color: Bronze .
6. Interspace Content: Argon.
7. Indoor Lite: Clear fully tempered float glass.
8. Low-E Coating: Sputtered on second surface.
9. Winter Nighttime U-Factor: .24 maximum.
10. Summer Daytime U-Factor: .21 maximum.
11. Visible Light Transmittance: 42 percent minimum.
12. Solar Heat Gain Coefficient: .28 maximum.
13. Safety glazing required.

C. Glass Type: SG-1 Low-E-Coated, tinted insulating spandrel glass with ceramic frit.
1. Basis of Design Product: Oldcastle Building Envelope Vitro Solarban 60 on Vitro Solar Bronze Low-E #2. 100% warm gray ceramic frit on #4.
2. See IG-1 above for performance criteria.

END OF SECTION 08 80 00

SECTION 08 88 13 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire-protection-rated glazing.
   2. Fire-resistance-rated glazing.

1.2 DEFINITIONS

A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and incapable of blocking radiant heat.

B. Fire-Resistance-Rated Glazing: Glazing that prevents spread of fire and smoke and radiant heat; used in rated wall and door applications 60 minutes and above without size limitations.

C. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

D. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of glass and glazing product.

B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: For each glass type, obtain from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems to withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction . Label indicates manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Ultraclear Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

E. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and complies with NFPA 80.
1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes is exempt from hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test;

whether glazing meets 450 deg F temperature-rise limitation; and fire-resistance rating in minutes.

C. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear , ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Technical Glass Products; FireLite Plus or comparable product by one of the following
      a. SAFTI FIRST Fire Rated Glazing Solutions.
      b. Vetrotech Saint-Gobain.

2.6 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
      a. GE Construction Sealants; Momentive Performance Materials Inc.
      b. The Dow Chemical Company.
      c. Tremco Incorporated.
   2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

C. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 FIRE-PROTECTION-RATED GLAZING SCHEDULE

A. Glass Type FPGL-1: 90-minute fire-protection-rated glazing with 450 deg F temperature-rise limitation in rated doors only, with a maximum vision area of 100 sq. in.; fire-protection-rated laminated ceramic glazing .

END OF SECTION 08 88 13

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.

B. Related Requirements:
   1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

A. Product data and schedule for studs in walls demonstrating compliance with structural performance indicated in the drawings and specifications.
   1. Indicate compliance with deflection criteria at walls receiving ceramic tile finishes.

1.3 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height measured from bottom track to top track based on horizontal loading of 5 lbf/sq. ft. .
   1. Horizontal Deflection for wall assemblies receiving ceramic tile finish limited to 1/360 of the wall height measured from the bottom track to the top track based on a horizontal loading of 5 lbf/sq.ft.

D. Horizontal Deflection: For non-composite wall assemblies, limited to 1/240 of the wall height measured from bottom track to top track based on horizontal loading of 5 lbf/sq. ft.
   1. Horizontal Deflection for wall assemblies receiving ceramic tile finish limited to 1/360 of the wall height measured from the bottom track to the top track based on a horizontal loading of 5 lbf/sq.ft.

E. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

F. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

G. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inch .

2.2 FRAMING SYSTEMS

A. Studs and Track: ASTM C645 .
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. ClarkDietrich.
      b. Marino\WARE.
      c. Telling Industries.
   2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection .
   3. Depth: As indicated on Drawings .

B. Slip-Type Head Joints: Where indicated, provide the following:
   1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) ClarkDietrich.
         2) Marino\WARE.

3) MBA Building Supplies.
4) TELLING Industries.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. ClarkDietrich.
b. Marino\WARE.
2. Minimum Base-Steel Thickness: 0.0329 inch .

D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. ClarkDietrich.
b. Marino\WARE.
2. Depth: 1-1/2 inches .
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

E. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. ClarkDietrich.
b. Marino\WARE.
2. Configuration: Asymmetrical .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
   2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
   3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Install studs so flanges within framing system point in same direction.
   1. Install studs with fasteners at both legs unless noted otherwise.
   2. Where double studs ore indicated indicated such as at door jambs, mechanically fasten double studs together prior as indicated on the drawings.

C. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
         1) Tie studs together with screws where double studs are indicated or required.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
3. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior gypsum board.
2. Tile backing panels.
3. Auxiliary Materials.

B. Submittals:
1. Product Data for each product indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Gypsum.
b. CertainTeed Gypsum.
c. Georgia-Pacific Gypsum LLC.
d. National Gypsum Company.
e. USG Corporation.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered .

B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. American Gypsum.
b. CertainTeed; SAINT-GOBAIN.

c. Georgia-Pacific Gypsum LLC.
d. Gold Bond Building Products, LLC provided by National Gypsum Company.
e. USG Corporation.

2. Core: 5/8 inch , Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corporation; GlasRoc Tile Backer
b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer
c. USG Corporation; USG Durock™ Glass-Mat Tile Backerboard.
2. Core: 5/8 inch , Type X.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Wall to Mullion Partition Gap Closure:
1. Seamless transition between curtain walls, windows, and partition walls.
a. Basis of Design: Provide Gordon Incorporated Mullion Mate Plus System or Mullion Mate Snap with Mullion Mate extender and partition wall end cap sized for partition walls indicated.
1) Materials:
a) Aluminum extrusions: 6063-T5 or T6 temper alloy.
b) Aluminum sheet, 3000 series alloy.
c) Endcaps:
(1) Mullion Mate® End Caps for wall thicknesses indicated.
d) Sealant: ASTM C920 Type S, Grade NS, Class 35, Use NT, G, A
2) Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and MetalProducts" for recommendations relative to applying and designating finishes.
a) Factory Anodized - Dark Bronze.

B. Interior Trim: ASTM C1047.
1. Material: PVC or Paper-faced galvanized-steel sheet.
2. Shapes:
a. Cornerbead.
b. Expansion (control) joint.
1) Basis of Design: TrimTex 093V V-Shaped Expansion Joint with C & T intersections.
c. L-Beads and Tear-Away L-Beads.
1) L-Bead BOD: Trim-Tex Architectural L-Bead, 5/8"
2) Tear-Away L-Bead BOD: Trim-Tex Tear-Away L Bead 5/8"
d. J-Beads

1) J-Bead BOD: Trim-Tex Mud-On J-Bead, 5/8".

e. Reveal and Shadow Beads

1) Reveal Bead BOD: Trim-Tex Architectural Reveal Bead, sizes as indicated on the drawings.

2) Shadow Bead BOD: Trim-Tex Architectural "F" Reveal Bead, sizes as indicated on the drawings.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints , rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound .

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

E. Acoustical Sealant for concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying withASTM C834.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. GE Construction Sealants; Momentive Performance Materials Inc.
      b. Hilti, Inc.
      c. Specified Technologies, Inc.
      d. Tremco Incorporated.
      e. USG Corporation

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints , rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile .
   3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated .
      a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
   4. Level 5: Where indicated on Drawings .
      a. Primer and its application to surfaces are specified in Division 9 Painting Sections.

H. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.2 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Crack isolation membrane.
   3. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:
   1. Each type and composition of tile and for each color and finish required.
   2. Each type of metal trim profiles in color and finish required.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile Units: Furnish one carton of full-size units for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Ceramic Tile Type CT1: Through-body porcelain tile.
   1. Floor Tile: Provide product as indicated in Interior Finish Legend on Drawings.
   2. Grout Color: Color as indicated in Interior Finish Legend on Drawings.

2.3 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product , selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. H.B. Fuller Construction Products Inc. / TEC.
      b. Laticrete International, Inc.
      c. MAPEI Corporation.

2.4 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
   1. Basis of Design Product: Subject to compliance with requirements, provide TEC, Ultimate Mortar or comparable product by one of the following:
      a. H.B. Fuller Construction Products Inc. / TEC.
      b. MAPEI Corporation
      c. Laticrete International, Inc
   2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
   3. For floor and wall tile applications, provide nonsagging mortar.

2.5 GROUT MATERIALS

A. High-Performance Polymer-Modified Tile Grout: ANSI A118.7 and ANSI A118.3.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide TEC Power Grout, or comparable product by one of the following:
      a. H.B. Fuller Construction Products Inc. / TEC.
      b. MAPEI Corporation
      c. Laticrete International, Inc
   2. For use at porcelain floor and glazed wall tile applications.

B. Unsanded Tile Grout: ANSI A118.6.

2.6 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
   1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primers, backer rods and sealant accessories recommended by sealant manufacturer.
   3. Provide TEC, Accucolor 100, 100% Silicone Sealant or equal.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated

C. Refer to TCNA Handbook, Method EJ171A-G-11 for recommendations on locating and detailing vari-ous types of construction joints

D. Provide soft joint to match grout joint color at all locations where a change in plane occurs.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
   1. Provide surface preparation as required to achieve surface tolerance for each tile type indicated per ANSI A108.02 and all TCNA requirements.
   2. Provide product from same manufacturer as installation materials.

B. Metal Edge Strips: Refer to drawings for metal edge trim and transition products required; heights to match tile and setting-bed thickness.

C. Grout Release: Provide grout test or mock-up for approval to determine if grout release will be required.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.
      b. Tile floors consisting of tiles 8 by 8 inches or larger.
      c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Porcelain Tile: 1/8 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Metal Edge Strips: Install at locations indicated .

J. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

K. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
   1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Ceramic Tile Installation : TCNA F125-Full ; thinset mortar on crack isolation membrane.
      a. Ceramic Tile Type: Porcelain tile.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: High-performance sanded grout for porcelain tile applications.

B. Interior Wall Installations, Wood or Metal Studs or Furring:
   1. Ceramic Tile Installation : TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
      a. Ceramic Tile Type: Porcelain tile.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: High-performance sanded grout for porcelain tile applications.

END OF SECTION 09 30 13

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Provide one (1) box of full-size of each type installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E 1264.
   2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS (APC-1, APC-2)

A. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.

B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.

C. Classification: As indicated by manufacturer's designations .

D. Color: As indicated on Drawings.

E. Ceiling Attenuation Class (CAC): As indicated on Drawings .

F. Noise Reduction Coefficient (NRC): As indicated on Drawings .

G. Articulation Class (AC): As indicated on Drawings .

H. Edge/Joint Detail: As indicated by manufacturer's designation .

I. Thickness: As indicated on Drawings .

J. Modular Size: As indicated on Drawings .

2.3 METAL SUSPENSION SYSTEM

A. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.

B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.

C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
   1. Structural Classification: Intermediate -duty system.
   2. End Condition of Cross Runners: Override (stepped) type.
   3. Face Design: Flat, flush.
   4. Cap Material: Cold-rolled steel .
   5. Cap Finish: Painted white .

D. Transitions: Provide pre-engineered transitions by the suspension system manufacturer design to transition from acoustic panel ceiling to flush gypsum ceilings / bulkheads / soffits, and where ceilings change elevation where indicated on the drawings.
   1. At the discretion of the Architect traditional interior framing for bulkheads, soffits, and ceilings will be considered equivalent upon request by the contractor. Contractor shall include in such request details of metal stud framing for configurations indicated on the drawings.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Armstrong World Industries, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M , seismic design requirements, and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Thermoplastic-rubber base.
2. Rubber stair accessories.
3. Vinyl stair accessories.
4. Vinyl molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE - RB1

A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
1. Group: I (solid, homogeneous) .
2. Style and Location:
a. Style B, Cove .

C. Thickness: 0.125 inch .

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length .

F. Outside Corners: Job formed .

G. Inside Corners: Job formed .

H. Colors: As indicated on Drawingss .

2.2 RUBBER STAIR ACCESSORIES - RSA1

A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.

B. Stair Treads: ASTM F 2169.

1. Type: TP (rubber, thermoplastic).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Group: 2 (with contrasting color for the visually impaired).
4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees .
5. Nosing Height: 2 inches .
6. Thickness: 1/4 inch and tapered to back edge .
7. Size: Lengths and depths to fit each stair tread in one piece .

C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
1. Style: Coved toe, 7 inches high by length matching treads .
2. Thickness: Manufacturer's standard .

D. Locations: Provide rubber stair accessories in areas indicated .

E. Colors and Patterns: As indicated on Drawings .

2.3 VINYL STAIR ACCESSORIES - RSA2, RSA3

A. Stair Nosing: ASTM F 2169, Type TV (vinyl, thermoplastic).
1. Provide products indicated on Drawings.
2. Size: Lengths and depths to fit each stair tread in one piece .

B. Colors and Patterns: As indicated by manufacturer's designations .

2.4 VINYL MOLDING ACCESSORY - RTS1

A. Description: Vinyl reducer strip .

B. Profile and Dimensions: As indicated on drawings.

C. Locations: Provide vinyl molding accessories in areas indicated .

D. Colors and Patterns: As indicated on Drawings .

2.5 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:
   1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
   2. Tightly adhere to substrates throughout length of each piece.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: This section includes labor, materials and other services necessary to complete resilient sheet flooring, slip resistant sheet vinyl safety flooring systems and accessories work. Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section.

B. Related Sections:

C. Section 03300 - Cast-in-Place Concrete: Concrete finishing.

D. Section 06100 - Rough Carpentry: Plywood floor sheathing.

E. Division 7 - Thermal and Moisture Protection.

1.2 REFERENCES

A. ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

B. ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

C. ASTM E662, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

D. ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

E. ASTM F 970, Standard Test Method for Static Load Limit.

F. ASTM F1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring.

G. ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing.

H. ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

I. (RFCI) Resilient Floor Covering Institute
   1. RFCI Standard Slab Moisture Test Method (Calcium Chloride Method)

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01330 - Submittal Procedures.

B. Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Section 01330 - Submittal Procedures including but limited to the following:
   1. Submit a cut diagram indicating seam locations and roll direction. Use mitered seam layouts for corners when changing directions 180 degrees (e.g. when running material down corridors which bisect at a right angle), unless approved otherwise.

C. Samples: Submit duplicate 12" x 12" (300 mm x 300 mm) sample pieces of sheet material, 12" (300 mm) long cap strip cove former in accordance with Section 01330 - Submittal Procedures.

D. Closeout Submittals: Submit the following:
   1. Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

E. MAINTENANCE MATERIALS:
   1. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      a. Extra Sheet Vinyl: 50 sq ft of each type, color, and pattern installed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   1. Training: Installer who has attended an Altro flooring installation training clinic.

B. Regulatory Requirements: Provide slip resistant sheet vinyl safety flooring in compliance with the following:
   1. Americans with Disabilities Act Architectural Guidelines (ADAAG).
   2. Occupational Safety & Health Administration (OSHA).

C. Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing.
   1. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   2. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

D. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, manufacturer's warranty requirements, and installer qualifications.

1.5 SITE CONDITIONS

A. Temperature Requirements: If storage temperature is below 65F (18C) or the floor temperature is below 50F (18C), the Altro safety flooring product must be moved to a warmer place and allowed to reach this temperature before unrolling or installation. For further information, refer to current Altro Installation Practices and Quick Facts.

B. Maintain air temperature and structural base temperature at flooring installation area between 68F (20C) and 80F (26C) for 48 hours before, during and 24 hours after installation.

1.6 WARRANTY

A. Warranty period for Altro Walkway 20 shall be 10 years commencing on date of substantial completion. Refer to conditions of the contract for project warranty provisions.

PART 2 - PRODUCTS

2.1 SAFETY FLOORING

A. Slip Resistant Sheet Vinyl Manufacturer: Walkway 20 by Altro, Telephone 800.377.5597, Fax 610.746.4325; E-Mail Assistance: support@altro.com

B. Acceptable material: Altro Walkway 20 (measurements and product weights given below are approximate): Slip Resistance .85

2.2 ACCESSORIES

A. Vinyl welding rod: Acceptable material:
   1. Altro weld rod

B. Cove former: Acceptable material, sized to suit application:
   1. Altro Cove former 20R - 24 mm (1") radius .

C. Cap strip: Acceptable material, sized to suit application, Vinyl :
   1. Altro Cap Strip C4 .
      a. Color to be selected from Manufacturer's full range of colors.

D. ubfloor Filler and Leveler: Use only gray Portland cement-based “moisture tolerant” underlayments, and patching compounds. Use for filling cracks, holes or leveling. White gypsum materials are not acceptable.

E. Metal edge strips:
   1. Aluminum extruded, smooth, stainless steel with lip to extend over flooring.

2.3 ADHESIVES

A. Altrofix 31- 2 part polyurethane fast set adhesive

PART 3 - EXECUTION

3.1 EXAMINATION

A. A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog, installation instructions.

B. B. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.2 PREPARATION

A. Safety flooring shall be installed over subfloors conforming to ASTM F710 for concrete and other monolithic floors or ASTM F1482 for wood subfloors.

B. Always conduct moisture tests per ASTM F-2170 on all concrete slabs regardless of age or grade level. ASTM F-2170 Relative Humidity (RH) test results must not exceed 85%.

C. Do not proceed with work until results of moisture condition tests are acceptable.

D. When patching, a moisture tolerant patching compound must always be used.

3.3 INSTALLATION

A. Walkway 20 Installation: Install Altro safety flooring in accordance with the current posted Altro Installation Practices and Quick Facts Guide. All Seams shall be heat welded with Altro Weldrod™ only. Failure to install Altro safety flooring in accordance with recommended procedures will void the Altro Limited Product Warranty.

B. Coved Installation: Where Altro safety flooring is coved up wall surfaces and other abutments, installation shall be in accordance with Altro safety flooring Installation Practices using the following accessories:
   1. At standard wall finishes: Use Altro C7 vinyl cap strip to accommodate sheet vinyl to a height as indicated; adhere with contact tape.
   2. At FRP paneling: Use Altro C4 cap.
   3. At 0.75" (19.1 mm) radius coving at juncture of vertical and horizontal surfaces: Use Altro Vinyl Cove Former 20R: install with contact tape.
   4. Top set cove base: Install in accordance with manufacturer's instructions.

3.4 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas.
   1. Repair or replace damaged installed products.
   2. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

B. Protection:

1. Sweep or vacuum all construction debris and dust first, then clean the flooring with Altro Clean 44 using an auto scrubber.

3.5 PROTECTION

A. Cover and protect finished installation from damage from other trades using a non-staining, temporary floor protection system, such as a reusable textured plastic sheeting.

B. Walkway 20 should be covered and protected from all other trades during construction with a suitable non-staining protective covering without taping to the surface of the flooring.

END OF SECTION 09 65 16

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Luxury Vinyl Planks
   2. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Samples: For each exposed product and for each color and pattern specified.

B. Testing Documentation: Provide required sub-floor testing results prior to installation.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data for owner.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed..

1.5 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Luxury Vinyl Tile: Provide one (1) box of full-size of each type installed.
   2. Vinyl Composition Tile: Provide one (1) box of full-size of each type installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL TILE RFT1, RFT2

A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.

B. Tile Standard: ASTM F 1700.
   1. Class: Class III, Printed Film Vinyl Tile.
   2. Type: B, Embossed Surface.

C. Thickness: As indicated on Drawings .

D. Size: As indicated on Drawings .

E. Colors and Patterns: As indicated on Drawings .

2.3 VINYL COMPOSITION FLOOR TILE - RFT3

A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.

B. Tile Standard: ASTM F 1066, Class 2, through pattern .

C. Wearing Surface: Smooth .

D. Thickness: 0.125 inch <**Insert dimension>**.

E. Size: 12 by 12 inches.

F. Colors and Patterns: As indicated on Drawings .

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
   4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern(s) indicated on Drawings.

C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply three coat(s).

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet tile installation, plans showing the following:
1. Carpet tile type, color, and dye lot.
2. Pattern of installation.
3. Pattern type, location, and direction.
4. Type, color, and location of edge, transition, and other accessory strips.

C. Samples: For each exposed product and for each color and texture required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Carpet Tile: Provide one (1) box of full-size of each type installed.

1.6 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT1,CPT2, CPT3, CPT4)

A. Products: Subject to compliance with requirements, provide the following:

1. Manufacturers: As indicated in the Drawings.
    a. Patterns, Colors, Sizes, and Backings: As indicated in the Drawings.
    b. Installation patterns: As indicated in the Drawings.

B. Primary Backing/Backcoating: Manufacturer's standard composite materials .

C. Applied Treatments:
    1. Soil-Resistance Treatment: Manufacturer's standard treatment .

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:
    1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
        a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
        b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
        c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive .

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings .

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 68 16 - SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tufted carpet.

1.2 RELATED REQUIREMENTS

A. 09 6513 Resilient Base and Accessories

B. 09 6516 -Resilient Sheet Flooring

C. 09 6813 Tile Carpeting

D. 09 6519 Resilient Tile Flooring

E. 09 3000 Ceramic Tiling: Metal Transition Strips

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet installation, showing the following:
   1. Carpet type, color, and dye lot.
   2. Seam locations, types, and methods.
   3. Type of installation.
   4. Pattern type and direction.
   5. Types, colors, and locations of edge, transition, and other accessory strips.

C. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Submit test reports meeting or exceeding the substrate requirements indicated in paragraph 3.1 of this section to the Architect and Carpet Manufacturer's Representative at least two (2) weeks prior to installation.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Warranty Documents

1.6 MAINTENACE MATERIALS

A. Extra Flooring Material: Furnish the following for Owner's use in maintenance of project.
   1. Extra Carpet: 60 sq ft of each type, color, and pattern installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 MATERIAL STORAGE AND HANDLING

A. Store rolls on a flat surface, away from vents and direct sunlight.

B. Store in protected dry conditions between 65 and 85 degrees.

1.9 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Manufacturer's standard Lifetime Limited Warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET CPT5

A. Products: Subject to compliance with requirements, provide the following:
   1. Manufacturers: As indicated in the Drawings, or Architect approved equivalent.
      a. Patterns, Colors, Sizes, and Backings: As indicated in the Drawings.
      b. Installation patterns: As indicated in the Drawings.

B. Backings: As indicated on the Drawings.

C. Roll Width: 6 feet .

D. Applied Treatments:
   1. Applied Soil-Resistance Treatment: Manufacturer's standard material .
   2. Antimicrobial Treatment: Manufacturer's standard material .
      a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

E. Performance Characteristics:
   1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
   2. Radiant Panel ASTM E648: Class I

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer .

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:
1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rates that fall within range required by relevant flooring and adhesive manufacturers in 24 hours.
   b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum percent relative humidity level measurements that fall within range required by relevant flooring and adhesive manufacturers.
   c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.
2. pH Testing: Perform pH Testing on the floor in several locations. A reading below 5.0 or above 9.0 required corrective measures.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with the Carpet and Rug Institute's CRI 104 and carpet manufacturer's written installation instructions for the following:
   1. Direct-glue-down installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Install as indicated on Drawings .

D. Do not bridge building expansion joints with carpet.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer .

END OF SECTION 09 68 16

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exterior paint and coating systems including surface preparation.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.

B. Section 10 53 00 – Manufactured Canopies

C. Section 23 05 00 - Common Work Results for HVAC.

D. Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

A. SSPC-SP 1 - Solvent Cleaning.

B. SSPC-SP 2 - Hand Tool Cleaning.

C. SSPC-SP 3 - Power Tool Cleaning.

D. SSPC-SP11, Power Tool Cleaning to Bare Metal.

E. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: For each paint system indicated, including.
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Cautions for storage, handling and installation.

C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors, and sheens available.

D. Verification Samples: For each finished product specified, submit samples that represent the actual product, color, and sheen.

E. Coating Maintenance Manual: Upon conclusion of project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams, "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

F. Only submit complying products based on project requirements (i.e. LEED). One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors, and sheens available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
   1. Product name, and type (description).
   2. Application and use instructions.
   3. Surface preparation.
   4. VOC content.
   5. Environmental handling.
   6. Batch date.
   7. Color number.

B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; ASD Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Fax: 440-826-1989; Email: request infospecifications@sherwin.com; Web:www.swspecs.com.

B. Requests for substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.

2.2 APPLICATIONS/SCOPE

A. Exterior Paint and Coating Systems:
   1. Metal: Aluminum, galvanized steel.
   2. Metal: Miscellaneous iron, ornamental iron, ferrous metal.

2.3 PAINT MATERIALS - GENERAL

A. Paints and Coatings:
   1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
   2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufactures product instructions for optimal color conformance.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use a primer categorized as "best" by the manufacturer.

C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

D. Color: Refer to Finish Schedule for paint colors, and as selected.

2.4 EXTERIOR PAINT AND COATING SYSTEMS

A. Metal: Aluminum, Galvanized.
   1. Alkyd Systems; Waterbased:
      a. Gloss Finish:

1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils. wet, 2.0 mils. dry per coat).
2) 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series.
3) 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series (4.0-5.0 mils. wet, 1.4 - 1.7 mils. dry per coat).

B. Metal: Miscellaneous. Iron, Ornamental Iron, Structural Iron and Steel, Ferrous Metal.
1. Alkyd Systems; Waterbased:
a. Gloss Finish:
1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils. wet, 2.0 mils. dry per coat).
2) 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series.
3) 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series (4.0-5.0 mils. wet, 1.4 - 1.7 mils. dry per coat).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.
1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface, and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.

B. Aluminum: Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

C. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply to a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.

D. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
   1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
   2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Beforehand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
   3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
   4. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
   5. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

3.3 INSTALLATION

A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.

B. Do not apply it to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.

C. Apply coatings using methods recommended by manufacturer.

D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

F. Regardless of the number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.4 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior paint and coating systems including surface preparation.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 04 20 00 - Unit Masonry: Concrete Masonry Units (CMU).

C. Section 05 50 00 - Metal Fabrications.

D. Section 05 51 13 – Metal Pan Stairs

E. Section 05 52 13 – Pipe and Tube Railings

F. Section 08 11 13 - Hollow Metal Doors and Frames.

G. Section 09 29 00 - Gypsum Board

H. Divisions 20-28 - Common Work Results for MEPT Systems.

1.3 REFERENCES

A. SSPC-SP 1 - Solvent Cleaning.

B. SSPC-SP 2 - Hand Tool Cleaning.

C. SSPC-SP 3 - Power Tool Cleaning.

D. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.

E. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.

F. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.

G. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.

H. SSPC-SP11, Power Tool Cleaning to Bare Metal.

I. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.

J. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: For each paint system indicated, including.
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Cautions for storage, handling and installation.

C. Verification Samples: For each finished product specified, submit samples that represent the actual product, color, and sheen.

D. Coating Maintenance Manual: Upon conclusion of project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams, "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

E. Only submit complying products based on project requirements. Comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors, and sheens available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish surfaces for verification of products, colors, and sheens.
   2. Finish area designated by Architect.
   3. Provide samples that designate primer and finish coats.
   4. Compatibility and Adhesion: Check after one week of drying and curing by testing in accordance with ASTM D3359; Adhesion by tape test. If the coating system is incompatible, additional surface preparation up to and including complete removal may be required.

5. Do not proceed with remaining work until the Architect approves the mock-up.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
   1. Product name, and type (description).
   2. Application and use instructions.
   3. Surface preparation.
   4. VOC content.
   5. Environmental handling.
   6. Batch date.
   7. Color number.

B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities, described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Furnish Owner with 1 gal (3.8 l) or 1 case, as appropriate for each type of paint applied to surfaces. Do not include dry fall coatings at exposed ceilings and MEP systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; ASD Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Fax: 440-826-1989; Email: request infospecifications@sherwin.com; Web:www.swspecs.com.

B. Requests for substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.

2.2 APPLICATIONS/SCOPE

A. Interior Paint and Coating Systems:
   1. Concrete: Poured, precast, tilt-up, cast-in-place, cement board, plaster.
   2. Concrete: Non-vehicular floors.
   3. Masonry: Concrete masonry units, including split-face, scored, and smooth block.
   4. Metal: Aluminum, galvanized steel.
   5. Metal: Structural steel, joists, trusses, beams, partitions, and similar items.
   6. Drywall: Drywall board, Gypsum board.

2.3 PAINT MATERIALS - GENERAL

A. Paints and Coatings:
   1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
   2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufactures product instructions for optimal color conformance.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use a primer categorized as "best" by the manufacturer.

C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

D. Color: Refer to Finish Schedule for paint colors, and as selected.

2.4 INTERIOR PAINT AND COATING SYSTEMS (LEED-V4 AND V4.1 NC/CI/CS COMPLIANT)

A. Concrete: Ceilings, Poured Concrete, Precast Concrete, Cement Board, Cast-In-Place including Plaster Ceilings.
   1. Dryfall Waterborne Topcoats:
      a. Flat Finish:
         1) 1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series.
         2) 2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series (6 mils. wet, 1.7 mils. dry per coat).

B. Masonry; CMU: - Concrete, Split Face, Scored, Smooth, High Density, Low Density, Fluted.
   1. Latex Systems:
      a. Eg-Shel / Satin Finish:
         1) 1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42W150 (75-125 sq ft/gal).
         2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
         3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils. wet, 1.7 mils. dry per coat).

2. Epoxy Systems; Waterbased:
    a. Eg-Shel/Low Luster Finish:
        1) 1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42W150 (75-125 sq ft/gal).
        2) 2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series.
        3) 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series (4.0 mils. wet, 1.5 mils. dry per coat).

C. Metal: Aluminum and Galvanized.
1. Latex Systems:
    a. Semi-Gloss Finish High Performance:
        1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils. wet, 2.0 mils. dry per coat).
        2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series.
        3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series (2.0-4.0 mils. dry per coat).

D. Metal: Galvanized; Ceilings, Duct work.
1. Dryfall Waterborne Topcoats:
    a. Flat Finish:
        1) 1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series.
        2) 2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series (6.0 mils. wet, 1.7 mils. dry per coat).

E. Metal: Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, and Ferrous Metal.
1. Latex Systems:
    a. Semi-Gloss Finish High Performance:
        1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils. wet, 2.0 mils. dry per coat).
        2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series.
        3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series (2.0-4.0 mils. dry per coat).

F. Drywall: Walls, Ceilings, Gypsum Board, and similar items.
1. Latex Systems:
    a. Eg-Shel / Satin Finish:
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils. wet, 1.5 mils. dry per coat).
        2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
        3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils. wet, 1.7 mils. dry per coat).
2. Epoxy Systems; Waterbased:
    a. Eg-Shel/Low Luster Finish:
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils. wet, 1.5 mils. dry per coat).
        2) 2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series.

3) 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series (4 mils. wet, 1.5 mils. dry per coat).

G. Concrete: Floors, non-vehicular.
1. Epoxy Systems:
a. Satin Finish:
1) 1st Coat: S-W ArmorSeal 8100 B70-8160 Series.
2) 2nd Coat: S-W ArmorSeal 8100 B70-8160 Series (5-12 mils. wet, 2-5 mils. dry per coat).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.
1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Aluminum: Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

C. Block (Cinder and Concrete): Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75 degrees F (24 degrees C). The pH of the surface should be between 6 and 9 unless the products are

designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

D. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

E. Copper and Stainless Steel: Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP 2, Hand Tool Cleaning.

F. Exterior Composition Board (Hardboard): Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard) must be cleaned thoroughly and primed with an alkyd primer.

G. Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth, and all dust removed prior to painting.

H. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply to a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.

I. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
   1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
   2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Beforehand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
   3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

4. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.

3.3 INSTALLATION

A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.

B. Do not apply it to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.

C. Apply coatings using methods recommended by manufacturer.

D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

F. Regardless of the number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.4 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION 09 91 23

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. DuraSeal DuraClear 1K Polyurethane Finish. (Clear Water Based Finish)

1.2 RELATED SECTIONS.

A. Section 09 64 00 - Wood Flooring.

1.3 REFERENCES

A. ASTM International (ASTM):
1. ASTM D523 - Standard Test Method for Specular Gloss.
2. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings.
3. ASTM D2369 - Standard Test Method for Volatile Content of Coatings.
4. ASTM D3828 - Standard Test Methods for Flash Point by Small Scale Closed Cup Tester.
5. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

1.4 SUBMITTALS

A. Product Data:
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

B. Verification Samples: Two representative units of each type, size, pattern, and color.

C. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.5 QUALITY ASSURANCE

A. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; Toll Free Tel: 800-4-SHERWIN (474-3794); Tel: 216-566-2000; Fax: 216-566-1392; Email:request info (specifications@sherwin.com); Web:http://www.sherwin-williams.com/pro/services/architects_designers|https://www.uniflexroof.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PRODUCT: DURASEAL DURACLEAR 1K POLYURETHANE FINISH

A. Basis of Design: DuraSeal DuraClear 1K Polyurethane Finish (Clear Water Based Finish). A single-component finish.
   1. Luster: Satin: 20-35 according to ASTM D523.

B. Product Properties:
   1. Number of Coats; 1-2.
   2. Dry Time: Based on thin coats, an average temperature of 77 degrees F and 50 percent relative humidity.
      a. Re-Coat: Within 2 hours. Meets ASTM D1640.
      b. Hot coat window 2 to 24 hours
   3. Dry Film Thickness: 0.6 mils (0.15 mm) per coat.
   4. Coverage: Approx. 500 to 600 sq ft per gallon (12.3 to 14.7 sq m per Liter)
   5. Odor: Mild Amine.
   6. Clean-Up: Clean application tools with warm water immediately after use.
   7. Storage: Store at room temperature. Keep container tightly closed.
      a. If stored at high temperature, cool to room temperature before use.
      b. Keep from freezing. Product is unusable if frozen.

C. Physical Properties:
   1. Resin Type: Urethane.
   2. Solids: 29 to 33 percent according to ASTM D2369.
   3. Solvent: Water, Tripropylene glycol n-butyl ether.
   4. Product Weight: 8.65 to 8.76 lbs per gallon (1.04 to 1.05 kg per L).
   5. Viscosity: 90 to 155 cps.

6. VOC: 1.04 lbs [er ga(125 grams per Liter) or less according to ASTM D3960
7. pH: 7.0 to 9.0.
8. Flash Point: Greater than 212 degrees F (100 degrees C) SETAFLASH according to ASTM D3828.

PART 3 - EXECUTION (BUFF AND RE-COAT)

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly constructed and prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by DuraSeal for achieving the best result for the substrate under the project conditions.
1. Buff as to not show swirl marks on existing finish. DuraSeal recommends 150 to 180 grit pads.
2. Vacuum and tack accordingly based on DuraSeal Product Data Page.
a. DuraSeal DuraClear 1K Polyurethane Finish (Clear Water Based Finish): Use water to tack and allow to dry thoroughly.

3.3 APPLICATION

A. DuraSeal DuraClear 1K Polyurethane Finish (Clear Water Based Finish):
1. Apply at 500 to 600 square feet per gallon with preferred application method.
2. If applying one coat allow to dry minimum overnight.
3. If a second coat is desired, apply second within hot coat window (2 to 24 hours) or buff if over 24 hours and recoat.

3.4 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer’s recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 09 93 00

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Visual display board assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For visual display units.
   1. Include plans, elevations, sections, details, and attachment to other work.
   2. Show locations of panel joints

1.3 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Warranty Period:
      a. 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 VISUAL DISPLAY BOARD ASSEMBLIES

A. Aluminum Frames: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape .
   1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints .
   2. Aluminum Finish: Clear anodic finish.

2.3 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high -gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
   1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
   2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
   3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 TACKBOARD PANELS

A. Tackboard Panels:
   1. Facing:
      a. Fabric, factory laminated to 1/4-inch- thick, cork sheet.
         1) Guilford of Maine, FR701, 380 Quartz
   2. Core:
      a. Manufacturer's standard.

2.5 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout ; with surface-burning characteristics indicated.

C. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd.; with surface-burning characteristics indicated.

D. Hardboard: ANSI A135.4, tempered.

E. Particleboard: ANSI A208.1, Grade M-1.

F. MDF: ANSI A208.2, Grade 130.

G. Fiberboard: ASTM C208 cellulosic fiber insulating board.

H. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

I. Extruded Aluminum: ASTM B221, Alloy 6063.

J. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies:
   1. Adhere to wall surfaces with adhesive gobs at 16 inches o.c., horizontally and vertically.
   2. Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

END OF SECTION 10 11 00

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Dimensional characters.
      a. Cutout dimensional characters.

B. Related Sections:
   1. 01 10 00 Summary of Work for Alternate Bids affecting work of this section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size .
   4. Show locations of electrical service connections.
   5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters : Characters with uniform faces; square-cut, smooth , eased edges; precisely formed lines and profiles; and as follows:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. A.R.K. Ramos.
      b. ACE Sign Systems, Inc.
      c. ASI Sign Systems, Inc.
      d. Diskey Sign Company.
   2. Character Material: Sheet or plate aluminum .
   3. Character Height: 6-inches tall .
   4. Thickness: 0.25 inch min.
   5. Font: As selected by Architect from manufacturer's full capabilities.
   6. Finishes:
      a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range .
   7. Mounting: As indicated on Drawings .

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into tapped lugs cast integrally into bottom of cast letter material, for mounting to a continuous stainless steel rail. Entire Sign (lettering plus rail) mounts to exterior entrance canopy.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Stainless Steel Brackets: Factory finish brackets finish unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10 14 19

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Panel signs.

B. Related Requirements:
   1. Section 01 50 10 "Temporary Facilities for Renovation Projects" for temporary Project identification signs and for temporary information and directional signs.
   2. Section 14 21 23 "Electric Traction Passenger Elevators (Machine Roomless)", Section 14 24 13 "Hydraulic Freight Elevators", and Section 14 31 00 "Escalators" for code- required conveying equipment signage.
   3. Section 22 05 00 "Common Materials & Methods for Fire Suppression, Plumbing & HVAC" for labels, tags, and nameplates for plumbing systems and equipment.
   4. Section 26 05 00 "Common Work Results for Electrical" for labels, tags, and nameplates for Electrical systems and equipment.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
   2. Product Data: For adhesives, indicating VOC content.

3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For panel signs.
1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.

E. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
1. Room-Identification Signs: Full-size Sample.

F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SIGNS, GENERAL

A. Regional Materials: Products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.3 PANEL SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASI Sign Systems, Inc.
   2. Essential Architectural Signs, Inc.
   3. Inpro Corporation.
   4. Sign Solutions, Inc.

B. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Solid-Sheet Sign: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:
      a. Base Thickness: 0.080 inch.
   2. Mounting: Surface mounted to wall with two-face tape.
   3. Surface Finish and Applied Graphics:
      a. Painted Finish and Graphics: Manufacturer's standard, factory-applied exterior-grade sign paint on second surface, in color matching Architect's sample.
   4. Text and Typeface: Accessible raised characters and Braille, Helvetica Medium font and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
   5. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

2.4 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.5 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Internally brace signs for stability and for securing fasteners.
   6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to the accessibility standard.
   3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Panel Signs: Install in locations on walls as indicated and according to accessibility standard.

C. Mounting Methods:
   1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

SECTION 10 21 13.13 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Painted steel toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Color Samples: For Initial Selection. Color selected by Architect from Manufacturer's complete line of painted compartment colors.

C. Shop Drawings: For toilet compartments. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PAINTED STEEL TOILET COMPARTMENTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ASI Global Partitions; ASI Group.
2. Bradley Corporation.
3. Flush Metal Partition, LLC.
4. General Partitions Mfg. Corp.
5. Hadrian Manufacturing Inc.
6. Metpar Corp.

B. Toilet-Enclosure Style: Floor Anchored - Overhead Braced .

C. Urinal-Screen Style: Wall-Mounted .

D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf (1112 N), when tested according to ASTM F446, without deformation of panel.
3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

E. Facing Sheets and Closures: hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:
1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch.
2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch.
3. Panels: Manufacturer's standard thickness, but not less than 0.030 inch .
4. Doors: Manufacturer's standard thickness, but not less than 0.030 inch.

F. Pilaster Shoes and Sleeves (Caps): Stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

G. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets; stainless steel .
2. Continuous Type: Manufacturer's standard, stainless steel.

H. Steel Sheet Finish: Manufacturer's standard baked-on finish.
1. Color: As selected by Architect from manufacturer's full range .
a. Allow for application of one color in each room.
b. A different color will be specified / selected for Men's and Women's Restrooms.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
1. Material: Stainless Steel. Zamac will not be accepted .
2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
   2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.
   3. Continuous Brackets: Secure Urinal Screens to walls with continuous brackets.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.13

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corner guards.

B. Related Requirements:
   1. Section 06 40 23 "Interior Architectural Woodwork for solid-wood handrails, bumper rails, chair rails, or corner moldings without plastic bumpers.
   2. Section 08 71 00 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.
   1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.2 CORNER GUARDS

A. Surface-Mounted, Opaque-Plastic Corner Guards - CG1 : Fabricated as one piece from uPVC ; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
   1. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
   2. Mounting: Adhesive.
   3. Color(s): As indicated on drawings .

2.3 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Adhesive: As recommended by protection product manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

END OF SECTION 10 26 00

SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Products included in this section are ISU Terre Haute Campus Standard Toilet Accessories.

B. Furnish and install accessories where shown on the Drawings and specified herein. Work of this Section includes prefabricated framed mirrors up to and including units measuring 4'-0" wide x 6'-0" high. Fully review Drawings to confirm items located in restrooms and other areas.

1.2 SUBMITTALS

A. Submit product data to the Architect for approval in accordance with Division 1 specifications.

1.3 PRODUCT HANDLING

A. Packaging:
   1. Furnish all accessories and concealed mounting devices with each unit clearly marked or numbered in accordance with the schedule.
   2. Pack each item complete with all necessary pieces of fasteners.
   3. Properly wrap and cushion each item to prevent scratches during delivery and storage.

B. Delivery, Storage and Handling:
   1. Deliver all accessories to the installers in a timely manner to ensure orderly progress of the total work.
   2. Deliver items in manufacturer's original unopened protective packaging.
   3. Store materials in original protective packaging to prevent physical damage, or wetting.
   4. Handle so as to prevent damage to finished surfaces.
   5. Maintain protective covers on all units until installation is complete. Remove covers at final clean-up of installation.

C. Coordination:
   1. Provide all information as requested by other trades so that they may provide cutouts and blocking that occur in their work for the installation of the accessories.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Accessory items listed hereinafter are intended to be manufacturer's current standard catalog items of institutional design and construction and are scheduled on the drawings as enumerated herein:
   1. Prefabricated, Framed Mirrors
      a. Manufacturer: Bobrick Washroom Equipment, Inc. or approved equal.
      b. Model: B-290 (See drawings for mirror size)

c. Material:No. 1 quality 1/4" polished plate glass mirror with stainless steel channel frame. Concealed hangers for frame.
d. Finish: Bright polished (frame)

2. Grab Bars
   a. Manufacturer: Bobrick Washroom Equipment, Inc. or approved equal.
      1) Model: B-5806 x 42", 18", and 36"
   b. Material: Type 304, 18 gauge, Stainless Steel
   c. Finish: Satin
   d. Every stall sized for accessibility by the disabled shall be provided with grab bars in compliance with A.D.A. Title III Design Guidelines.
3. Sanitary Napkin-Tampon Disposal: Provide Disposal Unit for every Women's stall or Public Single-Use Restroom
   a. Manufacturer: Rubbermaid (no substitutions ISU Standard)
   b. Model: 6140
   c. Material: plastic
   d. Color: white
   e. Supplier – abc
4. Waste Receptacle: Provide in every Public-Use Restroom
   a. Manufacturer: Impact Products (no substitution ISU Standard).
   b. Model: 7703 (41 quart)
   c. Material: plastic
   d. Color: grey
   e. Supplier – abc
5. Toilet Paper Holders
   a. Twin Roll Jumbo (2-9” Jumbo): Provide at all Public / Adult-Use Restrooms
      1) Manufacturer: Prime Source (no substitution ISU Standard).
      2) Model: #34017742100
      3) Color: Translucent Black
      4) Supplier – abc
   b. Double Roll : Provide at Children's Use Toilets and Restrooms
      1) Manufacturer: Impact Products, LLC www.impact-products,com (no substitution ISU Standard).
      2) Model: #2501
      3) Color: Silver
      4) Supplier – abc
6. Paper Towel Dispenser : Provide at all locations where Paper Towel Dispensers are indicated
   a. Manufacturer: Scott (no other substitution ISU Standard).
   b. Model: #46253-00
   c. Color: Smoke Plastic
   d. Supplier – Staples
7. Foam Soap Dispense: Provide at all locations where Soap Dispensers are indicated.
   a. Manufacturer: GoJo (no substitution ISU Standard)
   b. Model: 957836 (Staples #) Foam hand soap
   c. Color: ADX12 Chrome/Black Plastic
   d. Supplier – Staples

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:
   1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
      a. Verify that blocking has been provided in walls at all accessory locations. Do not mount accessories to stud-framed walls where blocking has not been correctly installed. Notify the Contractor of missing blocking and coordinate installation of blocking and repair and refinish of wall prior to installation of accessories.
   2. Verify that accessories may be installed in accordance with the original design, all pertinent codes and regulations, and the referenced standards.
   3. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Architect/Owner.
   2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

A. Anchor all accessories rigidly and securely in place so that accessories are level, plumb, and true-to-line. Fit tightly to surfaces to which they are attached. Use mounting techniques in accordance with the appropriate manufacturer's instruction. Conceal anchorage wherever possible.

B. Install manufacturers recommended anchor system for all grab bars.

C. Conceal evidence of drilling, cutting and fitting on adjacent finishes.

D. Fit flanges of accessories snug to wall surfaces. Provide for caulking in gaps between 90 degree return flanges and finish wall surface after accessories are installed.

3.3 COMPLETION OF WORK

A. Repair or remove and replace all defective or damaged materials and equipment to the satisfaction of the Architect and at no additional cost to the Owner.

B. Adjust accessories for proper operation.

C. Clean and polish exposed surfaces prior to final inspection.

D. Deliver accessories schedule, keys and parts manual as part of project close-out documents. For Owner's permanent records, provide two sets of the following items of manufacturer's literature:

1. Technical data sheets of each item used for the project.
2. Service and parts manuals.
3. Name of local representative to be contacted in the event of need of field service consultation.

END OF SECTION 10 28 13

SECTION 10 43 13 - AUTOMATED EXTERNAL DEFIBRILATOR

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install automated external defibrillator (AED) where indicated on the drawings.

B. The AEDs shall be battery powered and will report when activated via an analog PABX/KSU station line.

1.2 SUBMITTALS

A. The following items shall be submitted for approval prior to ordering.
   1. Automatic External Defibrillator

B. Submit the above information in PDF Format.

1.3 WARRANTY

A. Defibrillator eight (8) years

B. Battery four (4) years

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Automatic External Defibrillator
   1. Battery powered. Battery includes 4-year warranty.
   2. Monitored by ISU Fire Alarm Network via Owner provided interface module, as a Priority 2 Supervisory alarm that notifies Public Safety and they’re supposed to respond.

B. Manufacturer and Model Number
   1. Basis of Design: Cardiac Science Powerheart G5 Model G5A-80A-P AED with optional Intellisense™ CPR Feedback monitors the quality of both chest compression depth and rate if either compression rate or depth is outside of the 2015 American Heart Association acceptable parameters.
      a. Fully Automatic
      b. One (1) set of standard adult pads
      c. One (1) set of Child / Pediatric Pads
   2. Cabinets
      a. Semi - recessed with alarm/security (50-00400-20):
      b. Fully recessed cabinet with alarm, security enable
   3. All others must submit for approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring
   1. All exposed wiring shall be in raceway.
   2. All cable above ceiling, not in raceway, shall be plenum rated cable.

B. Automatic External Defibrillator
   1. All installations shall be per Manufacturer’s recommendations and using good electrical practices.

END OF SECTION 10 43 13

SECTION 10 44 13 - FIRE EXTINGUISERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Fire extinguisher cabinets.
   2. Fire extinguisher identification signs.
   3. Fire extinguisher

B. Related Sections include the following:
   1. Division 07 Section “Sealants”

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
   1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.4 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

A. Manufacturer: J. L. Industries
   1. Model Number: Academy
   2. Installation: Full Recessed
   3. Interior Material: 20 gauge, cold-rolled steel – Provide rated box if required to maintain wall fire rating

4. Interior Size: 24"H x 9 ½"W x 6"D
5. Interior Finish: White baked enamel
6. Door Type: Vertical Duo
7. Door and Trim Material: Stainless Steel #304
8. Door and Trim Finish: #4
9. Lettering: Red vertical die cut lettering
10. Glass: Break glass (Laminated Safety Glass)
11. Hardware: Manufacturer's Standard

B. Or Equal Submitted to and approved by Architect prior to bidding.

2.2 IDENTIFICATION

A. Identify fire extinguishers with the words "FIRE EXTINGUISHER" in red letters on a white background metal sign, both sides, bracket mounted perpendicular to wall surface above the extinguisher.

B. Lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as directed by Architect.

2.3 FIRE EXTINGUISHERS

A. Fire Extinguisher Manufacturer and Type
1. Buckeye – no substitutions campus standard
2. Dry Chemical
3. 5lb
4. Type A B C

PART 3 - EXECUTION

3.1 INSTALLATION

A. General - Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulation of governing authorities.

B. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

END OF SECTION 10 44 13

SECTION 10 53 00 - MANUFACTURED CANOPIES

PART 1 - Part 1: General

1.1 Description of Work

A. Work in this section includes furnishing and installation of extruded aluminum overhead hanger rod style canopies as manufactured by Mapes Industries Inc.

B. Related Items and Considerations
1. Flashing of various designs may be required. Generic flashing supplied by Mapes. Specialty flashing to be supplied by installer.
2. Determine wall construction, make-up and thickness.
3. Ensure adequate wall condition to carry canopy loads where required.
4. Consider water drainage away from canopy where necessary.
5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.2 Submittals

A. Delegated Design: Submit calculations for design certified by a Professional Engineer licensed in the State of Indiana, who is responsible for the design.

B. Shop Drawings: Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.
1. Contractor shall confirm dimensions prior to requesting shop drawing submittals from the manufacturer.

C. Product Data: Manufacturer's standard Product Data indicating system, features, and finishes.

D. Warranty: Copy of manufacturer's warranty for system and finishes.

1.3 Quality Assurance

A. Products meeting these specifications established standard of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska 1-888-273-1132.

1.4 Field Measurement

A. Confirm dimensions prior to preparation of shop drawings when possible.

B. If requested, supply manufacturer s standard literature and specifications for canopies.

C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.5 Performance Requirements

A. Canopy must conform to local building codes.

B. PE Stamped calculations are required and must be signed and sealed by an engineer licensed within the state canopy is installed.

1.6 Deliver, Storage, Handling

A. Deliver and store all canopy components in protected areas.

PART 2 - PRODUCTS

2.1 Manufacturer

A. Mapes Canopies, Lincoln, NebraskaPhone: 1-888-273-1132.Fax: 1-877-455-6572.
   1. Basis of Design Product: Mapes Cantilever Supershade.
   2. Acceptable Equal: Lawrence Fabric & Metal Structures LSF - FLA Steel Internal Outrigger System similar to Basis of Design.

2.2 Materials

A. Sun shading elements shall consist of extruded aluminum blades (min. .110 thickness)

B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.

C. Cantilever support brackets:
   1. Finish to match canopy.
   2. Design engineered by manufacturer.

D. Fascia shall be standard extruded 8" J style.

2.3 Finishes

A. Finish type shall be 2-Coat Kynar Finish.

2.4 Fabrication

A. All Mapes SuperShade aluminum canopies are shipped with the materials precut to size for field assembly.

B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Downspout From Fascia.

PART 3 - EXECUTION

3.1 Inspection

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.2 Installation

A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 After installation, entire system shall be left in a clean condition.

END OF SECTION 10 53 00

SECTION 10 57 23.16 - PLASTIC LAMINATE-CLAD CLOSET AND UTILITY SHELVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Shelf standards, brackets, and accessories.

B. Closet hardware and accessories.

C. Miscellaneous wall brackets and accessories.

1.2 RELATED SECTIONS

A. Section 06 23 00 - Finish Carpentry.

1.3 REFERENCES

A. ANSI/BHMA A156.9, American National Standard for Cabinet Hardware.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Shelf standards and brackets meet or exceed the ANSI performance standards as established by ANSI/BHMA A156.9.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 WARRANTY

A. Provide manufacturer's standard limited lifetime warranty.

1.8 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Deliver extra sets of hardware items for Owner's use in maintenance.
   1. Furnish 12 extra standard straight brackets of each size required; deliver to location designated by Owner in original packaging.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Knape & Vogt Mfg. Co., which is located at: 2700 Oak Industrial Dr. N.E.; Grand Rapids, MI 49505-6083; Toll Free Tel: 800-253-1561; Tel: 616-459-3311; Fax: 616-459-0249; Email:request info (carol.johnson@kv.com); Web:https://www.knapeandvogt.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00

2.2 SHELVING SYSTEMS: SUPER-DUTY 87 SERIES STANDARDS / 186/187 SERIES BRACKETS

A. Super Duty Shelf Standards and Brackets:
   1. Shelf Standard Components: Super-Duty 87 Standard single-slotted channel wall standards. Standards mounted to suitable wall surface with mounting hardware 16 inches (406 mm) o.c. is capable of supporting 540 to 1,060 pounds per pair of brackets when properly installed.
      a. Face Width: 7/8 inch (22 mm), single slotted.
      b. Material:
         1) Material and Finish: Steel, White, powder-coat; provide screws with matching heads, ROHS compliant.
      c. Lengths: As required to support shelving indicated but not less than four feet.
   2. Straight Shelf Bracket Components: Steel, reinforced, locking into slots with molded nylon cam lock lever; size to suit shelves. Brackets adjustable in 2 inch (50.8 mm) increments along entire length of standard, drilled and countersunk for screws.
      a. Shelf Brackets:
         1) Triple Lug Model 187.
         2) Stainless Steel 18" (KV# 187LL SS 18)
         3) 12 gage steel, reinforced, locking into slots with molded nylon cam lock lever; size to suit shelves; same finish as standards.
   3. Shelving:
      a. Shelving: Model 1987 SS Series: Stainless Steel; mounted 32 inches on center for use with 87 SS/186 SS/187 SS shelving system; screws included.
      b. Shelving: 3/4" thick particle board with White, thermally-fused, melamine surface on all sides, for use with brackets indicated.
   4. Steel Shelf Rests and Rubber Shelf Cushions: Provide as required to fasten shelves to shelf brackets.
      a. Type: Shelf rests, end: Model 210: Connects one shelf to end of shelving run.

b. Type: Shelf rests, center: Model 211: Connects two shelves together at center of shelves.
c. Type: Shelf rests, front: Model 212: Connects two shelves together at front of shelves
d. Type: Shelf rests, front: Model 213: Connects two shelves together at center of shelves
e. Type: Shelf cushions, rubber: Model 129.

B. Heavy Duty Pilaster Shelf Standards and Brackets (@ Reception Display):
1. Shelf Standard Components: Heavy-Duty 255 single-slotted channel wall standards. Surface or Flush mounted standards mounted to a suitable wall surface with mounting hardware 16 inches (406 mm) o.c.
a. Face: 5/8 inch (16 mm) wide by 3/16 inch (4.8 mm) deep, single slotted.
b. Material and Finish:
1) Steel, White, powder-coat; provide nails and/or screws with matching heads.
c. Lengths: As indicated on Drawings.
2. Shelving Support for use with 255 standards:
a. Model 256R, includes Rubber Cushion for Glass Shelves: Steel, Zinc, electroplated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces and components to receive hardware using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount standards to solid backing capable of supporting intended loads. Install standards using fasteners suitable for supporting intended loads.

C. Install brackets sand accessories as indicated on the Drawings.

D. Install shelving, and accessories as indicated on the Drawings.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 57 23.16

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes basis of design residential appliances provided by the Owner:
   1. Refrigeration appliances.
      a. Classroom Refrigeration Appliances.
      b. Resource Room Refrigeration Appliances.
   2. Cleaning appliances.
      a. Laundry Room Washers and Dryers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer : One-door refrigerator with freezer compartment inside and complying with AHAM HRF-1.
   1. <Click here to find, evaluate, and insert list of manufacturers and products.>
   2. Type: Freestanding .
   3. Storage Capacity:
      a. Refrigeration Compartment Volume: [**15.6 cu. ft.**] <**Insert volume>**.
      b. Freezer Volume: [**5.13 cu. ft.**] <**Insert volume>**.
   4. General Features:
      a. Dispenser in door for [**and**] [**with dispenser lock**].
      b. Interior light in refrigeration compartment.
      c. Manual defrost.
   5. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.

B. Refrigerator/Freezer : Two-door refrigerator/freezer with freezer on top.
   1. <Click here to find, evaluate, and insert list of manufacturers and products.>
   2. Type: Freestanding.
   3. Storage Capacity:
      a. Refrigeration Compartment Volume: [15.6 cu. ft.] <Insert volume>.
      b. Freezer Volume: [5.13 cu. ft.] <Insert volume>
   4. General Features:
      a. Interior light in refrigeration compartment.
      b. Manual defrost.

2.3 CLEANING APPLIANCES

A. Clothes Washer :
   1. Basis-of-Design Product: Whirlpool Corporation; 4.5-cu ft High Efficiency Stackable Steam Cycle Front-Load Washer #WFW5605MW .
      a. https://www.lowes.com/pd/Whirlpool-Front-Load-Washer-White/5013208987
   2. Type: Freestanding , front-loading unit.
   3. Capacity: 4.5 cu. ft. .
   4. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
   5. Appliance Finish: Enamel .
   6. Front-Panel Finish: Manufacturer's standard .

B. Clothes Dryer :
   1. Basis-of-Design Product: Whirlpool Corporation; 7.4-cu ft Stackable Electric Dryer # WED5605MW.
      a. https://www.lowes.com/pd/Whirlpool-7-4-cu-ft-Electric-Dryer-White/5013208995
   2. Type: Freestanding , frontloading, electric unit.
   3. Capacity: 7.4 cu. ft. .
   4. Features:
      a. Interior drum light.
      b. Stacking kit to stack dryer over washer.
   5. Appliance Finish: Enamel .
   6. Front-Panel Finish: Manufacturer's standard .

PART 3 - EXECUTION

3.1 INSTALLATION - BY OWNER

A. Contractor shall provide all plumbing, electrical, and ventilation requirements for residential appliances provided by the Owner. Coordinate building systems with actual appliance data from the Owner (ECEC Director Holly Curtsinger).

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Refrigerator Anti-Tip Device: Install at each classroom refrigerator according to manufacturer's written instructions.

END OF SECTION 11 30 13

SECTION 11 40 00 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related work specified elsewhere:

1. Instruction to Bidders
2. Mechanical Division
3. Electrical Division

B. Food Service Equipment Contractor or abbreviation FSEC means the Person, Company, or Corporation, which will contract for the work specified.

C. Work by Mechanical Contractor
   1. Roughing-in all required mechanical services as shown on drawings provided by FSEC after bidding.
   2. Furnish and install all piping, traps, tailpieces, loop vents, stoops, and related items necessary to make the final connections from the rough-in to the connection points on the equipment.
   3. Install the following items, which are furnished by the FSEC: faucets, disposers, vacuum breakers, solenoid valves, check valves and related items.
   4. Work required by any notes on the Food Service Equipment drawings
   5. Make all final connections from point of rough-ins shown on the plans and specifications to the connection points on the equipment.
   6. Install all kitchen equipment items as noted to be provided by owner on Food Service Equipment Drawings.
   7. Provide and install all backflow prevention devices required by local and state plumbing code for kitchen equipment.
   8. Disconnect all existing equipment in old kitchen as noted on drawings and in specifications as existing for removal and relocation at time as to be determined for reuse of equipment in new kitchen.
   9. Provide all final connections from point of rough-ins to the connection points on any old used existing equipment relocated to new kitchen for items determined to be reused.
   10. Provide gas supply line and final connections to rooftop make-up air supply unit for kitchen hood.
   11. Install floor troughs provided by FSEC and make necessary drain connections.

D. Work by Electrical Contractor
   1. Roughing-in all required electrical services as shown on drawings provided by FSEC after bidding.
   2. All final connections from point of rough-ins shown on the plans and specifications to the connection points on the equipment.

3. Furnish and install all disconnects, conduit, wire, flexible conduit, cover plates, fittings as required to make the final connections from the junction box to the equipment.
4. All interwiring of fire system to fuel shut-offs. Provide fuel shut-offs and shunt trip breakers where required.
5. Provide all final connections from point of rough-ins to the connection points on any old used existing equipment relocated to new kitchen for items determined to be reused.

E. Work by General Contractor
1. Drill through walls and provide sleeves where shown or required. Provide sleeves through wall for refrigeration lines and electrical conduits for remote refrigeration units.
2. Provide and install back-bracing in walls where required.
3. Provide fire rated chases as needed for hood welded exhaust duct access to wall openings as required.
4. Provide wall penetrations and setting and flashing of curbs for kitchen exhaust system fans/furnaces when required.

F. Work by the Food Service Equipment Contractor
1. The furnishing, delivery to the building, uncrating, setting in place, leveling and scribing to the walls, or floor, as required, all Food Service Equipment covered herein.
2. The furnishing of all electrical service fixtures directly attached to the equipment, as called for herein or shown on the drawings.
3. When work covered by this specification connects to equipment furnished by others, FSEC shall check the equipment in the field for the proper connections to such equipment. When an item is called out in the specifications as "existing", "future" or "by owner", the FSEC shall verify the make, model number and size of the equipment and make provisions on the rough-in drawing for these items.
4. The Owner has right of first refusal to all existing equipment. Existing equipment not being reused or claimed by the owner to be removed by the General Contractor and disposed of as directed.

G. Preparation of Bid
1. FSEC is to submit itemized list of equipment in duplicate, listing manufacturer's name and model number with separate price shown for each item. Owner reserves the right to delete any item of equipment from list.
2. Each bidder will submit, with their bid, the name of the fabricator who will be used to manufacture the items specified or listed "fabricated" in the itemized specifications. The Architect and/or Owner reserve the right to accept or reject any fabricator without recourse. Bids submitted without these items are subject to rejection.

1.02 QUALITY ASSURANCE

A. All equipment installed under these specifications shall be manufactured and installed in strict compliance with all codes, regulations and requirements of the Indiana State Board of Health, all local Health and Sanitation Authorities, and the National Sanitation (NSF) Standard #2.

B. All electric equipment shall conform to the standards of the NEMA and shall be UL approved, where applicable standards have been set, or otherwise conform to the jurisdictional authorities.

C. All equipment installed shall be of latest design. Any improvements made in design or construction of prefabricated items after this contract has been awarded and before equipment is delivered to the site, shall be incorporated in the equipment, provided such incorporation does not affect date of delivery of equipment.

D. Fabricated equipment, described in the following itemized specifications, is required to be manufactured by one equipment manufacturer, who has the facilities to detail and fabricate highest quality of equipment in strict compliance with appropriate standards of NSF. Accepted fabricators are as follows: Conover Custom Fabrication, Indianapolis, IN.

1.03 SUBMITTALS

A. Provide all submittals for review per the following:
   1. Electronic Format: FSEC to retain one hard copy for their records and submit one set through proper channels for review electronically.

B. The FSEC shall prepare sets of detailed drawings and brochures as follows:
   1. Equipment Fabricator shop drawings prepared on a ¾" = 1'-0" scale.
   2. All necessary cross-section drawings - scale at 1-1/2" =1'-0".
   3. Roughing-in drawings - scale 1/4" = 1'-0".
   4. Properly bound and identified brochures on all buy-out equipment.
   5. Drawing of walk-in cooler/freezer systems including panels, refrigeration details, and proposed piping requirements.

All the above drawings and brochures are to be submitted at the same time. The above shall be delivered to the Architect within 30 days following signing of the contract.
Changes or corrections shall be noted and returned to the FSEC. FSEC shall revise drawings and brochures, if necessary, and return eight (8) complete sets to the Architect for distribution to other trades involved with the kitchen area. FSEC shall be solely responsible for any errors and omissions on approved drawings.

C. The FSEC shall furnish to the other contractors doing work in the kitchen area, proper instructions regarding these rough-in drawings and shall ascertain that all items furnished by others are properly set and installed during the progress of the work.

D. Drawings showing a detail of duct locations, and locations of any special wall opening, or floor detail are also required and shall be submitted as part of roughing-in drawings.

E. Submit an electronic copy of the maintenance and operating instructions to the Architect or Construction Manager for approval.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The FSEC is responsible for all deliveries and for the unloading and storing of all equipment to be installed by him under this contract. Equipment shall not be shipped to the project unless the FSEC is at the job site and has the necessary manpower and unloading equipment to properly handle each item of equipment.

B. All equipment shall be received at the building fully protected. It will be the responsibility of the FSEC to protect his equipment until accepted by the Architect or Owner.

1.05 JOB CONDITIONS

A. The FSEC shall be responsible for checking the building conditions for access into the building and to the Kitchen area. If it is necessary to have hoisting equipment, or to remove any door, doorframe, wall, or window, FSEC shall assume the cost of this work.

1.06 SPECIFICATIONS

A. NOTE: All equipment to be bid as specified. If Bidder desires to substitute another manufacturer in lieu of item specified, they must request approval within ten (10) days prior to the bid date. Requests need to be submitted to Architect complete with information of manufacturer's name, model number, etc. If approved, Architect will issue addendum to all Bidders of record.

B. The basis for the design of all the drawings, specifications and detail references is the manufacturer and model listed for each item in section 3.06. If in any case another manufacturer is listed by the FSEC, it is the responsibility of the FSEC to provide a model that is equal in production capabilities, capacity and performance to the listed manufacturer and model number. The FSEC is also to verify, coordinate and allow for proper installation of equipment; considering possible revisions for utility connections, loads and physical sizes. In the event there are any upcharges or change orders by other trades as a result of the FSEC submitting another listed manufacturer, those charges shall be the sole responsibility of the FSEC.

1.07 GUARANTEE

A. The FSEC shall execute and deliver to the OWNER a "Letter of Guarantee" covering all workmanship and materials for a period of one (1) year from the date of acceptance by the Architect, or first day's use by Owner, whichever comes first.

B. FSEC shall warrant to repair or replace any defective part or material at his own expense, upon notice from Architect or Owner in this one-year period.

C. All compressors shall have an additional four (4) year warranty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. STAINLESS STEEL
1. U.S. Standard gauges specified.
2. Type 302 or Type 304, composition:
18% minimum chromium
8% minimum nickel
2/10th% maximum carbon
3. Mill finish 180 grit one side with not less than 100 grit other side.
4. Sheets shall bear manufacturer's trademark designating type and heat number.
5. All sheets stretcher leveled.
6. Hard ground finish not acceptable.

B. GALVANIZED IRON
1. Approved grade low carbon steel or copper bearing steel.
2. Commercial quality.

2.02 FABRICATION AND MANUFACTURE

STAINLESS STEEL

A. Leg Assemblies
1. Legs 1-5/8" O.D., stainless steel.
2. Cross-rails 1-1/4", stainless steel.
3. Cross-rails welded to legs ground and polished to a smooth fillet.
4. Feet to be stainless steel, adjustable, bullet shape with 1-1/2" adjustable minimum.
5. Feet to have vermin-proof closed bottoms and unexposed threads.
6. Legs attached to tops with stainless steel gussets welded to tabletop.
7. Legs to be removable, held by set screws to gussets.
8. Leg spacing not more than 5'-0" O.C., connected with cross braces unless otherwise noted.

B. Doors
1. To be insulated double pan stainless steel construction with recessed handles.
2. Attach to enclosed mullions with stainless steel piano hinges.

3. All screws to be stainless steel
4. All cabinets to be sealed to the wall with Dow Corning # 732 Clear sealant.

C. Table Tops
1. 14-gauge stainless steel
2. All seams and corners welded.
3. Heights to be adjustable from 34" to 35".
4. All reinforced with 4" x 1" 14 gauge “c”channel underbracing, galvanized standard in all prep areas and 14 gauge stainless steel standard in all dishrooms and water related areas.
5. Any studs to have chrome plated acorn nuts.
6. Cross members at each pair of legs, length and width.
7. Two angles welded lengthwise on the underside of tops up to 30" wide. Angles spaced maximum 24" O.C. on tops over 30" in width.
8. Undercoated with approved sound-deadening material.
9. Unless against wall and/or other equipment otherwise noted, to turn down 1-1/2" at 90 degree and back 3/4" at 45°.
10.Where tops are against walls and/or other equipment, provide 8" high backsplash with 2-1/2" return at 45 degree and down ½". All horizontal and vertical corners to be ¾" cove. End of splashes welded closed.

D. Stainless Steel Counters
1. Tops to be 14-gauge stainless steel, unless against wall and/or other equipment otherwise noted, to turn down 1-1/2" at 90 degree and back 3/4" at 45 degree.
2. End and backsplash to turn up 4” with 1” return to wall and down ½”.
3. Attach to wall with “Z” clips.
4. Top to be sound deadened.

E. Cabinet Body
1. To be constructed of 18-gauge stainless steel.
2. All front corner and door mullions to have enclosed double wall construction with no raw edges.
3. All intermediate and bottom shelves to be 18-gauge stainless steel and to turn up 2” at rear and ends with coved corners.

F. Base
1. To be of 14-gauge stainless steel and shall be welded to counter body.
2. Front base to be recessed 2” behind front of counter body.

G. Dishtables
1. 14-gauge stainless steel tops with s/s underbracing.
2. Backsplash 10” high with 2-1/2” return @ 45 degree and down ½”.
3. Edges not adjacent to walls and/or other equipment to have 3” high 1-1/2” 180 degree rolled rim, corners bullnosed.
4. Tops slope to dishwasher, sink, trough, cone and/or quick drain.
5. At dishwashers turn down per manufacturers recommendation, bolt and seal.

6. Pass-thrus shall be integral with top and backsplash.
7. Quick drains to be 4” wide x 3” deep integral with top with removable perforated splash cover, and 1” chrome plated brass drain.
8. Undercoated with approved sound-deadening material.
9. All horizontal and vertical corners to be ¾” cove, end of splashes welded closed.

H. Drawers
1. Bodies 18-gauge stainless steel.
2. Face 14-gauge stainless steel welded to drawer liner frame.
3. Drawer slides to be sloped, mounted on angle frame with nylon roller bearings.
4. Pan slide assemblies to be removable.
5. Size 20" x 20" x 5".

I. Sinks
1. 14-gauge stainless steel welded integral with top.
2. Corners to have ¾" cove welded, smoothed and polished on interior and exterior.
3. Multiple sinks to have 1” divider partitions between compartments and one piece s/s front apron.
4. Scrap sinks to have “H” style removable rack guides.
5. All sinks to have lever handle waste except where disposer is specified. All pot and pan sinks to have lever waste with rear connected overflow.
6. Faucet to be T & S Brass and Bronze with removable seats.
7. All sink sections shall be mounted on legs, complete with cross braces at front and ends.

J. Drainboards
1. 14-gauge stainless steel welded integral to sinks.
2. Rims and backsplash to match sinks coved ¾".
3. Slope to sink.
4. Two (2) legs, with cross braces between legs, are required for support when drainboard length does not exceed 54". A minimum of four (4) legs are required for drainboards over 54".

K. Undershelves
1. 18-gauge stainless steel welded to each leg or removable type as specified.
2. Supported by connecting rails or notched and welded to each leg.

L. Overshelves
1. 12" wide or less 16-gauge stainless steel.
2. Wider than 12", 14-gauge stainless steel.
3. Ends and front turn down 1-1/2" at 90 degrees and under 1/2" at 45°.
4. When adjacent to wall or fixtures turn up 1-1/2" with a minimum of 3/4" cove.
5. All corners welded, ground and polished.
6. Supporting brackets to be 14-gauge stainless steel cantilever type.
7. When specified as table mounted, support with 1-1/4" stainless steel tubing going thru ferruled openings in tabletop or backsplash and braced below tabletop.

M. Wall Shelves

1. 16-gauge stainless steel.
2. When adjacent to wall or fixtures turn up 1-1/2”.
3. All corners welded, ground and polished.
4. Supporting brackets to be 14-gauge stainless steel cantilever type.

N. Disposer Troughs
1. 14-gauge stainless steel.
2. Slope to disposer approximately ¼" per foot.
3. Provide water inlet, plumbed to disposer solenoid by Division 15.
4. Provide removable stainless steel silver saver in trough.
5. Disposer to mount so legs are a minimum of 4" from front of table.

O. Grinding, Polishing and Finishing
1. All joints, including field joints, unless otherwise specified, shall be welded and suitably ground flush with adjoining material and neatly finished to harmonize with same. Wherever materials have been depressed or sunken in by the welding operation, such depressions shall be hammered and peened flush with the adjoining surfaces, and again ground to eliminate low spots. All ground surfaces shall be polished or buffed to match adjoining surfaces, consistent with good workmanship. Care shall be exercised in all grinding operations to avoid excessive heating of the metal and metal discoloration.
2. The texture of the final polishing operation shall be uniform and smooth. The general finish of all metal shall e of a high grade. Wherever sheared edges occur, they shall be free of burrs and projections to eliminate all danger of cutting and laceration when the hand is drawn over sheared edges. Where miters or bullnosed corners occur, they shall be neatly finished with the under edge of the material neatly ground to a uniform condition and in no case shall overlapping of materials be acceptable. It is the intention of the specifications to cover equipment of a high quality finish consistent with the highest grade of manufacturing practice in the industry.

PART 3 - EXECUTION

3.01 INSPECTION

A. It is the responsibility of the FSEC to continually be aware of the progress of the entire project and especially that part of the project affecting his work

B. Before any floor is poured, it is the responsibility of the FSEC to check all roughing-in, wall openings, floor depressions, and to notify the Architect and the Sub-Contractor involved, in writing, of any errors, and/or omissions. The FSEC shall not be held responsible for any omissions of roughing-in if said roughing-in was on the drawings used by the mechanical and electrical contractors. FSEC will be responsible for any and all omissions required on the project, but not shown on his drawings.

3.02 PREPARATION

A. The FSEC shall be required to take all field measurements and be responsible for his own errors or omissions. FSEC is responsible for coordinating the location of chases and passageways of supply lines in the equipment with the location of the corresponding lines in the building.

3.03 FIELD QUALITY CONTROL

A. The FSEC shall provide a representative on the premises during the installation of the equipment and shall supervise the installation of the equipment and connections.

3.04 ADJUST AND CLEAN

A. At the completion of this work, and continuously during the progress of the work, the contractor shall remove all rubbish and accumulated trash resulting from his work. He shall leave the premises clean, orderly and in an acceptable condition.

B. All equipment resting against walls, floor, and/or ceilings shall be sealed to same with mastic sealer such as Dow-Corning Clear #781 building sealant.

C. All equipment resting on masonry bases shall be sealed to such structures with above sealant and shall be constructed to overhang same to provide toe space.

D. Metal framework and/or housing are to be turned under sufficient distances to overlap base to eliminate openings at this point.

E. Before final inspection, the FSEC shall remove all protection covering from the equipment and give all items of equipment thorough

3.05 DEMONSTRATIONS AND INSTRUCTIONS TO OWNER

A. Upon completion of this contract, the FSEC shall perform, at a time determined by the Architect, demonstrations of all items of the Food Service Equipment provided under this contract. The FSEC shall explain the function, performance, and general application of the equipment.

3.06 EQUIPMENT SCHEDULE

ITEM 1 – CLEAN DISHTABLE
Quantity: ONE
Manufacturer: CONOVER CUSTOM FABRICATION
Model: CUSTOM

To be size, shape, and located as shown on drawings. Top to be constructed of 14-gauge stainless steel and reinforced with 12-gauge stainless steel hat channels on the underside. Top is to be sound deadened and to include backsplash. Custom stainless combination clean dishtable. Include fully welded undershelf.. Coordinate table opening with Hobart Dishmachine.

FSEC to submit shop drawing for approval.

ITEM 1.1 – DISHTABLE SORTING SHELF
Quantity: ONE
Manufacturer: JOHN BOOS
Model: BHS1842-TS-X

Dishrack Sorting Shelf, 42"W x 18"D x 12-1/4"H, wall mounted, slanted, tubular, includes brackets, 16/300 stainless steel

ITEM 2 - DISHWASHER, DOOR TYPE, VENTLESS
Quantity: ONE
Manufacturer: HOBART
Model: AM16VL-ADV-2

Ventless Dishwashing Machine, door type, energy recovery, automatic soil removal (ASR), drain water energy recovery (DWER), high temp sanitizing, 208-240/60/3 (field convertible to single phase), internal condensing system, 40 racks/hour, straight-thru or corner installation, user-friendly smart touchscreen controls, Wi-Fi connectivity with SmartConnect app, Complete Delime™ with Delime Notification, Auto Dispensing, and Booster Guard™, Sense-A-Temp™ booster, electric tank heat, X-shaped wash arms, scrap screen and basket, door actuated start, door lock, stainless steel tank, tank shelf, chamber, trim panels, frame & feet, pumped drain air gap, drain water tempering, cULus, NSF, ENERGY STAR®. Factory Startup - Free for installations within 100 miles of a Hobart Service Office during normal business hours with appropriate notice; installation beyond 100 miles will be quoted by Service.

Include the Following:
1 ea. RAPID-FILL1-AM16 Rapid Fill Kit Single Valve – For faster filling, requires separate hot water connection
1 ea. ACC-INSTALL-RAPID16 Accessory Installation - for installation within 100 miles of a Hobart Service Office during normal business hours with appropriate notice; installation beyond 100 miles will be quoted by Service. Includes installation of this item only, final electrical or plumbing connections by others.
1 ea. WTRHAMARREST-AM16 Water Hammer Arrestor – Assembly includes ¾” brass pressure regulator, pressure gauge, shock arrestor and garden hose adapter
1 ea. CHEMPUMP-STD-AM16 Hobart Chemical Pumps – Includes detergent and rinse-aid pumps, tubing, wiring, detergent connection port, pump housing and mounting bracket; with empty chemical notification or lockout

2 ea. Vollrath TR30 Dishracks Rack-Master Dishwasher Stock Rack, plate & tray rack, open end, bottom & sidewalls, full size, 3-1/4" inside height, handles on all (4) sides, beige co-polymer plastic, double wall construction, snap-fit extenders/construction, beige
4 ea. Vollrath 5267210 Signature Plate Racks. Full size, standard height pegs

PC to make necessary water and drain connections.
EC to make necessary electrical connections

ITEM 3 – 3 COMPARTMENT SINK/SOILED DISHTABLE
Quantity: ONE
Manufacturer: CONOVER
Model: CUSTOM

Custom Fabricated Stainless Steel 3 Compartment Sink with 12” weld-in disposer cone. Include disposer control bracket and dishmachine disconnect bracket. Include 3 sets of faucet holes and holes for vacuum breaker. Include 14 gauge top, welded crossrails and undershelf on clean end. Size and shape as shown on drawings. Bowls to be 18” wide, 24” front to back, and 14” deep.

Include the Following:
3 ea. T&S Model B-3950 Waste Valve, twist handle, 3-1/2” opening
2 ea. T&S Model B-0231 Sink Mixing Faucet, Wall Mount. 12” Swing nozzle, lever handles, quarter-turn Eterna Cartridges, ½” NPT female inlets.
2 ea. T&S Model B-0230-K Installation Kit, (2) ½” NPT nipples, locks nuts & washers, (2) short “Ell” ½” NPT female x male
1 ea. T&S Model B-0133 Prerinse Faucet with B-TEE-EZK tee assembly, B-0109-01 Wall Bracket, B-0230-K Install Kit, B-0230-KIT inlet kit.

PC to mount faucets, vacuum breaker, and disposer. PC to make necessary water and drain connections.

FSEC to submit shop drawing for approval.

ITEM 4 - DISPOSER
Quantity: ONE
Manufacturer: INSINKERATOR
Model: SS-200-12A-MRS

SS-200 Complete Disposer Package, with 12" diameter bowl, 6-5/8" diameter inlet, with removable splash baffle & reversible bowl cover, 2 HP motor, stainless steel construction, includes syphon breaker, solenoid valve, flow control valve, manual reverse switch, adjustable leg kit

Include the following:
1 ea. 208v/60/3-ph, 3.6 amps
1 ea. T&S Model B-0455 ½” IPS piping Vacuum Breaker. For mounting on a 45° surface, 6” between piping

PC to make necessary water and drain connections.
EC to make necessary electrical connection including inter-wiring between disposer and control panel.

ITEM 5 - HAND SINK
Quantity: TWO
Manufacturer: JOHN BOOS
Model: PBHS-W-1410-1-X

Pro-Bowl Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep bowl, (1) centered splash mount faucet hole, 1-7/8" drain opening with basket drain, includes mounting bracket, all stainless steel

Include the Following:
2 ea. PB-STD-1410-X Towel and Soap Dispenser, 17-1/4"W x 4-3/4"D x 18"H, 18/300 stainless steel, for 17"W hand sinks with 14" x 10" bowls
2 ea. PB-MV Tempering Valve, manual temperature mixing valve with built in check valves, rough chrome finish, 9/16 -24 UNEF threads to accept 3/8" compression female hose fitting
2 ea. JOHN BOOS PBF-SEF3GLF Hands Free Electronic Faucet

PC to make necessary water and drain connections.

ITEM 6 - DRYING RACK UNIT
Quantity: ONE
Manufacturer: METRO
Model: MAX4-PR48VX3

MetroMax 4 Mobile Drying Rack Unit, 48"W x 24"D x 68"H, 4-tier, for bulk drying & trays/cutting boards/sheet pans, includes: (3) open shelf frames, (1) shelf, (4) 63" mobile posts, (2) drop-ins, (1) cutting board/tray drying rack, (4) polymer swivel casters (2) with brakes

ITEM 7 - REACH-IN FREEZER
Quantity: TWO
Manufacturer: TRAULSEN
Model: RLT232DUT-FHS

Spec-Line Freezer, Reach-in, 48" wide, 42.0 cu. ft., self-contained refrigeration, StayClear Condenser, stainless steel exterior and interior, standard depth, full-height doors, (3) adjustable wire shelves per section, microprocessor controls, unit can be programmed to operate at -10° F, 3/4 HP

Include the Following:
2 ea. 0 degrees Fahrenheit holding temperature, standard
2 ea. 115v/60/1-ph, 14.9 amps, cord with NEMA 5-20P, standard
2 ea. Door Hinging Per Plan

8 ea. Additional adjustable wire shelves (2 per section)
2 ea. Door Hinging Per plan (one to have doors hinges on left, the other to have doors hinges on right)

ITEM 8 - REACH-IN REFRIGERATOR
Quantity: TWO
Manufacturer: TRAULSEN
Model: RHT232DUT-FHS

Spec-Line Refrigerator, Reach-in, 48" wide, 42.0 cu. ft., self-contained refrigeration, StayClear Condenser, stainless steel exterior and interior, standard depth, full-height doors, (3) adjustable wire shelves per section, microprocessor controls, 6" adjustable stainless steel legs, 1/3 HP

Include the Following:
2 ea. 115v/60/1-ph, 10.4 amps, cord with NEMA 5-15P, standard
2 ea. Full height solid door, standard
2 ea. Full height solid door, standard
2 ea. Door Hinging Per plan (one to have doors hinges on left, the other to have doors hinges on right)
8 ea. Additional adjustable wire shelves (2 per section)

ITEM 9 SPARE NO.

ITEM 10 SPARE NO.

ITEM 11 SPARE NO.

ITEM 12 – 2 COMPARTMENT SINK
Quantity: ONE
Manufacturer: CONOVER CUSTOM FABRICATION
Model: CUSTOM

Custom Fabricated 2 Compartment Sink. Size and shape as shown on drawings. Top to be 14 gauge stainless steel with square edges turned down 2” and back 45°. Back splash to be square and 8” tall and 2” deep. Item 13 will have a matching backsplash. Provide a single cap to fit over both backsplash and a 4” x 16” stainless chase to rise 4” above ceiling. Chase to have a removeable access panel on side opposite sinks. Provide a single GFCI receptacle mounted in backsplash as shown. Item 13 will also have a single GFCI and both to be wired to a common junction box. Top to be 14 gauge stainless. Provide 20” x 20” x 5” drawer with vinyl insert. Sink to be 18” x 16” x 10” deep each. Provide necessary faucet holes for pre-rinse. Provide 16 gauge stainless steel undershelf as shown. Provide stainless steel scrap basket.

Include the Following:
1 ea. T&S Model B-0133-10CRBJST Easy Install Pre-Rinse Faucet

2 ea. T&S Model B-3950 Waste Valve

PC to make necessary water and drain connections.
EC to complete necessary interwiring and electrical connections.

FSEC to submit shop drawing for approval.

ITEM 13 - WORKTABLE WITH SINK
Quantity: ONE
Manufacturer: CONOVER CUSTOM FABRICATION
Model: WORKTABLE WITH SINK

Custom Fabricated Worktable with Dump Sink. Size and shape as shown on drawings. Top to be 14 gauge stainless steel with square edges turned down 2" and back 45°. Back splash to be square and 8" tall and 2" deep. Item 12 will have a matching backsplash. Provide a single cap to fit over both backsplashes. Provide a single GFCI receptacle mounted in backsplash as shown. Top to be 14 gauge stainless. Provide 20" x 20" x 5" drawer with vinyl insert. Sink to be 14" x 18" x 10" deep each. Provide necessary faucet holes for dec mount faucet. Provide 16 gauge stainless steel undershelf as shown.

Include the Following:
1 ea. T&S Model B-0221 Deck Mount Faucet
1 ea. T&S Model B-0425-M Supply Nipple Kit
1 ea. T&S Model B-0425-KIT Inlet Kit with 24" supply hoses
1 ea. T&S Model B-3950 Waste Valve for 3-1/2" opening

PC to make necessary water and drain connections.
EC to complete necessary inter-wiring and electrical connections.

FSEC to submit shop drawing for approval.

ITEM 14 - CAN OPENER
Quantity: ONE
Manufacturer: EDLUND
Model: 270/115V

Can Opener, electric, for heavy volume, 2-speed motor, knife and gear assemblies that are removable for cleaning, recommended for up to 200 cans per day 115v/60/1-ph, 1.5 amp

ITEM 15 - CABINET, COOK / HOLD / OVEN
Quantity: ONE
Manufacturer: ALTO-SHAAM
Model: 1200-TH

Halo Heat Slo Cook & Hold Oven, electric, low-temperature, double-deck, standard depth, 120 lb. capacity each - (4) 12" x 20" x 2-1/2" full-size pans, simple or deluxe controls, LED display, (8) programmable menu buttons, (6) stainless steel wire shelves, (1) exterior drip tray with removable pan, heavy-duty stainless steel, 3-1/2" casters (2 rigid, 2 swivel with brakes), EcoSmart

Include the Following:
1 ea. 208-240v/50/60/1-ph, 29.0-34.0 amps, 6.2-8.2 kW
1 ea. NEMA 6-50P & 6 ft. cord
1 ea. Simple controls, standard
1 ea. PR-46999 Single point, standard
2 ea. Solid Door, hinged on right, standard
1 ea. Stainless steel exterior, standard
1 ea. Casters, 3-1/2", standard

ITEM 16 - COMBI OVEN, ELECTRIC
Quantity: ONE
Manufacturer: RATIONAL
Model: ICP 10-HALF E 208/240V 3 PH (LM100DE)

iCombi Pro 10-Half Size Combi Oven, electric, (10) 13" x 18" sheet pan or (10) 12" x 20" steam pan or (10) 1/1 GN pan capacity, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 208/240v/60/3-ph, 18.9 kW, ENERGY STAR

Include the Following:
1 ea. CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
1 ea. 8720.1551US Installation Kit
1 ea. 1900.1154US Water Filtration Single Cartridge System, for any iVario, single Combi model, or XS or half-size Combi-Duos, includes: (1) single head with pressure gauge, R95-CL filter & filter installation kit
2 ea. 56.01.535 Active Green Cleaner Tabs, for all iCombi Pro/Classic, 150 pieces/bucket
2 ea. 56.00.562 Care Tabs, bucket of 150 packets for all iCombi Pro/Classic models and SelfCooking Center units from 10/2008, with CareControl - Serial SG, SH or SI
1 ea. 60.76.177 UltraVent Plus Ventless Recirculating Condensation Hood, with HEPA filter for smoke capture, for single or Combi-Duo, for 6- and 10-half size (electric), 120v/50/60/1-ph, 170 watts, 6' cord, NEMA 5-15P
2 ea. 60.75.210P UltraVent Plus HEPA Filter (2 pack)
6 ea. 6010.1101 Gastronorm Grid Shelf, 1/1 size, 12-3/4" x 20-7/8", stainless steel
1 ea. 60.72.107 Starter Package, includes: (1) grill and pizza tray, (2) baking trays, & (2) granite-enameled containers
2 ea. 6019.1150 CombiFry Basket, 1/1 GN, 12-3/4" x 20-7/8"
2 ea. 6017.1002 Muffin & Timbale molds, 1/1 GN, 12-3/4" x 20-7/8"

6 ea. 6013.1106 Gastronorm Steam Pan, 1/1 size, 12-3/4" x 20-7/8", 2-1/2" deep, stainless steel
4 ea. 6015.1165 Gastronorm Perforated Steam Pan, 1/1 size, 12-3/4" x 20-7/8", 2-1/2" deep, stainless steel
1 ea. 60.31.103 Stand II Mobile Oven Stand, 27-1/2"H, (14) supporting rails, side panels and top closed, rear panel open, stainless steel construction, height adjustable casters, for iCombi 6- and 10-half size Classic/Pro

PC to mount water filter and make necessary water and drain connections.

ITEM 17 - INDUCTION RANGE, COUNTERTOP
Quantity: ONE
Manufacturer: VOLLRATH
Model: 924HIMC

Cayenne Heavy-Duty Induction Range, countertop, 24"W x 30"D x 13-5/8"H, (4) hob, (4) rotary dial controls, (100) power settings, 100°-400°F temperature range, 1-180 minute timer function, 2500-2900 watts per hob (5000-5800 watts total), (2) 208-240v/50/60/1ph, (2) 24 amps, (2) cords with NEMA 6-30P

Include the Following:
1 set Vollrath Model 3822 Pot & Pan Set. Optio Deluxe Cookware Set, (7) piece, includes: (1) each of 3800, 3900C, 3802, 3907C, 3902, 3910C & 3809, induction ready, stainless steel

ITEM 18 – EQUIPMENT STAND
Quantity: ONE
Manufacturer: Conover Custom Fabrication
Model: CUSTOM

Custom fabricated equipment stand. 30"W x 30"D, 14 gauge stainless flat top with square edges turned down 90° and back 45°. Provide 16 gauge stainless steel fully welded undershelf. Table to have 5” casters with 2 being lockable. Overall height to be 35”.

FSEC to submit shop drawing for approval.

ITEM 19 - BUSSING UTILITY TRANSPORT CART, METAL
Quantity: THREE
Manufacturer: LAKESIDE
Model: 411

Utility Cart, 3-tier, open base, 500 lbs capacity, 15-1/2" x 24" shelf size, 11-1/2" shelf clearance, sound deadening panels, (1) push handle with bumpers, (2) bumpers on front legs, galvanized steel dolly frame, stainless steel construction, 4" swivel casters

ITEM 20 - MOP SINK CABINET
Quantity: ONE
Manufacturer: JOHN BOOS
Model: PBJC-222584

Janitor Cabinet, 25"W x 22-1/2"D x 84"H overall size, enclosed cabinet with open back for plumbing, (2) lockable louvered swing doors, includes: 20" x 16" x 12" deep mop sink with drain, overhead shelf, rear-mounted mop holder with (2) locking cams, service faucet with vacuum breaker and 120" hose, 18/300 stainless steel, NSF

PC to make necessary water and drain connections.

ITEM 21 - SHELVING, WITH METAL FRAME
Quantity: LOT
Manufacturer: METRO
Model: Super Erecta Pro

Quick Ship - Super Erecta Pro Shelfremovable polymer shelf mat, Metroseal 3 epoxy-coated frame, built-in Microban product protection, split sleeves, attaches to Super Erecta round posts

15 ea. Metro Model PR2448NK3 Shelf, 48"W x 24"D, removable polymer shelf mat
5 ea. Metro Model PR2454NK3 Shelf, 54” W x 24” D, removable polymer shelf mat
5 ea. Metro Model PR2436NK3 Shelf, 54” W x 24” D, removable polymer shelf mat
20 ea. 86PK3 Quick Ship - Super Erecta SiteSelect Post, 86-1/2"H, adjustable leveling bolt, posts are grooved at 1" increments & numbered at 2" increments, double grooved every 8", Metroseal 3 Green epoxy coated corrosion-resistant finish with Microban antimicrobial protection

ITEM 22 - ICE MAKER WITH BIN, CUBE-STYLE
Quantity: ONE
Manufacturer: MANITOWOC
Model: UDF0240A

NEO Undercounter Ice Maker, cube-style, air-cooled, self-contained, 26"W x 28"D x 38-1/2"H, production capacity up to 215 lb./24 hours at 70°/50° (160 lb. AHRI certified at 90°/70°) 90 lbs. ice 90 lb. ice storage capacity, electronic controls, full bin and service indicators, production delay of (4, 12, or 24 hours), Alpha-San anti-microbial protection, forward sliding storage bin for access to refrigeration components, sealed food zone with removable water trough, distribution tube and damper door, dice size cubes, 6" adjustable legs with flanged feet (painted gray), 1/3 HP

Include the following
1 ea. (-161B) 115v/60/1-ph, 7.0 amps, cord with NEMA 5-15P
1 ea. AR-PRE-P Arctic Pure® Plus Pre-Filter Assembly, 5 micron filtration includes head, shroud, hardware, mounting assembly, & (1) filter cartridge
1 set. Manitowoc Model K00064. Casters, 2.5", (2) each locking swivel & (2) each non-locking swivel

PC to mount filter and make necessary water and drain connections.

ITEM 23 - TABLE, UTILITY
Quantity: ONE
Manufacturer: CONOVER CUSTOM FABRICATION
Model: CUSTOM

Custom Fabricated worktable. Top to be 14 gauge stainless steel with 10" high rear and right side backsplash. Provide welded side and rear crossrails. Table to remain open below for undercounter ice machine.

FSEC to submit shop drawing for approval.

ITEM 24 - MICROWAVE OVEN
Quantity: ONE
Manufacturer: ACP
Model: HDC1015

Amana Commercial C-Max Microwave Oven, countertop, compact, 1000 watts, 0.6 cu. ft capacity, accommodates standard half-size pan, (2) magnetrons, stackable, X2 quantity pad, 4-stage cooking, (11) power levels, (100) memory settings, auto voltage sensor, smart USB connectivity, ACP Programming compatible, multi-language operation, side hinged door, Grab & Go door handle, removable air filter, LED interior light, stainless steel interior & exterior, 1.61kW consumption, 120v/60/1-ph, 14.4 amps, cord, NEMA 5-15P,

ITEM 25 - TRASH CAN (PROVIDED BY OWNER)
Quantity: TWO
Manufacturer: CUSTOM
Model: TRASH CAN (PROVIDED BY OWNER)

TRASH CAN (PROVIDED BY OWNER)

END OF SECTION 11 40 00

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Motorized, roll-up fabric interior window shades including motor operator, controls, and mounting hardware.

B. Manually operated, roll-up fabric interior window shades including mounting and operating hardware.

1.2 RELATED SECTIONS

A. Section 06 10 53 – Misc. Rough Carpentry.

B. Section 09 51 23 - Acoustical Tile Ceilings.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 26 - Source Quality Control Reporting:

B. Product Data: Manufacturer's data sheets on each product specified, including:
1. Preparation instructions and recommendations.
2. Installation and maintenance instructions.
3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, and operating instructions.
4. Storage and handling requirements and recommendations.
5. Mounting details and installation methods.
6. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual, and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams, and relationship to adjacent work.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

E. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade

fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.

F. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware, and controls.

G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

H. Standard manufacturer’s defect warranty: Standard manufacturer’s warranty documents indicating compliance with requirements of Section 1.9 below.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years’ experience in manufacturing products comparable to those specified in this section. If manufacturer does not meet minimum experience requirement, please submit life cycle test data showing minimum 2000 complete operational cycles for each year of warranty showing no failure and that shade remains fit for use as an operable shade).

B. Shading system shall be UL listed. Provide documentation and proper labeling.

C. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use. Show complete manufacturer data (name, location, contact) and certification from manufacturer that the fabrics sourced for this project comply with the test data provided.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Label containers and shades according to Window Shade Schedule.

D. Store products in manufacturer's unopened packaging until ready for installation.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity, and ventilation conditions are maintained at levels recommended for project upon completion.

1.9 WARRANTY

A. Hardware and Shade Fabric: Draper standard twenty-five-year limited warranty.

B. Motors and Controls: Draper standard five-year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425; Spiceland, IN 47385-0425. ASD. Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Web:www.draperinc.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Contractor to be responsible for ALL COSTS related to a substitution requested less than 10 days prior to bid date, including cost of review by Architect.

2.2 MANUALLY OPERATED WINDOW SHADES

A. Heavy-Duty Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Clutch-Operated FlexShade® NEXD as manufactured by Draper, Inc.
   1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
      a. Clutch mechanism: Molded components from proprietary POM thermoplastic, .118” (3mm) steel baseplate and .354 inch (9 mm) primary carbon steel post are joined via a high tonnage hydraulic swaging process; assembled with a rotational roller bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right- or left-hand operation and accommodates side channel with no adjustment of chain location.
         1) Spring-assist bead chain clutch mechanism: Adjustment-free system includes spring-assist components to reduce lifting forces required to raise the shade. Manufacturer shall provide estimated torque for shade unit. Spring-assist is recommended on estimated non-spring-assist torque above 6 lb-in; required on shades with an estimated torque higher than 15 lb-in.
      b. Bead chain loop: Stainless Steel
      c. Bead Chain Hold Down: Spring-Loaded Tensioner complying with ANSI/WCMA A100.1-2018 safety standard.
   2. Single Roller Configuration:
      a. Mounting:

1) Endcaps and pocket headbox.

b. Endcaps: 1018 stamped steel. Suitable for mounting to ceiling, wall, and jamb. Field adjustable from ceiling to wall. No “L” angle required for wall mounting.
   1) Endcap covers: To match fascia or headbox color.

c. Type D Shade pocket: Rectangular pocket and endcaps designed for recessed ceiling installation of window shades with ceiling tile lip.
   1) Material: Extruded aluminum alloy or steel with white finish.
   2) Size: 5 inches (127 mm) wide by 5-3/8 inches (137 mm) high.
   3) Closure Panel:

d. 1-1/2 (38 mm) closure dimension, recommended for bead chain operation.
   1) Pocket End Cap Kit: Metal endcaps with 7/8-inch (22 mm) lip for support of acoustical ceiling panel.

3. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Minimum roller diameter 1.25 inches. Tube diameters less than 1.5” shall not be acceptable unless manufacturer provides deflection analysis showing deflection limited to <= width(inches)/700 at 1.5X design load.
4. Fabric to tube attachments: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
5. Shade slat:
   a. Open pocket elliptical slat: 1 inch (25mm) aluminum elliptical slat with plastic ends inside of a 1-5/8 inch (41 mm) pocket.
6. Fabric: See Fabric specified for Motorized Roller Shades.

2.3 MOTORIZED WINDOW SHADES

A. Type: UL listed, motorized, vertical roll-up, fabric window shade with motors, controls, mounting brackets, and other components necessary for complete installation; Motorized FlexShade® I/O AC as manufactured by Draper, Inc.
   1. Ceiling pocket.

B. Shade Motor and Control System.
   1. Motorized FlexShade I/O AC.
      a. IntelliFlex I/O AC Motor: 120V AC, single phase, 60 HZ, 3-wire, 6nm or 15nm, at the manufacturer’s discretion, instantly reversible, lifetime lubricated smart motor. Tubular motor concealed inside each shade roller tube. Equipped with internal thermal overload protector, and electric brake. Thermal protection: 4 minutes.
         1) Rated current: 1.0 Amps. Motors drawing greater than 1.0 amps shall not be acceptable without prior approval by Architect responsible for electrical design of project.
         2) Speed: 28RPM. All motors within a discrete control zone must operate at same speed.
         3) Sound level: 42dBA.
         4) UL Listing: UL325 & CSA C22.2 No. 247. Motors not listed as part of an entire shade assembly and control system shall not be acceptable.

5) Encoded motors with two-way communication to network control devices. Motor/control networks that do not support two-way communication shall not be acceptable.
6) Limits: Intermediate stopping points and presets.

b. IntelliFlex I/O Network Devices.
1) Network Device Connector. Connects lntelliFlex I/O devices into a network. Distributes power and communications between devices. One provided with each IntelliFlex I/O motor and network device. Approved for use in plenum spaces. LED Indicators indicate network status. Includes built-in terminating resistor, and network bypass switch for troubleshooting. Material: ABS plastic. Operating temperature: Ambient. Dimensions: 3 3/8" x 2" x 1 1/16" (90 x 31 x 27mm). Mounting hardware provided. Indoor use only.

c. NDC1. Connects a single device.

d. NDC3. Connects up to 3 devices.
1) Wireless Network Gateway. Allows wireless devices to control shades on the wired network. Required when using Radio Frequency handheld remote. LEDs indicate the status of both the wired and wireless networks. Allows wireless control of the entire network from a single receiving point. Material: ABS plastic. Operating temperature: Ambient. Dimensions: 3 3/8" x 2" x 1 1/16" (85 x 52 x 27mm). Mounting hardware provided. Indoor use only.
2) A\V Gateway. Used to integrate with third party control systems. Single entry point must support RS-232 and RS-485 and contain at least 6 contact closure inputs, low voltage trigger, and IR receiver input. Approved for use in plenum spaces. LCD display allows for commissioning of serial groups. Material: ABS plastic. Operating temperature: Ambient. Dimensions: 4 7/8" x 3" x 1" (124 x 83 x 32m). Mounting hardware provided. Indoor use only.
3) Contact Closure Interface. Allows up to 6 contact closure inputs to be connected to the network. These are grouped into 3 sets of Up/Down signals, each of which can control any number of shades on an lntelliFlex I/O network. Configuration must be done using onboard programming buttons, without rewiring or the use of external configuration devices. Power is provided through the lntelliFlex I/O network using a single Ethernet cable for power and communication. Material: ABS plastic. Operating temperature: Ambient. Dimensions: 3" x 3" x 1" (76 x 76 x 25mm). Mounting hardware provided. Indoor use only.
4) Sensor/Schedule Interface. Allows up to 4 sensors to be added to an IntelliFlex I/O network. Must include built-in support for brightness, temperature, wind, and precipitation sensors, and pyranometers. Must support up to 8 scheduled override events. Configuration must be done using on-board buttons and LCD display. Supports 0-10V, 4-20mA, photodiode and pulse sensors. External power input for sensors provides support for any sensor power requirements. Material: ABS plastic. Operating temperature: Ambient. Dimensions: 4 7/8” x 3¼” x 1¼” (124 x 83 x 32m). Mounting hardware provided. Indoor use only.

e. SSI Transformer. To be used when adding third party sensors to the network.
   1) Sensor/Schedule Interface with Automated Glare Control. The IntelliFlex® I/O Sensor / Scheduler Interface with automated glare control allows up to 4 sensors to be added to an IntelliFlex I/O network. Includes built-in support for brightness, temperature, wind, and precipitation sensors as well as pyranometers. Also provided support for up to 8 scheduled override events. Configuration is done using on-board buttons and LCD display. Supports 0-10V, 4-20mA, photodiode and pulse sensors. Configuration using built-in buttons and LCD display. Scheduled events can be configured to run on any combination of days of the week. External power input for sensors provides support for any sensor power requirements. Material: ABS plastic. Operating temperature: Ambient. Dimensions: 4 7/8" x 3" x 1" (124 x 83 x 32m). Mounting hardware provided.
   2) Central Network Controller. Touchscreen device to add advanced functionality to a network. It also acts as a router between the control network and a building IP network. Graphical user interfaces on local touchscreen as and remote access web interfaces. Automated glare control and scheduling. BACnet/IP integration. Interface to monitor and override network devices. Allows logging of shade movements, sensor readings, and user overrides. Input power: Micro USB. Operating temperature: ambient. Dimensions: 9 7/8" x 5¾" x 2" (251 x 146 x 51mm). Rough cutout: 8" x 5" x 1¾" (203 x 127 x 44mm). Mounting hardware provided.
   3) IP Gateway. For connecting a network of IntelliFlex I/O devices to an IP network. Built-in two port network switch for connecting directly to a building network. Can be daisy chained to other IPGs to form a stand-alone network for access to all connected IntelliFlex I/O devices. Each IPG is a BACnet/IP device and allows for an additional 120 devices to be added to the network. Configuration is done using the built-in buttons and display. Material: ABS plastic. Operating temperature: ambient. Dimensions: 4 7/8" x 3" x 1" (124 x 83 x 32mm). Mounting hardware provided.

f. IntelliFlex I/O User Input Devices.
   1) Single Zone Wall Switch. Allows user to move roller shades to any position with a single touch. Swipe gestures must be recognized to move shades to fully open or closed positions. Power provided through lntelliFlex I/O network using a single Ethernet cable for power and communication. Switch shall be capable of controlling any number of shades on an lntelliFlex I/O network using onboard programming buttons without rewiring or the use of external configuration devices. Must allow unlimited number of preset alignment positions. Push button switches not permitted.

g. Single Zone Room Location: Meeting Room 289
   1) Dual Zone Wall Switch. Allows user to control two independent zones of roller shades, moving them to any position with a single touch. Swipe gestures must also be recognized to move shades to fully open or closed positions. Power for switch must be provided through the lntelliFlex I/O network using a single Ethernet cable for power and communication. Each zone must be configured to control any number of shades on an lntelliFlex

I/O network using the onboard programming buttons, without rewiring or the use of external configuration devices. Unlimited number of preset alignment positions. Push button switches not permitted.

h. Dual Zone Room Location: Recruiting Room 290.

i. IntelliFlex I/O Sensors.

1) External Brightness Sensor. For mounting on the exterior side of the window. For use with Sensor/Schedule Interface.

C. Roller: Fabricated from extruded aluminum or steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

D. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.

E. Endcap covers to match fascia/headbox finish.

F. Coupling system: Couplings to join motorized shade rollers to allow operation by single motor. FlexShade Coupling System as manufactured by Draper, Inc. Provide endcaps to receive couplers and support multiple shades.

1. Standard straight coupler.
2. Angled coupler.

G. Shade slat: Slat encased in heat-seamed hem.

1. Open pocket elliptical slat: 1" (25mm) aluminum elliptical slat with plastic ends inside of a 1 5/8" (41mm) pocket.
2. Finish: Selected from Manufacturers standard range.
3. Finish: Custom powder coat as selected by the Architect.

H. Type D Shade pocket: Rectangular pocket designed for recessed ceiling installation of window shades.

1. Material: Extruded aluminum alloy with white finish.
2. Size: 5 inches (127 mm) by 5-5/8 inches (137 mm) high.
3. Closure Panel:
   a. 3 inch (78 mm).
4. Pocket Endcap Kit: Endcaps with 7/8-inch (22 mm) lip for support of acoustical ceiling panel.
5. Pocket ends: Welded one-piece aluminum sections connecting to and matching pockets.

I. Interior cable guide kit

1. Interior cable hem bar finial.
2. Cable mount.
3. Cable.
4. Tension Stop.

2.4 FABRIC

A. Light-Filtering Fabrics
   1. PVC Coated Fiberglass
      a. Twill Weave
      b. SheerWeave Series SW2701 by Pfifer. BS 5867 Part 2 Type B Performance, California U.S. Title 19 (small scale), CAN/CGSB2-4.162-M80, CAN/ULC-S 109 (large & small scale), IBC Section 803.1.1 (Class A Rating), NFPA 101 (Class A Rating), NFPA 701 TM#1 (small scale), NFPA 701 TM#2 (large scale). ASTM E 2180, ASTM G21, ASTM G22, AATCC30 Part 3, ASTM D 3273, GREENGUARD Mold and Bacteria Standard ASTM 6329; includes Microban antimicrobial additives. Certified to GREENGUARD and GREENGUARD Gold standards for low chemical emissions into indoor air during product usage. RoHS Compliant and REACH Compliant, ANSI/WCMA A 100.1-2007 for lead content, US Consumer Product Safety Commission Section 101. Average 1 percent open. Approximately 99% UV Blockage; 36% Fiberglass, 64% Vinyl on Fiberglass; 14.6 oz/yd2 (495 g/m2); 0.027 in (0.66 mm) thickness. NRC 0.15 / SAA 0.15.

B. Color and pattern: Refer to Material Finish Legend on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

B. Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings specified in Section 09 51 23

C. Coordinate installation of recessed shade pockets with construction of suspended gypsum board ceilings specified in Section 09 21 16

D. Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Shade pockets:
   1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
   2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
   3. Install corner pieces securely and in alignment with pockets.
   4. Install pocket ends securely and in alignment with pockets.
   5. After interior construction is essentially complete, install shade and operating mechanism in pocket.

D. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
   1. Closure panels.
   2. Endcaps.

E. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

3.4 TESTING AND DEMONSTRATION

A. Test motorized window shades to verify that controls, limit switches, interface to other building systems, and other operating components are functional. Correct deficiencies.

B. Demonstrate operation of shades to Owner's designated representatives.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.6 SCHEDULES

A. Refer to Drawings for shade types and locations.

END OF SECTION 12 24 13

SECTION 12 34 00 - MANUFACTURED PLASTIC CASEWORK

PART 1 - PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Fixed modular laminate clad casework and components.

B. Mobile storage units, tables and components.

C. Plastic Laminate Lockers

1.2 RELATED SECTIONS

A. Blocking within walls where indicated: Division 6.

B. Millwork, trim, and custom cabinetry: Division 6.

C. Locks master keyed to room doors: Division 8.

D. Glass: Division 8.

E. Base molding: Division 9.

F. Appliances: Division 11.

G. Sinks and service fixtures, service waste lines, connections, and vents: Division 15.

H. Electrical service fixtures: Division 16.

1.3 DEFINITIONS

A. Identification of casework components and related products by surface visibility.
   1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
   2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
   3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
   4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
   5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
   6. Concealed Surfaces: Any surface not visible after installation.

1.4 QUALITY ASSURANCE

A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

C. Single Source Manufacturer: Casework, countertops and architectural millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework, countertops and/or architectural millwork between multiple manufacturers will not be permitted.

D. Quality Standard: Unless otherwise indicated, comply with AWI's Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

1.5 SUBMITTALS

A. Comply with Section 01330, unless otherwise indicated.

B. Product Data: Manufacturer's catalog with specifications and construction details.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Include section drawings of typical and special casework, work surfaces and accessories.
   2. Indicate locations of plumbing and electrical service field connection by others.
   3. Provide one set of shop drawings which includes all products within this section, engineered and built by a single source manufacturer, with seamless coordination amongst all products.

D. Casework Samples (To be available upon request):
   1. Base cabinet: Cabinet conforming to specifications, with drawer and door.
   2. Wall cabinet: Cabinet conforming to specifications, with door.
   3. Cabinet samples shall be complete with specified hardware for doors, drawers and shelves.
   4. Component samples: Two sets of samples for each of the following:
      a. Decorative laminate samples, colors indicated on drawings, and matching PVC and ABS edgings.
      b. Pulls

1.6 PRODUCT HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 25 percent to 55 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.7 JOB CONDITIONS

A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
   1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.

B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.

1.8 WARRANTY

A. All materials and workmanship covered by this section will carry a five (5) year warranty from date of acceptance.

PART 2 - PART 2 – PRODUCTS

2.1 2.01 ACCEPTABLE MANUFACTURERS:

A. Basis of Design Manufacturer:
   1. TMI Systems Corporation.
      a. Drawings and specifications are based on manufacturer's literature from TMI SYSTEMS CORPORATION, 50 South Third Avenue West, Dickinson, North Dakota, 58601, Phone: 800-456-6716, fixed modular, flexible rail mounted, and mobile casework and accessories.
      b. Other manufacturers shall comply with the minimum levels of material and detailing indicated on the drawings or as specified.

2.2 MATERIALS

A. Core Materials:
   1. Particleboard up to 7/8 inch thick: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.
   2. Particleboard 1 inch thick and thicker: Industrial Grade average 45-pound density particle-board, ANSI A 208.1-2009, M-2 requirements.
   3. Medium Density Fiberboard 1/4 inch thick: Minimum average density 45-50 lbs., ANSI A208.2-2009 requirements.
   4. MR Moisture Resistant Particleboard: Average 45-pound density particleboard, ANSI A208.1 1-2009, M-2 requirements.

B. Decorative Laminates: GREENGAURD Indoor Air Quality Certified
   1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
   2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.

3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
6. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005. (TFM allowed on casework interiors only, as specified below. Utilization of TFM on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)

C. Laminate Color Selection: Maximum 1 color per unit face and 5 colors per project. (See Color Selection in section 3.05).

D. Edging Materials:
1. 1mm PVC banding, machine applied.
2. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius.

2.3 SPECIALTY ITEMS

A. Support Members:
1. Countertop support brackets: Basis of Design: Rakks EH Countertop Support Bracket Off-White finish, sized to fit countertop depth.
2. Hidden countertop support brackets: Basis of Design: Rakks Concealed EH Countertop Support Bracket, Off-White finish, sized to fit countertop depth.

B. Side panels, back, top, door and drawer fronts are of 3/4 inch thick particleboard, laminated on the exterior with VGS (0.028”) high pressure decorative laminate and balanced on the interior with CLS (0.020”) high pressure cabinet liner. Use of TFM on exposed exterior surfaces or interior surfaces will not be permitted.

C. Exposed edges are PVC banding, 1mm or 3mm thickness, to match adjacent casework.

2.4 CABINET HARDWARE

A. Hinges:
1. Butt Hinges: Stainless steel, semiconcealed, five-knuckle hinges complying withANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips.
   a. Doors up to 34 inches in height have 2 hinges per door.
   b. Doors 35 inches to 62 inches in height have 3 hinges per door.
   c. Doors 63 inches to 80 inches in height have 4 hinges per door.
   d. All doors have rubber bumpers.

B. Pulls:
1. Metal Wire Pull: Brushed Chrome.
2. All pulls with 96mm spacing on screws. Pull designs shall comply with the Americans with Disability Act (ADA).

C. Drawer Slides:
1. Regular, kneespace and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.

2. File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:
1. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:
1. Five-pin tumbler, cam style lock with strike. Lock for sliding 3/4 inch thick doors is National #M2-3708-157 lock, National #M2-3709-100 strike and National #M5-0057-110 escutcheon plunger lock with strike. Sliding glass door lock is National #M2-0225-002 sliding showcase lock.
2. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

F. File Suspension System: Extruded molding integral with top of drawer box sides to accept standard hanging file folders.

2.5 FABRICATION:

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

C. Cabinet Body Construction:
1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 14 inch deep cabinets. (Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.)
a. Tops, bottoms and sides of all cabinets except sink cabinets are particleboard core.
b. Tops, bottoms and sides of sink base units are moisture resistant particleboard core.
2. Cabinet backs: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength.

a. Exposed back on fixed or movable cabinets: 3/4 inch thick particleboard with the exterior surface finished in VGS laminate as selected.
b. Exposed back on fixed or movable sink base cabinets: 3/4 inch thick moisture resistant particleboard with the exterior surface finished in VGS laminate as selected.

3. Fixed base and tall units have an individual factory-applied base, constructed of 3/4 inch thick plywood. Base is 102mm (nominal 4 inch) high unless otherwise indicated on the drawings.
4. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. (Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.)
   a. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
6. Exposed and semi exposed edges.
   a. Edging: 1mm PVC machine applied.
7. Adjustable Shelves in Cabinets
   a. Core: Particleboard.
   b. Core Thickness: 3/4 inch up to 30 inches wide, 1 inch over 30 inches wide.
   c. Edge: 1mm PVC on All Four Edges.
8. Interior finish, units with open Interiors:
   a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with high-pressure decorative VGS laminate. Use of TFM on open cabinet interiors will not be permitted.
9. Interior finish, units with closed Interiors:
   a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with TFM Thermally Fused Melamine laminate.
10. Exposed ends:
    a. Faced with high-pressure decorative VGS laminate. Use of TFM on exposed ends will not be permitted.
11. Wall unit bottom:
    a. Faced with thermally fused melamine laminate.
12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.

D. Drawers:
1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with TFM Thermally Fused Melamine, doweled and glued into sides. Top edge banded with 1mm PVC.
2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with TFM Thermally Fused Melamine, screwed directly to the bottom edges of drawer box.

E. Door/Drawer Fronts:
1. Core: 3/4 inch thick particleboard except at sink units which are 3/4 inch thick moisture resistant particleboard.

2. High-pressure decorative VGS laminate exterior, balanced with high-pressure cabinet liner CLS. Use of TFM on exterior or interior surfaces of door/drawer fronts will not be permitted.
3. Edges: 3mm PVC, machine applied, external edges and outside corners machine profiled to 1/8 inch radius.
4. Provide double doors in opening in excess of 24 inches wide.

F. Miscellaneous Shelving (not in Cabinets):
1. Core material: 1 inch thick particleboard.
2. High-pressure decorative VGS laminate on both faces.
3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

G. Reagent and Wall Shelving:
1. Core material: 1 inch thick plywood.
2. Chemical Resistant high-pressure decorative VGS laminate on both faces.
3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius. Front edge reagent 'lip' to be raised above the shelf 3/8 inch.

2.6 PLASTIC LAMINATE LOCKERS

A. Locker cabinet with two individual inset doors and two compartments.
1. Basis of Design: TMI T8230-P specialty locker.
2. Size: 15" x 18" x 84" including base (Two Lockers Each Unit).
3. Locking: Hasp for padlocks (padlocks provided by Owner).
4. Accessories: Provide one single coat hook at the back and one double coat hook from the top of each locker.

PART 3 - EXECUTION

3.1 INSPECTION:

A. The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 PREPARATION:

A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.3 3.03 INSTALLATION:

A. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.

B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.

C. Repair minor damage per plastic laminate manufacturer's recommendations.

3.4 CLEANING:

A. Remove and dispose of all packing materials and related construction debris.

B. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building owner.

3.5 COLOR SELECTION:

A. Laminate Color Selection:
   1. Provide colors and patterns indicated on Drawings.
   2. Thermally fused melamine laminate matched to White color.

B. PVC Edge Banding Color Selection:
   1. 3mm PVC: Select from the TMI Vendor Stock PVC Program, including over 230 pattern, woodgrain and solid colors matched to Wilsonart® and Formica® laminates.
   2. 1mm PVC: Select from the TMI Vendor Stock PVC Program, including over 230 pattern, woodgrain and solid colors matched to Wilsonart® and Formica® laminates.

END OF SECTION 12 34 00

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.
5. Solid surface material sinks.
6. Solid surface wall caps.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
1. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
4. Colors and Patterns: As indicated by manufacturer's designations .

B. Particleboard: ANSI A208.1, Grade M-2 .

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
1. For use at sink locations.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: Custom .

B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
   1. Includes wall caps.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Joints: Fabricate countertops in sections for joining in field.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

B. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

E. Install aprons to backing and countertops with adhesive.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

G. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

SECTION 14 21 23.16 - MACHINE ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Electric gearless traction passenger elevators with machine room-less application.
   2. Securing variance and other required clearances from State and local authorities having jurisdiction including costs of filing and other fees.
   3. Installation and coordination of work with others to facilitate fire alarm, security camera(s) and other items indicated.

B. Related Sections:
   1. Section 01 50 00 – Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting
   2. Section 03 30 00 – Cast-In-Place Concrete: elevator pit and elevator machine foundation
   3. Section 04 20 00 – Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills
   4. Section 05 50 00 – Metal Fabrications: pit ladder, divider beams, supports for entrances and rails, and hoisting beam at top of elevator hoistway
   5. Division 08 - Openings (Hardware Best Lock key switches, cores for key switches - Furnished and installed by Owner.)
   6. Section 09 – Carpet Floor Finish.
   7. Division 23 –HVAC
   8. Division 26 –Electrical
      a. Main disconnects for each elevator
      b. Electrical power for elevator installation and testing.
      c. Disconnecting device to elevator equipment prior to activation of sprinkler system.
      d. The installation of dedicated GFCI receptacles in the pit and overhead.
      e. Lighting in controller area, machine area and pit.
   9. Division 27 – Communications, including Voice Communications, ADAAG-required emergency communications equipment.
   10. Division 28 - Electronic Safety and Security, including Fire Alarm Systems; Fire and Smoke detectors, interconnecting devices, fire alarm signal lines to contacts in the machine area.

C. Contractor shall obtain all necessary bidding documentation for the complete elevator installation. No additional compensation will be granted due to not being fully appraised of all the requirements associated with a complete and proper elevator installation.
   1. The Elevator Supplier/Installer shall coordinate and schedule all work in a timely manner not resulting in delays or additional cost and will physically install fire alarm and security devices inside the elevator cars.

a. Division 26/27/28 contractor(s) shall coordinate work with the Elevator Supplier/Installer.
b. The Elevator Supplier/Installer shall coordinate scheduling of all such work.

1.2 REFERENCES

A. American National Standards Institute
1. ANSI A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
2. ANSI/NFPA 70, National Electrical Code.
3. ANSI/NFPA 80, Fire Doors and Windows.
4. ANSI/UL 10B, Fire Tests of Door Assemblies.
5. ANSI A17.1, Safety Code for Elevators and Escalators.

B. ADAAG, Americans with Disabilities Act Accessibility Guidelines.

C. ASME A17.1 “Safety Code for Elevators and Escalators” (with Amendments adopted by the State of Indiana)

D. ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.

E. Indiana Elevator Code, Local Building Codes, and other applicable codes.

1.3 SYSTEM DESCRIPTION

A. Equipment Description: Gen3 Edge® gearless machine-room less elevator where all components fit inside the hoistway.

B. Equipment Control: Elevonic® Control System.
1. IoT Connectivity: Elevator connected to Otis ONE IoT Platform

C. Drive: Regenerative.
1. Elevator Type - A/C gearless traction elevators with machine room-less application.
2. Quantity: One
3. Stops & Openings – Four (4).
a. Floor Markings – First, Second, Third, and Fourth (Verify with Owner)
4. Rise – Approximately 37'-3", Field verify
5. Openings: 3 at Front, 1 at rear
6. Rated Capacity/Speed -4,000 lbs. at 150 FPM
7. Platform Size: 7’ 6-3/4” W x 6’ 8-3/16” D
8. Clear Inside Dimensions: 7’ 5-9/16” W x 5’ 6 1/8” D
9. Cab Height: 93”
10. Clear Cab Height: 7’-4 5/16”
11. Entrance Type and Width: Center Opening 4’ 0” (2243 mm)
12. Main Power Supply - 480 Volts + or - 5% of normal, 3 Phase, with a separate equipment grounding conductor.
13. Lighting Power Supply - 120 Volts, 1 Phase, 15 Amp, 60 Hz.

14. Machine Location: Inside the hoistway at the top of the hoistway.
15. Signal Fixtures: Signal Fixtures: Manufacturer's standard with metal button targets.
16. Controller Location: Machine-Roomless Controller(s) shall be located at the front opening of the top terminal landing in entrance frame.

D. Performance Requirements
   1. Car Performance:
      a. Car Speed - +/- 3% of contract speed under any loading condition or direction of travel.
      b. Car Capacity - Safely lower, stop, and hold at least 120% of rated load
   2. System Performance (Ride Quality):
      a. Vertical Vibration (maximum) - 20 milli-g
      b. Horizontal Vibration (maximum) - 12 milli-g
      c. Vertical Jerk (maximum): 4.59 1.0 ft./ sec3 (1.4 0.3 m/ sec3)
      d. Acceleration/Deceleration (maximum) - 2.62 ft./ sec2 (0.8 m/ sec2)
      e. In Car Noise - 55 - 60 dB(A)
      f. Stopping Accuracy - 0.375 in. (10 mm) max, 0.25 in. (6 mm) Typical
      g. Re-leveling Distance - 0.5 in. (12 mm)

E. Operation: Simplex Collective Operation- Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
   1. Full Collective Operation
   2. Anti-nuisance
   3. Fan and Light Protection
   4. Load Weighing Bypass
   5. Independent Service
   6. Firefighters' Service Phase I and Phase II
   7. Top of Car Inspection

F. Operating Features:
   1. Automatic Rescue Operation
   2. Automatic Standby Power Operation with Manual Override

G. Door Control Features:
   1. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call
   2. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
   3. Door protection shall consist of a two-dimensional, multi-beam array projecting across the car door opening
   4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time

H. Provide equipment according to Seismic Zone 2

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
   1. Signal and operating fixtures, operating panels and indicators.
   2. Cab design, dimensions and layout.
   3. Hoistway door and frame details.
   4. Electrical characteristics and connection requirements.
   5. Indicate variations from specified requirements.
   6. Color selection chart for Cab and Entrances.
   7. Equipment data sheets (cut sheets) provided to the Elevator Supplier/Installer for all equipment that is to be installed inside the elevator car and or the elevator hoistway.

B. Shop Drawings:
   1. All shop-drawing submittals are required to be job specific. Factory typical submittals and reproductions of contract documents will not be acceptable.
   2. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
      a. Car, guide rails, buffers and other components in hoistway.
      b. Maximum rail bracket spacing.
      c. Maximum loads imposed on guide rails requiring load transfer to building structure.
      d. Loads on hoisting mounting or beams.
      e. Clearances and travel of car.
      f. Clear inside hoistway and pit dimensions, tolerances
      g. Location and sizes of access doors, hoistway entrances and frames.
      h. Indicate ventilation for elevator control rooms and hoistways.
      i. Wiring diagrams detailing locations and wiring for power, signal and control systems and differentiating between manufacturer-installed wiring and field-installed wiring. Indicate maximum and average power demands.
      j. All equipment, locations, and traveling cable information required for fire alarm, security cameras, and equipment.
   3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and layout and dimensions, as shown on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.

1.6 CLOSEOUT SUBMITTALS

A. Furnish O & M submittals as detailed in Section 01 7 7 .00 Contract Closeout.

B. Required O & M information includes but is not limited to the following -

C. Approved shop drawings

D. Maintenance information with parts lists

E. 'As Built' wiring diagrams

F. Inspection and acceptance certificates and operating permits

G. Copy of warranty

1.7 QUALITY ASSURANCE

A. Manufacturer - A firm ISO 9001 certified with a minimum of 15 years experience in fabrication of elevators equivalent to those specified.

B. Installer - Elevators shall be installed by the manufacturer.

C. Regulatory Requirements
   1. Elevator system design and installation shall comply with the latest versions of ASME A17.1
   2. Elevator shall be designed in response to Americans with Disabilities Act Accessibility Guidelines (ADAAG).

D. Permits and Inspections
   1. Provide licenses and permits and perform required inspections and tests.
   2. Obtain required variances and other approvals required by State and local authorities having jurisdiction and submit copies to Owner.
   3. Owner will sign applications for permit and compliance forms for submission to the State of Indiana by the elevator contractor.

E. Pre-installation Conference
   1. Immediately after award of contract, schedule a pre-installation meeting with Owner, Architect, Contractor, elevator installer, masonry sub-contractor, electrical sub-contractor, access control installer, and other trades involved in installation of elevator and elevator hoistway.
   2. Review:
      a. Schedules and critical target dates to assure appropriate completion, and the coordination of efforts of the various trades involved.
      b. Critical dimensions, tolerances, and other criteria
      c. Installation and coordination of Fire Alarm System components and Security Camera system components.

d. Coordination of work with other contractors.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store material, components, and equipment off of ground, under cover, and in a dry location.

C. Handle material, components, and equipment according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

D. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.

E. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the Prime Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage, and redeliver to the job site shall not be at the expense of the elevator contractor.

1.9 SCHEDULING

A. Schedule and execute the work of this Section so elevator is complete and operational in all respects no later than a date to be established by the General Contractor to permit the timely completion of the remaining portions of the work.

1.10 WARRANTY

A. The elevator contractor's acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The guarantee period shall not extend longer than one (1) year from the date of final elevator inspection by the Indiana Department of Homeland Security Elevator Division. The guarantee excludes: ordinary wear and tear or improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

1.11 MAINTENANCE AND SERVICE

A. Provide maintenance service consisting of regular examinations, adjustments and lubrication of the elevator equipment for the entire warranty period.
   1. This service shall be performed by the elevator contractor.
   2. All work shall be performed by competent employees on a 24/7 basis for the duration of the warranty period. Elevator contractor shall respond within 15 minutes during normal working hours and 30 minutes at all other times for all service calls.

3. Provide twice monthly preventive maintenance checks and monthly fireman's service testing. Maintain proper documentation in elevator control room.
4. At end of warranty period, turn over to owner all documentation associated with the installation and maintenance of the elevator and any service tools required for proper maintenance of the elevator.
5. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

B. The elevator control system must:
1. Provide on top of the car the necessary devices to run the elevator in inspection operation.
2. Provide in the control access cabinet an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.
3. Provide in the event of a power outage, means from the control access cabinet to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing.
4. Provide the means from the control access cabinet to reset the governor over speed switch and also trip the governor.
5. Provide the means from the control access cabinet to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

C. Provide the means from the control access cabinet to reset elevator earthquake operation.

D. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
1. Remotely diagnose elevator issues with a remote team of experts.
2. Remotely return an elevator to service.
3. Provide real-time status updates via email.
4. Remotely make changes to selected elevator functions including:
a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode and activate independent service.
b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Provide machine-roomless Gen3™ traction passenger elevators from Otis Elevator Company. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
    a. Controller located entirely inside the hoistway. No extra machine room or control closet space required.
    b. An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.
    c. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
    d. Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
    e. LED lighting standard in ceiling lights and elevator fixtures.
    f. Sleep mode operation for LED ceiling lights and car fan.
2. Approved Installer:
    a. Otis Elevator Company.

2.2 EQUIPMENT: CONTROLLER COMPONENTS

A. Controller - Microcomputer based control system performing all of the functions of safe elevator operation. The system shall also perform car operational control.
    1. All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
    2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
    3. Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
    4. Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity"
    5. Controller shall be located inside the wall next to the top landing entrance frame. Emergency access shall be provided through an access panel in the entrance frame secured by a key lock.
    6. Provide a locked service access cabinet installed in the hoistway frame at the top landing. Cabinet door shall be further secured with a minimum of two (2) tamper resistant screws installed on side opposite the hinge. Service control cabinet shall contain the following:

B. Main Power disconnecting means

C. Behind a separate internal locked cabinet all controls necessary for operation of the elevator to provide access to the internal hoistway installed controller in an emergency situation.

D. Drive - Variable Voltage Variable Frequency AC drive system, regenerative.

2.3 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: The governor shall be a tension type car-mounted governor.

C. Buffers, Car and Counterweight: Polyurethane type buffers shall be used for speeds of 150 and 200 feet per minute.

D. Hoistway Operating Devices:
   1. Emergency stop switch in the pit.
   2. Terminal stopping switches.

E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. The belts shall have an FT-1 rating as referenced by NFPA 13. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.

H. Governor Rope: Governor rope shall be steel and shall consist of at least eight strands wound about a sisal core center.

I. Fascia: Galvanized sheet steel shall be provided at the front of the hoistway.

J. Hoistway Entrances:
   1. Frames:
      a. Entrance frames shall be of bolted construction for complete one-piece unit assembly.
      b. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
   2. Sills shall be extruded Aluminum.
   3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
   4. Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2.
   5. Entrance Finish: Satin Stainless Steel.
   6. Entrance marking plates: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
   7. Sight Guards: Black sight guards will be furnished with all doors.

2.4 EQUIPMENT: CAR COMPONENTS

A. Car frame and Safety: A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp type.

B. Cab: Steel shell cab with rigidized Premium Laminate Columbian Walnut vertical panels. Brushed stainless steel finished vertical trim pieces optional. Brushed Steel Finish finished base plate located at top and bottom.

C. Car Front Finish: Satin Stainless Steel

D. Car Door Finish: Satin Stainless Steel

E. Ceiling Type: Dropped ceiling with LED lights in a brushed steel finish

F. Flooring – Carpetting furnished and installed by Section 09 66 23

G. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

H. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.

I. Handrail:
   1. Handrails shall be 3/8” x 2” (9.5 mm x 51 mm) flat tubular handrail with a brushed steel finish.
   2. Handrails shall be provided on the sides and rear of the car enclosure

J. Threshold: Extruded Aluminum

K. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

L. Guides: The car shall have 3” diameter roller guides at top and bottom and the counterweight shall have slide type guides at the top and the bottom.

M. Platform: The car platform shall be constructed of metal. Load weighing device shall be mounted on the belts at the top of the hoistway.

N. Certificate frame: Provide a Certificate frame with a satin stainless steel finish.

O. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button

P. Utility Outlet - 125V, 15 amperes utility outlet with ground-fault circuit-interrupter protection located in the cab.

Q. One (1) Set of Protective pad hooks and quilted fire retardant protective pads

2.5 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A standard car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a Satin Stainless Steel finish.

B. A car operating panel shall be furnished. It shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings to the left side of each push button with:
   1. Plastic 1/8” (3mm) fully illuminated button with white LED.
   2. The car operating panel shall be equipped with the following features:
      a. Raised markings and Braille to the left hand side of each push-button.
      b. Car Position Indicator at the top of and integral to the car operating panel.
      c. Door open and door close buttons.
      d. Inspection key-switch.
      e. Elevator Data Plate marked with elevator capacity and car number.
      f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
      g. Display Screen: Include display screen located near the top of the COP. The display screen shall display the car position indicator, travel direction arrows, elevator status jewels, and provide emergency text communication.
      h. Emergency Communication Camera: Include camera located above display screen for emergency video communication. This camera is for emergency communication only, in addition to the Campus Security Camera.
      i. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
      j. In car stop switch (toggle or key unless local code prohibits use)
      k. Firefighter’s hat
      l. Firefighter’s Phase II Key-switch
      m. Call Cancel Button
      n. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.
      o. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance jamb. Therefore, separate wiring and installation of electrical boxes inside the wall for the hall buttons are not required. Buttons shall be in vertically mounted fixture. Fixture shall be Satin Stainless Steel.

1) Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance frame face. Buttons shall be in vertically mounted fixture. Fixture shall be satin stainless steel finish.
2) Button: Flat flush mounted, satin stainless steel button with blue or white LED illuminating halo.
3) Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound

C. Emergency Car Lighting - Provide sealed rechargeable battery and totally static circuits to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

D. Emergency Car Signals
1. Mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged.
2. Siren pressure level - 80 dba at a distance of 3.0 m from the device.
3. Response time - A delay of not more than 1 second after the switch or push button has been pressed.

E. Exhaust Fan
1. Two-speed 120 VAC fan mounted to the structural ceiling to facilitate in-car air circulation, meeting A17.1 code requirements.
2. Airflow rates - 5.8 and 7.4 m3/min on low and high setting respectively.
3. Rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise.
4. Provide a switch in the car-operating panel to control the fan.

2.6 SIGNAL DEVICES AND FIXTURES - SPECIAL ISU REQUIREMENTS

A. Car-Operating Panel
1. Digital car position indicator 2" Blue LED
2. Flush mounted, brushed stainless steel, tamper resistant, panel with all push buttons, key switches, and message indicators for elevator operation.
3. Buttons - Vandal resistant, with blue LED light in center of each button with a Stainless Steel Halo.
4. Door open and door close buttons
5. Connect the emergency call button to a bell that serves as an emergency signal.
6. All buttons to have raised numerals and Braille markings with blue LED light in center of each button with a Stainless Steel Halo
7. Flat Flush targets. Target finishes - satin stainless steel.
8. A lockable phase 2 fire service control cabinet and helmet light. Note this lock does not have to be a Best Lock.

9. Prepare key switches for BEST Lock System for Access Control Override and Run/Stop. Cores provided and installed by Owner.
10. A Best keyed lockable service cabinet shall be located below emergency features and contain the following controls and services (this lock does not have to have a removable core):
    a. INSPECTION rocker switch
    b. CAR LIGHTING rocker switch
    c. 3-position FAN switch
    d. INDEPENDENT SERVICE rocker switch
    e. PUSH TO TEST emergency light switch
    f. 120VAC outlet
11. Make provisions for installation of access control system components (card reader) including over ride key switch.

B. Other Features
1. ADA compliant communication device designed in response to ADAAG requirements integral with the car operating panel. Phone to be programmed to dial 911; not to call Elevator Company's dispatch center
2. Car Lantern and Chime
3. Directional lantern visible from the corridor in the car entrance.
4. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
5. Landing Passing Signal - A chime bell shall sound in the car to tell a passenger that the car is either stopping at or passing a floor served by the elevator.

C. Hall Fixtures
1. All necessary vandal resistant push buttons and switches for elevator operation, illuminated.
2. Provide raised markings for each push-button.
3. At main egress level provide elevator on emergency power light
4. At main Egress level provide all necessary Phase 1 Fireman's Service switches and instructions.
5. At main egress level make provisions for card access (card reader)
6. Provide Emergency Key box complete with all keys required. Coordinate with the Owner to obtain building interior access keys
7. Provide hoistway access keyswitches at bottom and top landings (note: these key switches do not have to be Best key switches)
8. Hall Position Indicator at each floor shall be independent of the Hall Station. Green LED display 1" letters.

2.7 OPERATION AND CONTROL EQUIPMENT

A. Simplex Selective Collective Operation
1. Automatic by means of the car and hall buttons.
2. If all calls in the system have been answered, the car shall park at the last landing served.

B. Car Operating Features
   1. Fan/Light Switch
   2. Car stall protection
   3. Firefighters' Service Phase I and Phase II.
   4. Ascending car uncontrolled movement protection
   5. Access key switches
   6. Top of car inspection station
   7. Front/Back door operation
   8. Load Weighing Bypass.
   9. Independent Service.
   10. Provision for Card Reader in Car (Card Reader provided and Installed by others).
   11. Provision for standby power operation with manual override
   12. Provision for battery-power lowering or cab and operation of doors, to a designated floor location, in the event of power failure.

C. Control Systems for inspections and Emergency
   1. Provide devices within controller to operate the elevator in inspection mode.
   2. Provide devices on top of car to operate elevator in inspection mode
   3. Provide within controller an emergency stop switch to disconnect power from the brake and prevent motor from running.
   4. Provide means from the controller to mechanically lift and control the elevator brake to designated landing when power is interrupted.
   5. Provide the means from the controller to reset the governor over speed switch and also trip the governor
   6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

2.8 DOOR OPERATOR EQUIPMENT

A. Door Operator
   1. High speed, heavy duty operator to automatically open and close the car and hoistway doors simultaneously,
   2. Cushion at both limits of travel
   3. Provide electro-mechanical interlock at each hoistway entrance to prevent operation of the elevator unless all doors and closed and locked.
   4. Provide an electric contact on each car entrance to prevent operation of elevator unless the car door is closed.

B. Emergency Operation
   1. Arrange operator so doors can be easily opened manually from within the car in the event of power failure or interruption in accordance with applicable codes.
   2. Furnish emergency devices and keys as required by local authority having jurisdiction.

C. Automatic Operation
   1. Doors to open automatically when the car has arrived at or is leveling at the respective landings

2. Doors shall close after a predetermined time interval or immediately upon pressing door close button
3. Provide door open button to reopen the doors and reset the time interval.

D. Hangers & Tracks
1. Provide for each car and hoistway door
2. Contour to match the hanger sheaves
3. Design for power operation

E. Safety Devices
1. Full height infrared door reopening device shall be provided
2. Controls shall be arranged to prevent elevator operation if device is disabled.
3. Doors shall remain open as long as the flow of traffic continues and close shortly after traffic through the opening ceases.

2.9 EQUIPMENT – FIRE ALARM AND SECURITY CAMERA

A. The Elevator Supplier/Installer will physically install fire alarm and security devices inside the elevator cars.
1. The Div 26/27/28 contractor(s) shall coordinate the following work with the Elevator Supplier/Installer.
2. The Elevator Supplier/Installer will coordinate scheduling of such work with the General Contractor and provide access to other contractors for the work as required.

B. Fire Alarm System Speaker / Strobe:
1. A fire alarm speaker/strobe shall be installed in the elevator car. The Elevator Supplier/Installer shall provide a 2-#14 AWG cable for the strobe and a 2-#18 shielded twisted pair cable for the speaker, both in the hoistway travelling cable for each elevator.
2. The Fire Alarm Supplier shall furnish the speaker/strobes and jumper cables (for wiring from the COP to the speaker/strobe inside the car) and the Elevator Supplier/Installer shall install them.
a. Since this a life safety device, the installation shall be observed by the Fire Alarm Supplier, and tested by same to ensure proper operation.
3. The Fire Alarm Supplier shall provide all necessary wiring from the fire alarm system to the elevator controllers located in the shaft at the top landing (verify).
4. The Elevator Supplier/Installer shall make all connections at the controllers and inside the elevator cars

C. Fire Alarm System Fireman’s Hat, Primary Recall and Secondary Recall:
1. The Fire Alarm Supplier shall provide control modules and cabling to each elevator controller located in the shaft at the top landing (verify).
2. The Elevator Supplier/Installer shall make final connections inside the controller to provide operation of the fireman’s hat, primary recall and secondary recall.

D. Security Camera:

1. A security camera shall be installed in the elevator car.
    a. The Elevator Supplier/Installer shall provide a Belden #1694F stranded flexible RG6 coax cable in the hoistway travelling cable for each elevator.
    b. The Security System Supplier shall furnish the IP cameras, PoE+ over coax adapter kits, and jumper cables (for wiring from the COP to the camera) and the Elevator Supplier/Installer shall install them.
        1) Provide an adaptor at both ends of the coax cable.
    c. The Elevator Supplier/Installer shall install one inside the controller connection box in the shaft at the top landing (verify) and install the other inside the car COP.
    d. The Security System Supplier shall provide all necessary wiring from the security system to the elevator controllers located in the shaft at the top landing (verify).
    e. The Elevator Supplier/Installer shall make all connections at the controllers and inside the elevator cars.
    f. The Security System Supplier shall perform all necessary tests for proper operation and coordinate any necessary adjustments with the Elevator Supplier/Installer

PART 3 - EXECUTION

3.1 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 INSPECTION

A. Prior to beginning installation carefully inspect all conditions under which the work is to be installed and verify that no situation exists which would impair the work of this Section. Conditions include but are not limited to
    1. Critical dimensions.
    2. Hoistway & pit conditions.
    3. Control room conditions.
    4. Proper electric service.
    5. Adequate structural support.
    6. Opening locations & sizes.

B. If any condition exists which might impair the work of this Section immediately notify Architect. Do no work until the improper condition has been corrected in an acceptable manner.

3.3 INSTALLATION

A. Interface with Work of Others
    1. Coordinate construction of entrance walls with installation of door frames and sills. Ensure adequate support for entrance attachment points at all landings.

2. Coordinate openings for hall push buttons, signal fixtures, and any required sleeves.
3. Coordinate emergency power transfer switch and power change pending signals as required for termination at the elevator signal control cabinet. The Electrical Contractor shall provide a dry contact closure from the generator system to each elevator controller located in the shaft at the top landing (verify), that will close when the generator is running and/or power has transferred to generator power. Another dry contact closure shall be provided to signal in advance of transferring between two available sources of power (pre-signal), to enable the elevator controls to send the elevator to a designated landing and open its doors. Coordinate function and requirements with the Elevator Supplier/Installer and Elevator Inspector
4. Coordinate interface between elevators, fire alarm system, and security cameras.
5. Coordinate interface with telephone system.
6. Schedule and coordinate all work between trades and the Elevator Supplier/Installer to assure that work can be performed in a timely manner without requiring special job visits, otherwise that trade shall compensate the Elevator Supplier/Installer as necessary.
7. The Elevator Supplier/Installer shall provide all provisions at controller and elevator car for all connections and shall include all required materials and labor in their bid to make connections, install equipment described above, and assist with testing.

B. The Electrical Contractor will provide a 1" conduit from the elevator pit to a location near the building's fire alarm control panel, at the location for the elevator status panel.
   1. The Elevator Supplier/Installer shall provide all necessary wiring, connections, and equipment.

C. Properly locate guide rails and related supports and securely attach to building structure

D. Securely fasten hoistway frames to hoistway construction. Coordinate installation of sills and frames with other trades.

E. Sound Isolation - Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure and eliminate sources of structure-borne noise from elevator system.

F. Coordinate sill height with flooring installer. Sill height shall include the thickness of the tile and any associated components required for the completed tile installation. Failure to provide the proper code compliant sill height shall be cause for the Elevator Contractor to make whatever adjustments are required at no cost to the Owner.

G. Coordinate the bottom of the COP height to be a minimum of 1/16” above final finished floor to allow COP hinged door to open without rubbing the tile floor. Failure to maintain this clearance shall be cause for the Elevator Contractor to make whatever adjustments are required at no cost to the Owner.

H. Lubricate operating system components according to manufacturer’s recommendations

3.4 FIELD QUALITY CONTROL

A. Field Tests:
   1. Advise Owner, Architect, and governing agencies in advance of dates and times tests are to be performed on elevators.
   2. Acceptance Testing - Upon nominal completion of elevator installation and before permitting use of elevator (either temporary or permanent), perform acceptance tests as required and recommended by Code and governing regulations or agencies.

B. Make a final check of each elevator operation with the Owner's representative present prior to turning elevator over for use.

C. Demonstrate that control systems and operating devices are functioning properly.

3.5 ADJUSTMENTS & CLEANING

A. At completion of installation, provide suitable protective coverings, barriers, devices, signs or such other methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

B. Provide similar protective measures for elevator units which will be placed in temporary service, including inspection and maintenance service during period of temporary service.

C. Lubricate moving parts of system as recommended by manufacturer.

3.6 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
   1. Instruct Owner's personnel in proper use, operation, and daily maintenance of elevators.
   2. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies.
   3. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Provide new or update Owner's service tool to allow for maintenance to be performed.

END OF SECTION 14 21 23.16

SECTION 20 00 10 – COMMON WORK RESULTS FOR FIRE SUPPRESSION, PLUMBING AND HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this and all Sections of Divisions 20, 21, 22 and 23.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Requirements of Regulatory Agencies.
2. Abbreviations contained in Specifications.
3. Shop Drawings.
4. Record Drawings
5. Operation and Maintenance Manuals.
6. Drawings.
7. Construction Documents.
8. Work and Workmanship.
9. Coordination between Contractors.
10. Assignment of Miscellaneous Work.
11. Equipment Warranty and Early Equipment Startup.
12. Material Equipment Transport
13. Material Storage.
14. Product and Material Approval.
15. Protection and Treatment of Property.
16. Demolition and Removal of Equipment.
17. Electrical Connections to Equipment and Control Wiring.
18. Attaching to Building Construction.
19. Rough-ins.
20. Mechanical Installations.
21. Cleaning and Touch-up.
22. General Completion Startup/Owner Orientation.
23. Air Filters.

1.3 REQUIREMENT OF REGULATORY AGENCIES

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, utility company regulations and Contract Documents, the most stringent shall govern. Contractor shall promptly notify Engineer in writing of any such difference.

C. Non-compliance: should Contractor perform any work that does not comply with requirements of applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations and applicable requirements of the most recent editions of the following nationally accepted codes and standards:

1. The Indiana Building Code. (IBC)
2. The Indiana Electric Code.
3. The Indiana Mechanical Code. (IMC)
4. The Indiana Fuel-Gas Code.
5. The Indiana Fire Code.
6. The Indiana Plumbing Code. (IPC)
7. The Indiana Elevator Code.
8. The Indiana Handicapped Accessibility Code.
9. National Fire Protection Associates (NFPA) codes and regulations.
10. Regulations of the Indiana State Board of Health.
11. Regulations of the Insurance Bureau of Indiana.
12. Requirements of Factory Mutual (FM).
13. Regulations of the Indiana Department of Fire Prevention and Building Services.
14. The Americans with Disabilities Act (ADA).
15. All local and municipal codes and/or regulations.

E. Except as otherwise specified herein, all piping work and materials are to conform to the American Standards Association Code for Pressure Piping.

F. All fired and unfired pressure vessels furnished and installed under this contract are to conform to all requirements of current edition of State of Indiana Rules and Regulations for Boilers and Unfired Pressure Vessels. Copies of all certificates of tests and construction as required by this code to be turned over to Owner.

G. Permits: Contractor shall pay for all building permits required by work and permits for opening streets and for connection to various utilities, including fees for water meter installation and any other requirements necessary to carry out his work. Where streets or sidewalks are cut, same must be repaired to at least as good a condition as they were before, all at expense of this Contractor. Permits shall be posted in a prominent place at building site properly protected

from weather and physical damage. Where applicable (i.e. ESSER-funded), acquire and display required workplace posters. Maintain and adhere to all project, wage-rate and payroll documentation processes and requirements.

1.4 ABBREVIATIONS CONTAINED IN SPECIFICATIONS

A.	AABC	Associated Air Balance Council
B.	AASHTO	American Assn. of State Highway and Transportation Officials
C.	ABMA	American Bearing Manufacturers Association (formerly Anti-Friction Bearing Manufacturers Associates)
D.	ABMA	American Boiler Manufacturers Association
E.	ACI	American Concrete Institute
F.	ACIL	The Association of Independent Scientific, Engineering, and Testing Firms
G.	ACPA	American Concrete Pipe Association
H.	ADA	Americans with Disabilities Act
I.	ADC	Air Diffusion Council
J.	AFBMA	Anti-Friction Bearing Manufacturers Association (see ABMA)
K.	AGA	American Gas Association
L.	AIA	American Insurance Association
M.	AIHA	American Industrial Hygiene Association
N.	AISC	American Institute of Steel Construction
O.	AISI	American Iron and Steel Institute
P.	AMA	Air Moving & Conditioning Association
Q.	AMCA	Air Movement and Control Association International, Inc.
R.	ANSI	American National Standards Institute
S.	API	American Petroleum Institute
T.	AREA	American Railway Engineering Association
U.	ARI	Air-Conditioning and Refrigeration Institute
V.	ASA	American Standards Association
W.	ASA	Acoustical Society of America
X.	ASC	Adhesive and Sealant Council
Y.	ASHRAE	American Society of Heating, Refrigerating & Air-Conditioning Engineers
Z.	ASME	American Society of Mechanical Engineers
AA.	ASPE	American Society of Plumbing Engineers
BB.	ASTM	American Society for Testing Materials
CC.	AWS	American Welding Society
DD.	AWWA	American Water Works Association
EE.	AABC	Associated Air Balance Council
FF.	CAGI	Compressed Air and Gas Institute
GG.	CE	Corps of Engineers (U.S. Department of the Army)
HH.	CGA	Compressed Gas Association
II.	CISPI	Cast Iron Soil Pipe Institute
JJ.	CPPA	Corrugated Polyethylene Pipe Association
KK.	CTI	Cooling Tower Institute
LL.	DIPRA	Ductile Iron Pipe Research Association

MM.	DOT	Department of Transportation
NN.	EPA	Environmental Protection Agency
OO.	FAA	Federal Aviation Administration
PP.	FCC	Federal Communications Commission
QQ.	FDA	Food and Drug Administration
RR.	FIA	Factory Insurance Association
SS.	FCI	Fluid Controls Institute
TT.	FM	Factory Mutual System
UU.	HEI	Heat Exchange Institute
VV.	HI	Hydraulic Institute
WW.	HI	Hydronics Institute (Division of Gas Appliance Manufacturers Association)
XX.	INCE	Institute of Noise Control Engineering
YY.	IEEE	Institute of Electrical & Electronic Engineers
ZZ.	IRI	Industrial Risk Insurance
AAA.	ISA	International Society for Measurement and Control
BBB.	ITS	Intertek Testing Services (Formerly Inchcape Testing Services)
CCC.	MCAA	Mechanical Contractors Association of America
DDD.	MSS	Manufacturing Standardization Society of the Valve and Fittings Industry
EEE.	NACE	National Association of Corrosion Engineers
FFF.	NBS	National Bureau of Standards
GGG.	NCAC	National Council of Acoustical Consultants
HHH.	NCCA	National Coil Coaters Association
III.	NCPI	National Clay Pipe Institute
JJJ.	NCSPA	National Corrugated Steel Pipe Association
KKK.	NEBB	National Environmental Balancing Bureau
LLL.	NEC	National Electric Code
MMM.	NECA	National Electrical Contractors Association
NNN.	NEMA	National Electrical Manufacturers Association
OOO.	NETA	InterNational Electrical Testing Association
PPP.	NFPA	National Fire Protection Association
QQQ.	NIA	National Insulation Association (Formerly National Insulation and Abatement)
RRR.	NIST	National Institute of Standards and Technology (U.S. Department of Commerce)
SSS.	NUSIG	National Uniform Seismic Installation Guidelines
TTT.	OSHA	Occupational Safety & Health Administration (U.S. Department of Labor)
UUU.	PCA	Portland Cement Association
VVV.	PDI	Plumbing and Drainage Institute
WWW.	PPFA	Plastic Pipe and Fittings Association
XXX.	PPI	Plastics Pipe Institute
YYY.	RMA	Rubber Manufacturers Association
ZZZ.	SAE	SAE International
AAAA.	SAE	Society of Automotive Engineers
BBBB.	SMACNA	Sheet Metal & Air Conditioning Contractors' National Association
CCCC.	STI	Steel Tank Institute
DDDD.	SWPA	Submersible Wastewater Pump Association
EEEE.	UL	Underwriters Laboratories
FFFF.	UNI	Uni-Bell PVC Pipe Association

GGGG. WSC Water Systems Council

1.5 SHOP DRAWINGS

A. Review of Shop Drawings does not relieve Contractor of responsibility for correct ordering of material and equipment.

B. Contractor review should ensure that equipment will fit into available space.

C. Shop Drawings shall be prepared and submitted in accordance with Division 1 “Submittals”.

D. Include all significant data on Shop Drawing Submittals shown in Specifications and Equipment Schedule. Including, but not limited to the following:

1. Name each piece of equipment by scheduled name, noted as: “Mark No.” as indicated on drawings, i.e., FC-A, CSAC-A, etc.
2. Pressure drops at design flow.
3. Electrical characteristics and wiring diagrams: Power, signal, and control wiring. Wiring diagrams must match the equipment provided. Custom factory wiring such as terminal strip designations must be provided. Costs associated with field changes required if accurate wiring diagrams are not provided shall be borne by the equipment manufacturer.
4. Description of construction and material types and gauge of materials used.
5. Entering and leaving air and or water temperature at design conditions.
6. Performance characteristics/efficiency.
7. Dimensional drawing showing locations of all field connections including piping, control, power and sheet metal as well as equipment configuration.
8. Dimensional drawing showing locations of all field connections including piping, control, power and sheet metal as well as equipment configuration.
9. Note any special tools required for equipment service.

E. Items Requiring Submittals:

1. Each individual section lists the required items to be submitted.

1.6 RECORD DRAWINGS

A. Contractor shall be responsible for furnishing to Engineer a complete, accurate and neat set of marked-up blueline drawings in accordance with Division 1. This set shall contain all deviations between actual construction and Contract Drawings.

B. Contractor shall maintain a mark-up set of as-built drawings on the project site and shall keep all drawings up-to-date as construction progresses. This marked-up set shall be returned to Contractor, as many times as necessary, in order to obtain desired results.

C. Engineer's employees shall inspect Drawings regularly on project site for accuracy and omissions. Pay request will not be approved if marked-up record drawings are not onsite and up to date.

D. Refer to Division 1 “PROJECT CLOSEOUT” for further instructions.

1.7 CONSTRUCTION DOCUMENTS

A. Construction documents shall include all divisions of specifications, all drawings and all issued addenda.

B. In a case of conflict between the drawings and specifications, or between divisions of specifications, the most stringent condition shall apply.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Prepare Operation and Maintenance Manuals including the following information for equipment items:

1. Complete index identifying contents of manual. Also provide a comprehensive list of manufacturers, suppliers, subcontractors, etc., with name of contact person, address and phone number for each manufacturer, supplier and subcontractor.
2. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and exploded drawing of devices with names and part numbers of replacement parts.
3. Complete set of reviewed shop drawings.
4. Manufacturer’s printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
6. Servicing instructions and lubrication charts and schedules.
7. Warranty letter from contractor stating general warranty and any extended warranty items included in this contract.
8. Refer to Division 1 “Contract Closeout” for additional instructions.
9. O&M Manuals shall also be submitted in electronic format and neatly organized to the satisfaction of the engineer.

1.9 DRAWINGS

A. Mechanical Drawings show general arrangement of all piping, equipment and appurtenances. They shall be followed as closely as actual building construction and work of other trades will permit. Mechanical work shall conform to requirements shown on all Drawings. General and Structural Drawings shall take precedence over Mechanical Drawings. Because of small scale of

Mechanical Drawings, it is not possible to indicate all offsets, fittings and accessories, which may be required. Contractor shall investigate structural and finish conditions affecting work and shall arrange his work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions.

B. For purpose of clarity and legibility, Drawings are essentially diagrammatic, although size and location of equipment and piping are drawn to scale wherever possible. Verify Contract Document information at site.

C. Drawings indicate required sizes and points of termination of pipes and ducts and suggested routes. It is not the intention of Drawings to indicate all necessary offsets. Install work in manner to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear. Do not scale from Drawings.

D. In case of a conflict in construction documents and or the specifications, Contractor shall receive clarification, prior to bidding, in the form of an addendum or include in his price, the greater amount of work of the conflicts shown. (i.e., if two pipe sizes are indicated for the same pipe, the Contractor shall price the larger of the two pipes.)

1.10 WORK AND WORKMANSHIP

A. Provide all required labor, materials, equipment and Contractor's services necessary for complete installation of systems required in full conformity with requirements of authorities having jurisdiction; and as indicated on Drawings and herein specified.

B. Finished job shall be functional and complete in every detail, including any and all such items required for a complete system, whether or not these items are specified or shown on drawings.

C. Any apparatus, material or work not shown on Contract Drawings but mentioned in the Specifications, or vice versa, or any incidental accessories or minor details not shown but necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be provided without additional expense to the Owner.

D. Special attention shall be given to accessibility of working parts and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.

E. Each Contractor shall acquaint himself with details of all work to be performed by other trades and take necessary steps to integrate and coordinate his work with other trades.

F. It is assumed the Mechanical Contractor is familiar with standard first-class installation procedures. Therefore, these Specifications do not attempt to include every detail or operation necessary for the complete installation.

G. It should be particularly noted that the terms "furnish" and "provide" are interchangeable and that each of these terms means to provide, install and connect, unless otherwise stated.

H. Whenever tables or schedules show quantities of materials, they shall not be used as a guide to Contractor. Each Contractor shall be responsible for furnishing all materials noted on Drawings and as specified.

I. Craftsman trained in each respective trade shall install work in that trade.

1.11 COORDINATION BETWEEN CONTRACTORS

A. Note: Respective contractor infers the contractor installing the work.

B. Each Contractor and Subcontractor shall study all Drawings applicable to this work so complete coordination between trades will be affected. Special attention shall be given to points where ducts cross other ducts or piping, where lights fit into ceilings and where pipe, ducts and conduit pass through walls and columns. Temperature controls interface, where applicable, shall be given attention.

C. It is responsibility of each Contractor and Subcontractor to leave necessary room for other trades. No extra compensation will be allowed to cover cost of removing piping, conduit, ducts or equipment found encroaching on space required by others.

1.12 ASSIGNMENT OF MISCELLANEOUS WORK

A. Lintels required by Contractor in new or existing walls shall be furnished by Other Contractor. Contractor shall be responsible for notifying other Contractor of correct size and locations for all lintels prior to wall construction.

B. Painting: Respective Contractor will provide prime painting on all ferrous metals such as supporting steel or hangers for mechanical piping and equipment. Piping itself is not to be primed. Any finish painting required, including painting of all mechanical items exposed to outside environment will be painted by Respective Contractor.

C. Color Code Painting: piping shall be color coded by the Respective Contractor as specified in Section 20 00 50.

D. Roof Openings: required by Mechanical Contractor shall be cut by Respective Contractor. Mechanical Contractor is responsible for correct size and location of same.

E. Roof Curbs and Bases: for roof mounted mechanical equipment shall be furnished and anchored to structure by Respective Contractor.

F. Flashing: for roof curbs and bases shall be furnished by Other Contractor.

G. Counter flashing for roof curbs and bases shall be furnished by Respective Contractor.

H. Sanitary Vent Lead Pans and Flashing: by Other Contractor.

I. Louvers: furnished by Respective Contractor. Size and location verified by Respective Contractor.

J. Pads and Foundations: for mechanical equipment shall be formed and poured by Respective Contractor. The Respective Contractor shall verify pad sizes, locations and all anchoring devices.

K. Platforms and Supporting Stands: for mechanical equipment shall be furnished by Respective Contractor unless noted otherwise.

L. Penetrations: holes required for piping or ductwork shall be cut in field at expense of Respective Contractor. Engineer shall give approval prior to any cutting.

M. Holes required for piping or ductwork shall be installed as walls are erected at the expense of the Other Contractor. Mechanical Contractor to coordinate location and size of all openings prior to building erection or he will assume all costs for providing openings.

N. Penetrations through Structure: Other Contractor shall cut openings through structure unless otherwise indicated by others on structural drawings. Engineer shall give approval prior to cutting.

O. Excavating and Backfilling: for mechanical work shall be by Respective Contractor.

P. Chemical Treatment, system fill of closed loop systems by Owner.

Q. Caulking of all plumbing fixtures shall be by Mechanical Contractor.

R. All fire stopping of mechanical penetrations by Respective Contractor.

S. All caulking of mechanical penetrations through interior partitions by Respective Contractor. All sleeve seals for mechanical penetrations through exterior below grade penetrations by Mechanical Contractor.

T. Mechanical Contractor will install all taps, control valves and thermowells in piping for all temperature sensors, flow switches, pressure sensors and any other control device installed in piping whether shown or not on the Drawings.

U. Dust Protection:

1. Temporary partitions or barriers required to protect existing building or facilities specifically in areas requiring primarily mechanical work; i.e., cross country pipe, etc., shall be provided by Respective Contractor. Respective Contractor shall coordinate necessity and location of such protection with Owner.
2. Temporary filters and covers for protection of new and existing ductwork, piping, and equipment is required during construction and shall be by Respective Contractor.

V. Pipe identification shall be by Mechanical Contractor as specified in Section 20 00 50.

W. Kitchen Equipment: furnished and set in place by Other Contractor. Rough-in shall be by Respective Contractor. Final connections shall be by Respective Contractor.

X. Temporary Use of Equipment: should it become necessary or desirable to operate any equipment before final acceptance, Owner shall be allowed to do so, ONLY after proper adjustments and trial operation by Contractor specified. Respective Contractor shall be responsible for instructing Owner, or his Representative, as to proper operation and care of equipment so used. If equipment is used prior to final acceptance of job, date of first usage will begin warrantee period.

Y. All electrical control wiring between mechanical equipment (i.e., air cooled chiller and condensing unit, respective indoor and outdoor equipment, etc.) shall be by Control Contractor. Conduit and wiring requirements shall adhere to those specified in Division 26.

Z. Cutting and Patching: Respective Contractor shall cut and patch finished areas as required by Mechanical Contractor.

AA. Wall Sleeves in new construction for Mechanical systems shall be provided by the Respective Contractor and coordinated by Mechanical Contractor.

BB. Wall Sleeves in existing construction shall be provided and installed by the Respective Contractor.

CC. Ceiling and Wall Access Panels: shall be located by mechanical contractor and installed by Respective Contractor.

1.13 EQUIPMENT WARRANTY AND EARLY EQUIPMENT STARTUP

A. Contractor shall provide a complete warranty for all equipment, controls, etc. that includes parts and labor, any equipment that fails shall be repaired and/or replaced at no cost to owner.

B. The warranty shall start on the date of substantial completion. On projects with multiple phases, the date of substantial completion of the final phase shall be the date that the warranty starts for all phases, i.e. the entire project. No exceptions.

C. If special extended warranties exist, they will be noted in the respective sections. Extended warranty starts on the date of Substantial Completion of the final phase, unless another date is agreed to by all parties.

D. If equipment startup is required to provide suitable climate conditions for carpentry finish trim, painting, ceiling tile installation, etc., then this contractor is responsible for starting, operating equipment and providing an extended warranty.

E. Respective Contractor shall provide and change temporary filters over ductwork openings or grilles connected to air handling equipment operated prior to Owner occupancy and Substantial

Completion for temporary heating and cooling. Respective Contractor shall submit equipment and ductwork dust protection measures prior to installation of equipment and ductwork.

F. Some devices such as Control Valves, VFD's, etc. require extended warranties. Extended warranties are noted in the Specification Section for that piece of equipment. The prime Contractor shall be responsible for all implementation and cost of extended warranty work.

1.14 MATERIAL AND EQUIPMENT TRANSPORT

A. All material and equipment, shipped to site, shall be suitably covered and protected during shipment to site.

B. Protection shall include shrink wrapping and desiccant bags for humidity controls.

C. Protect equipment from weather, road salts, road dirt, condensation, damage and all other situations that can be detrimental to the condition of the equipment and material being shipped.

D. Engineer will not be on site during delivery; however, Engineer reserves the right to reject material or equipment after the fact that is delivered to site in unsatisfactory condition.

1.15 MATERIAL STORAGE

A. Provide suitable protection from weather and vandalism for all materials and equipment to be installed. Storage shall be dry, clean and safe. Provide heat as required to stop condensation. Condensation occurs during periods of large ambient temperature swings, i.e. spring or fall. Any materials or equipment damaged, deteriorated, rusted or defaced due to improper storage shall be fully repaired, refinished or replaced, as directed by Engineer at no additional cost.

PART 2 - PRODUCTS

2.1 PRODUCT AND MATERIAL APPROVAL

A. A Specification followed by one or more manufacturers is limited to those manufacturers. Names of other manufacturers may be submitted for approval, to the Engineer, a minimum of ten calendar days prior to receiving bids. Approval will be issued by Addendum if approval is granted.

B. The mechanical equipment shall be new, listed by UL and shall confirm to NEMA requirements.

C. If changes in pipe, ductwork, conduit, wiring, structural support, ceiling space, etc. are required as a result of the contractor's decision to purchase equipment with a different arrangement than shown on the Drawings, the Contractor shall be responsible for including all associated

costs in their bid. Manufacturers listed on schedules shall be considered “Basis of Design” (BOD). Note that manufacturers listed as equals may have physical characteristics such as weight, footprint, sound levels, electrical, etc., which require more coordination, piping, wiring, and/or general construction changes. The Mechanical Contractor will be responsible for all additional costs associated with the installation of this equipment. Contractors should seek clarification prior to bid for any equipment that does not meet or exceed the scheduled or specified characteristics.

D. Manufacturers listed for products and equipment does not imply that their standard construction or configuration is acceptable or meets the specifications. Equipment proposed “as equal”, must meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.

PART 3 - EXECUTION

3.1 PROTECTION AND TREATMENT OF PROPERTY

A. Repair and replace all property damaged in installation of underground lines to meet approval of Owner and authorities having jurisdiction.

B. Repair streets, which are part of State Highway System to satisfaction of State Highway Department.

C. Replace base and wearing surfaces of streets with same kind and thickness of material as existing. Replace brick, concrete and asphalt surface to width 6" wider than disturbed area. Replace entire surface if more than 30% has been disturbed.

D. Replace sidewalks, curbs, gutters, driveways, with same kind and thickness of material. Replace entire section of concrete walks or driveways.

E. Re-grade and replant lawn areas.

F. Protect existing utilities. Cap existing utilities that are abandoned.

G. All property in existing facilities that is damaged/removed, by contractor operations shall be repaired/replaced to previous operating and appearance condition.

3.2 DEMOLITION AND REMOVAL OF EQUIPMENT

A. Contractor shall remove all equipment, hangers and support for portion of mechanical system in present building as indicated on Drawings and/or implied by nature of the work to be removed. Contractor shall remove all pipes and ductwork back to source made obsolete by removing equipment unless specifically instructed otherwise.

B. Contractor shall properly support remaining portions of the work. Contractor shall provide valves, plugs, vents, etc. as required so existing systems remain operational.

C. Owner shall have first right of refusal on all equipment, piping, etc., being removed. If owner decides to keep removed items, then the contractor shall move items to a location on this project site as directed by owner.

D. Openings remaining after equipment has been removed shall be patched to match surrounding surfaces and in conformance with good practice.

3.3 ELECTRICAL CONNECTIONS TO EQUIPMENT AND CONTROL WIRING

A. All electrical work shall be done in accordance with the latest edition of the National Electric Code.

B. All above ground wiring shall be installed in metallic conduit with a minimum conduit size of ¾ inch. All wiring shall be concealed, except in equipment rooms, crawl spaces, tunnels and mechanical or electrical closets. Conduit shall be fastened securely at regular intervals and shall be run parallel to the building lines.

C. Running low voltage wire above bar joist in roof/floor metal deck flutes is not permitted. Wire to be run above bottom chord of truss and fastened to structure with wire ties at maximum 4'-0" o.c.

D. All flexible conduits shall not exceed 2'-0".

E. All below ground wiring shall be installed in rigid conduit with minimum size of ¾". Conduit system shall be sealed watertight.

F. Provide all wire, conduit, fittings, miscellaneous materials and labor as required for mounting and connecting the electrical control devices furnished in this contract.

G. All wiring shall be continuous from point to point. No splicing between terminations allowed.

H. In the event that a Supplier of equipment requires a larger starter, disconnect wiring conduit, etc. than those indicated in Contract Documents, he shall reimburse Contractor supplying these items for the difference.

I. Connections and wiring diagrams shown on Drawings or described in Specifications are typical and for bidding purposes only. Detailed diagrams and instructions shall be provided by Contractor supplying the equipment. If connections are different from those shown on Drawings, Mechanical Contractor shall reimburse Electrical Contractor for those differences.

J. Additional relays switches, contactors, etc. which may be required for control purposes in addition to those specified and indicated on Drawings shall be provided by Mechanical Contractor.

K. In the event that several pieces of mechanical equipment from different Suppliers are combined in one system, Mechanical Contractor shall furnish complete wiring and control diagrams to enable Electrical Contractor to make proper connections. Diagrams shall be submitted to Engineer for review, prior to actual wiring.

L. Mechanical Contractor shall furnish to Electrical Contractor written notice of approval and acceptance for all control wiring installed for mechanical systems by Electrical Contractor. Such approval shall be given within 30 days of completion of all such control wiring. Two copies of letter shall be sent to Engineer.

3.4 ATTACHING TO BUILDING CONSTRUCTION

A. Equipment and pipe supports shall be attached to structural members (beams, joists, etc.) rather than to floor or roof slabs. Support from structural members shall be in accordance with manufacturer recommendation of structural member and/or approved by Structural Engineer.

B. Where piping is suspended from existing concrete or masonry construction, use expansion shields to attach pipe supports to construction.

1. Anchors shall be installed horizontally into the sides (vertical portion) of concrete beams at a minimum of 5” from the bottom of the beam.
2. When support location is between concrete beams, then Unistrut shall be attached to sides of concrete beams and span continuously between the concrete beams. Unistrut shall be sized per manufacturer’s data to carry load.
3. Contractor must receive prior approval before attaching to the underside of concrete slabs or concrete beams.
4. Install all anchors according to manufacturer’s written instructions. Expansion shield bolt diameter shall be same size as support rod diameter hereinafter specified. If, in the opinion of the Owner/Engineer, existing structure is questionable, an angle will be required with two expansion shields to carry each vertical support rod. Expansion shields shall be combined friction and keying hold type wedge anchor like HILTI Red Head or approved equal.

C. Where existing masonry is not suitable to receive and hold expansion shields or where other means of attachment is advantageous, Contractor shall submit alternate method for approval of Engineer.

D. Where piping is suspended from structural steel building framing or supporting members, furnish and install beam clamps for attaching piping support device to building member.

E. Obtain approval from Engineer before cutting or welding to structural member or before hanging heavy equipment.

F. Support piping and ductwork from structure so that equipment connections are not being used for support.

3.5 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be installed.

B. Refer to shop drawings for equipment rough-in requirements.

3.6 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Keep all major equipment covered, in buildings, until major dust producing activities are complete. Equipment to be covered includes chillers, pumps, VFD's and AHU's.
2. All equipment must be installed such that maintenance and service may be properly accomplished. If necessary, the Owner, at their option, may require the contractor to demonstrate the service on any piece of equipment to determine sufficient service space exists. If the service space is not adequate, the equipment shall be relocated at no additional cost to the Owner such that sufficient service space is achieved.
3. Coordinate mechanical systems, equipment, and materials installation with other building components.
4. Verify all dimensions by field measurements.
5. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
6. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
7. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
8. Where mounting heights are not detailed or dimensioned, install systems, material, and equipment to provide the maximum headroom possible.
9. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
10. Install systems, materials, and equipment to conform with engineer reviewed submittal data. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.
11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
12. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

13. Extend grease fittings to an accessible location.
14. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at specified slope.
15. All shutdowns required to connect to existing systems shall be scheduled and coordinated with the Owner. Contractor shall prefabricate and install new materials as much as possible to keep shutdown duration to a minimum.
16. All pipe, duct and mechanical equipment shall be installed as high above floor (close to structure) as possible. When any pipe, duct or mechanical piece of equipment is installed lower than 7'-0" above finished floor, foam type insulation with black and yellow caution marker tape shall be installed on bottom leading edges.
17. Contractor shall field verify all locations, sizes and connection points to existing piping, ductwork and systems as shown on the drawings. Contact Engineer with any discrepancies.
18. Provide all contact information to Test and Balance Contractor 30 days prior to start-up of equipment.
19. Contact Test and Balance Contractor after leakage and pressure test on air and water systems has been successfully completed.

B. Platforms and Supporting Stands

1. Each piece of equipment or apparatus suspended from ceiling or mounted above floor level shall be provided with suitable structural support, platform or carrier, in accordance with best recognized practice.
2. Contractors shall exercise extreme care that structural members of building are not overloaded by such equipment. In all cases, details of such hangers, platforms and supports, together with total weights of mounted equipment, shall be approved by Engineer.

C. Drive Guards

1. All belt-driven equipment shall have belt guards with provisional slot for tachometer reading access at shaft. All rotating equipment and drives shall have safety guards.

3.7 CLEANING AND TOUCH UP

A. All mechanical equipment, cabinets, control panels and other enclosures shall be cleaned and have paint touched up as necessary to duplicate factory finished appearance. Touch up paint shall exactly match color, composition and quality of factory applied finish.

B. Equipment furnished with factory applied finish shall be protected from damage by the installing Contractor. Any damaged surface shall be repaired or replaced by the installing Contractor to match original finish or shall be replaced before final acceptance.

3.8 GENERAL COMPLETION, STARTUP

A. Work Included: furnish materials and labor required to perform startup of equipment and systems installed on project and provide operating instructions to Owner.

B. It is Mechanical Contractors' responsibility to conduct an owner orientation meeting which will review all systems, their operation and operation of all equipment.

C. General Requirements.

1. Inspect bearings for cleanliness and alignment and remove any foreign materials found. Grease as necessary and in accordance with manufacturer's recommendations. Replace bearings that run rough or noisy.
2. Adjust tension in V-belt drives, adjust vari-pitch sheaves and drives for proper equipment speed. Change belts and sheaves if necessary to obtain proper equipment speed; remove any foreign materials from sheaves or belts before starting operations; adjust drives for alignment of sheaves and v-belts. Construe proper speed as that which produces intended performance. Change sheaves so that design CFM is achieved when VFD is at 100%. Slowing VFD to meet maximum design CFM is not acceptable.
3. Tighten flanges and packing glands after system has been placed in operation. Replace gaskets in flanges that show any signs of leakage after tightening.
4. Inspect screwed joints for leakage and remake each joint that appears to be faulty. Do not wait for rust to form. Clean threads on both parts, apply compound and remake joint.
5. Adjust pipe hangers and supports for correct pitch and alignment.
6. **Flush systems and clean all strainers. After 30 days of operation clean strainers again.**
7. Provide such continuing adjustment services as is necessary to ensure proper functioning of all mechanical systems after building occupancy and during guarantee period.
8. Provide duct stiffeners, air straighteners, or turning vanes as required to stop any oil canning, drumming or fan surge to the satisfaction of the engineer.

3.9 AIR FILTERS

A. Provide a total of three (3) sets of air filters for each piece of equipment (AHU's, RTU's, VUV's, CUH's, FC's BC's, etc.) for Owner use after Substantial Completion has been awarded.

B. Never operate equipment without air filters. Contractor shall provide and change air filters, as needed during construction for equipment operation prior to Substantial Completion.

C. Replace temporary construction air filters in each and every piece of equipment within 2 weeks after substantial completion. Testing and Balancing shall not commence until fitter has been changed within respective equipment.

END OF SECTION 20 00 10

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SECTION 20 00 50 – COMMON MATERIALS AND METHODS FOR FIRE SUPPRESSION, PLUMBING AND HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this and all Sections of Divisions 20, 21, 22 and 23.

1.2 SUMMARY

A. Provide equipment, materials, labor and services common to more than one section of Divisions 20, 21, 22 and 23. The work generally includes, but is not limited to the following:

1. Electric Motors
2. Pressure Gauges
3. Thermometers
4. Separable Sockets
5. Pressure and Temperature Test Plugs (Pete's Plugs)
6. Sleeves
7. Firestop Sealants and Caulks
8. Mechanical Sleeve Seals
9. Elastomeric Joint Sealants
10. Pipe Identification
11. Mechanical Service Color
12. Equipment Identification
13. Paint
14. Concrete
15. Grout
16. Ceiling and Wall Access Panels
17. Thermostats and Sensors

1.3 SUBMITTALS

A. If specified products are provided, submittals are not required for products provided in this section.

B. If it is desired to use products that are not specified, then those products must be submitted for review prior to ordering said products.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. Service:

1. Constant Speed Motors: PREMIUM-EFFICIENCY, NEMA Design B, Class B insulation, nameplated and designed for electrical characteristics noted on Drawings in accordance with NEMA and IEEE Standards.
2. Variable Speed Motors: PREMIUM-EFFICIENCY, NEMA Design B, drive rated with Class F insulation, nameplated and designed for electrical characteristics noted on Drawings and in accordance with NEMA and IEEE Standards. All end plates shall be cast iron. Aluminum end plates are not acceptable.

    a. Variable speed motors shall include installation of a maintenance free, circumferential, conductive micro-fiber shaft grounding brush to divert shaft currents to ground. Aegis model SGR or approved equal.
    b. Variable speed motors shall be in compliance with NEMA MG1-2006, Part 31, Section 4.4.2 as pertains to voltage spikes. (This is to help prevent premature motor winding failures when there is a long cable distance between VFD and motor).

B. General: Motor shall be at least HP specified.

C. Bearings: Ball, sleeve or roller bearings with dustproof rings.

D. Temperature Rise: Continuous rating at 104^{o}F (40^{o}C) above ambient.

E. Base: Cast iron or steel with adjustable slide rail.

F. Rating: Motors specified for voltage of 220 to 240 volts and 440 to 480 volts shall have 230/460 rating. Motors specified for voltage of 208 volts shall be designed and nameplated for 200 volts.

G. Enclosures:

1. Hazardous Locations:

    a. Explosive Liquid Vapor and Gasses: Class I Explosion Proof.
    b. Combustible Dust (i.e., Coal, grain flower:): Class II - Dust Ignition Resistant.

2. Outside: Totally Enclosed Fan Cooled (TEFC).
3. All others: Open Drip-Proof (ODP) unless noted otherwise with a specific piece of equipment.

NEMA Premium^{TM}

Product Scope and Nominal Efficiency Levels

The NEMA Premium™ efficiency electric motor program scope is single-speed, polyphase, 1-500 horse-power, 2, 4 and 6 pole, squirrel cage induction motors, NEMA Design A or B, continuous rated. Products must meet or exceed the nominal energy efficiency levels presented below:

Table 1
Nominal Efficiencies for "NEMA Premium™" Induction Motors
Rate for 600 Volts or Less (Random Wound)

	Open Drip-Proof			Totally Enclosed Fan-Cooled		
HP	6-pole	4-pole	2-pole	6-pole	4-pole	2-pole
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1

H. Sizing:

1. Select motors to have required capacity to operate driven equipment under all conditions of operation without overload.
2. Do not include motor service factor when determining motor size.

I. Manufacturers:

1. Allis Chalmers
2. General Electric
3. Louis Allis
4. Reliance
5. Westinghouse
6. Century
7. Marathon
8. Baldor

2.2 PRESSURE GAUGES

A. Accuracy ASME/ANSI B40.1 Grade 1A (1%).

B. 6" minimum diameter dial, stainless steel bourdon tube, lower connection.

1. Manufacturers:

a. Ashcroft 1379S
b. Hellicoid 440
c. U.S. Gauge 1600
d. Duro United Series #10
e. Weksler 300 Series
f. Trerice No. 4500 Series
g. McMaster-Carr. High-Accuracy

C. Pressure Snubbers: Piston type like WEKSLER RS1.

2.3 THERMOMETERS

A. Provide and install light powered digital thermometers to meet the following criteria.

1. Display: 3/8" LCD digits
2. Accuracy: 1%
3. Range: -40/300°F
4. Humidity: Operational in ambient conditions up to 100% RH.
5. Case: High impact
6. Stem length to fit separable sockets. Reference separable sockets for required length.
7. Adjustable joint mounting so head can swivel and rotate for best visibility.
8. Heads shall be replaceable without any loss of water from system.

B. Manufacturers:

1. Weiss Vari-angle digital thermometer
2. Trend Instruments Inc.
3. Winters 9IT
4. Trerice

2.4 SEPARABLE SOCKETS

A. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

1. Material: Brass, for use in copper piping.
2. Material: Stainless steel, for use in steel piping.
3. Material: Steel, for use in steel piping
4. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for sockets in piping not insulated.
5. Insertion Length: To extend to a minimum of 1/3 (one-third) of diameter of pipe.

2.5 PRESSURE AND TEMPERATURE TEST PLUGS (PETE'S PLUGS)

A. Plug shall be brass or stainless steel arranged for a 1/8" diameter shaft to enter into the plug. The plug shall be rated for 350^{o}F for water and 200^{o}F for gases. The plug shall be equipped with a pipe cap. The plug system shall be rated for zero leakage to 250 PSIG.

B. Manufacturer:

1. Sisco
2. Trerice
3. Peterson Equipment

2.6 SLEEVES

A. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, plain ends.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

D. Sleeves shall be in accordance with the schedule unless otherwise specified.

PIPE SIZE	UNINSUL.	1" INSUL.	1-1/2" INSUL.	2" INSUL.
1"	2	4	6	6
1-1/2"	3	4	6	8
2"	3	6	8	8
3"	4	6	8	10
4"	6	8	10	10
6"	8	10	12	12
8"	10	12	12	14

2.7 FIRESTOP SEALANTS AND CAULKS

A. Penetration Sealant:

1. 3M Brand “Moldable Putty Pads and “Moldable Putty Stix”.
2. 3M Brand “Fire Barrier” Caulk, Putty or Penetrating Sealing Systems.
3. Dow Corning “Fire Stop Foam” and “Fire Stop Sealant” systems.
4. Insta-Foam Products, Inc. “Insta-Fire Seal Silicone RTV Foam”.
5. Standard Oil Engineering Materials Company “Fyre Putty”.

B. Intumescent Sealant:

1. 3M Brand “Fire Barrier” caulk or putty, FS-195 Wrap Strip and CS-195 Composite Sheet.
2. Dow Corning “Fire Stop Intumescent Wrap Strip”.
3. Fox Couplings, Inc. “The Fox Cast-in-Place Coupling”.
4. For plastic pipe penetrations up to 4” diameter: Use 3M pre-manufactured fire barrier plastic pipe devices or equal.
5. For plastic pipe penetrations larger than 4” diameter: Use 3M fire barrier RC-1 restricting collar with FS-195+ wrap/strip or equal.

C. Performance Characteristics: Firestopping materials shall conform to both Flame (F) and Temperature (T) rating as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests.

1. F Rating shall be a minimum of one hour but not less than the fire resistance rating of the assembly being penetrated.
2. Conduct the fire test with a minimum positive pressure differential of 0.01” of water column.

D. Quality Assurance: Installer qualifications – firm specializing in firestopping installation with not less than two years of experience or trained and approved by firestopping manufacturer.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular design with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

B. Manufacturers: Thunderline/Link-Seal; Calpico, Inc.; MetraFlex Co.

2.9 ELASTOMERIC JOINT SEALANTS

A. Sealant: Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated. Per ASTM C 920 like Dow Corning 995 GE Silicones, Tremco Spectrum 1 or equal.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26°F (minus 32°C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance. Verify compatibility with Elastomeric Joint Sealant Manufacturer prior to use.

C. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

D. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

2.10 PIPE IDENTIFICATION

A. Banding and labeling shall consist of the following:

1. Color-coded band to conform to color code hereinafter specified.

a. For pipe diameter of 6” or less (including insulation):

PIPE DIA.	SIZE OF LETTERS	LENGTH OF COLOR FIELD
3/4” – 1 3/8”	1/2”	8”
1 1/2” – 2 3/8”	3/4”	8”
2 1/2” – 6”	1 1/4”	12”

1) Manufacturer: Seton Setmark “SNA” Marker. Graphic Products or approved equal.

b. For pipe diameter of 6” or greater (including insulation):

PIPE DIA.	SIZE OF LETTERS	LENGTH OF COLOR FIELD
6" – 7 7/8"	1 1/4"	12"
8" – 10"	2 1/2"	24"
Over 10"	3 1/2"	32"

1) Manufacturer: Seton Setmark "STR" Marker, Graphic Products or approved equal.

B. Coded Pipe Color Selection

		Glidden	Rustoleum
Domestic Water	Light Blue	8O-L-2	886
Fire Lines, Sprinklers, etc.	Red (Painted in entirety in Mechanical Room)	452O	964
Chilled Water Supply	Dark Green	4554	H-3
Chilled Water Return	Dark Green	554	H-3
Hot Water Heating Supply	Light Green	71-L-2	H-27
Hot Water Heating Return	Light Green	1-L-2	H-27
High Pressure Steam Supply	Gray	4572	975
High Pressure Steam Return	Dark Blue	4564	721
Cond. Pump Discharge	Light Orange		
Steam Relief Vent	Platinum Light Gray		
Compressed Air	Gold Ingot Gold		
Natural Gas	Safety Yellow (Painted in entirety in Mechanical Room)		
L.P. Gas	Sienna Brown		

2.11 PLASTIC LAMINATE SIGNS FOR EQUIPMENT IDENTIFICATON

A. ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore.

1. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
2. Punch for mechanical fastening.
3. Thickness: 1/8 inch (3.2mm), unless otherwise indicated.
4. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
5. Nomenclature: Name and plan number as shown on Equipment Schedules and on Drawings or as directed by the Owner.
6. Size: Approximate 2 1/2 by 4 inches (65 by 100mm) for control devices, dampers, and valves; and 4 1/2 by 6 inches (115 by 150 mm) for equipment.

2.12 CONCRETE

A. Concrete shall be 1 part Portland cement, 2 parts sand and 4 parts gravel or broken stone that will pass through a 1" diameter hole. Clean sharp sand, washed gravel and Portland cement, Atlas, Alpha, LoneStar, Universal or approved equal, shall be thoroughly mixed in a dry condition

until color of mixture is uniform. This mixture shall be uniformly spread and gravel evenly distributed thereon, then wet and thoroughly mixed to a consistency that will need no tamping but can be easily faced for spading. Hand mixed concrete shall be prepared upon substantially constructed, tight bottom platforms and shall be mixed in batches not to exceed 1 cubic yard per batch. If concrete is machine-mixed, it shall not be mixed until same can be immediately placed. No concrete which has taken initial set shall be used.

2.13 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.14 CEILING AND WALL ACCESS PANELS

A. Plastered Wall or Ceiling: 24" x 24" unless otherwise noted. Constructed to receive plaster to match adjacent finish. Milcor Style with cam latch.

2.15 THERMOSTATS AND SENSORS

A. Refer to individual equipment specifications and temperature controls specifications for device specifications.

PART 3 - EXECUTION

3.1 PRESSURE GAUGES

A. Connection in Piping: provide spare pressure snubbers and install ahead of each gauge to minimize gauge needle pulsations as directed by Engineer. Install 1/2" ball valve to isolate each gauge. Mount gauges for maximum visibility from floor.

B. Where gauges are installed across pumps to measure differential pressure, install two (2) 1/2” ball valves, one in pipe from pump suction and one in pipe from pump discharge.

C. Install siphons on all steam gauges: brass or steel.

D. Scale Ranges

1. Hot Water Heating: 0-60 psig

2. Chilled Water: 0-100 psig
3. Steam High Pressure: 0-160 psig
4. Steam Low Pressure: 0-30 psig
5. Steam Condensate: 0-60 psig

3.2 THERMOMETERS

A. Connection in piping

1. Mount sockets in vertical up position to facilitate their being filled.
2. Mount and adjust thermometers so they may be read standing on floor without using ladder or straining back.

3.3 PRESSURE AND TEMPERATURE TEST PLUGS (PETE'S PLUGS)

A. Install Pete's Plugs at each and every piece of hydronic equipment including coils, heat exchangers and pumps and install where shown on Drawings.

B. Install Pete's Plugs in 1/4" plugged bosses at pump suction and pump discharge flanges.

C. Always install Pete's Plugs on equipment side of balance valves to measure true differential pressure across equipment, and not across balance valve.

3.4 ESCUTCHEONS

A. Escutcheons: Manufactured wall, ceiling and floor plates; deep-pattern of type required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening and sleeve.

B. Cast Brass: One piece, with set screw.

1. Finish: Rough brass.
2. Finish: Polished chrome-plate.

C. Cast Brass: Split casting, with concealed hinge and set screw.

1. Finish: Rough brass.
2. Finish: Polished chrome-plate.

D. Install pipe escutcheons for exposed pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Un-insulated Piping Wall Escutcheons: Cast brass or stamped steel, with chrome-plated finish and set screw.
3. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.

3.5 SLEEVES / PENETRATIONS

A. Sleeves are not required for core drilled holes through poured in place concrete walls.

B. Install sleeves for pipes and ducts passing through masonry walls, fire rated gypsum-board partitions, gypsum-board partitions with dry wall on both wall faces, and concrete floor slabs.

C. Sleeve length to be a minimum of 1” longer on each side of wall penetration.

D. Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring.

E. Build sleeves into new walls and slabs as work progresses.

F. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
2. Steel, Sheet-Metal Ductwork Sleeves: For ducts 6 inch and larger, penetrating gypsum-board partitions.
3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

G. Where sleeves are to be installed in existing floor or masonry wall, seal space between sleeve and wall with non-shrink grout.

H. Above Grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.

I. Below Grade Exterior-Wall Penetrations and Floors of Mechanical Spaces: Seal penetrations using mechanical sleeve seals. Size penetration for 1-inch annular clear space between pipe and opening for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

J. Fire-Barrier Penetrations:

1. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe and duct penetrations. Seal penetrations with fire sealants and caulks.
2. This assembly must maintain a watertight seal between floor or wall and pipe when used on exterior walls, or floors of wet areas. Also use mechanical link seals in these cases.
3. Use intumescent sealant for applications where combustible penetrants are involved (i.e., insulated or plastic pipe).
4. Install in all penetrations where required by code.

K. Sealant Application

1. Install sealants around all piping and duct penetrations.
2. Comply with sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
3. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of sealants as applicable to materials, applications, and conditions indicated.
4. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
5. Install sealant backings of type indicated to support sealants during applications and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    a. Do not leave gaps between ends of sealant backings.
    b. Do not stretch, twist, puncture, or tear sealant backings.

6. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

    a. Place sealants so they directly contact and fully wet joint substrates.
    b. Completely fill recess between pipe and opening.
    c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
    d. Remove excess sealants from surfaces adjacent to joint.
    e. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of product in which joints occur.

3.6 PIPE IDENTIFICATION

A. Install Pipe Identification on each system. Include pipe service as abbreviated on Drawings i.e. CHWS, CHWR, etc. and arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment of required for hot, un-insulated piping.

2. Locate pipe identification as follows:

    a. Exposed piping in unfinished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, above lay-in ceilings and exterior non-concealed locations.
    b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern or service is not obvious.
    c. Adjacent to penetrations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
    d. At access doors, manholes and similar access points that permit view of concealed piping.
    e. At all major equipment and other points of origination and termination.
    f. Spaced at maximum of 50-foot (15 m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment and in equipment rooms.

B. In addition to pipe identification, piping shall have color coded band adjacent to each label.

C. In all cases, Fire Protection and Natural Gas piping shall be painted in its entirety in all exposed areas including unfinished areas. Natural gas piping on roof shall be painted safety yellow in its entirety.

3.7 EQUIPMENT IDENTIFICATION

A. Install engraved plastic-laminate sign on each scheduled piece of mechanical equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 m) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (12.7 mm) high lettering for distances up to 72 inches (1800 mm) and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principle lettering.
2. Text of Signs: Provide specific name of unit as identified on Equipment Schedule on Drawings or as directed by the Owner. Inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
3. Locate identifying devices as necessary for unobstructed view in finished construction.
4. Where equipment is located above lay-in ceiling, affix a 1” adhesive label on ceiling grid system below equipment with equipment tag identification. Verify description requirements with Owner/Engineer. Where equipment is located above inaccessible ceilings, affix label or engraved plastic laminate sign securely to or near access panel.

3.8 PAINTING

A. Use paint type and method of application as follows:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Steel Supports: Use semigloss acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
7. Exterior or Interior Ferrous Supports for Cooling Towers, Tank Supports or any Wet or Corrosive Environment: Use epoxy paint.
8. Exterior Aluminum Rooftop Equipment: Factory applied Kynar, Dark Bronze.

B. Do not paint piping specialties with factory-applied finish.

C. Adhere strictly to paint manufacturer's written instructions for application.

D. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

E. Paint the following:

1. All exposed insulated and or uninsulated pipes, equipment, ductwork including insulation, etc. in finished areas.
2. All exposed ventilation equipment and ductwork in finished areas.
3. All equipment located in boiler room or equipment spaces.
4. All exposed bare pipe.
5. All hangers, platforms, supports and miscellaneous steel.
6. All exterior galvanized iron steel surfaces, including cooling towers, rooftop units, piping, ventilators, intake cowls, wall frames, louvers, exhaust vents, boiler stack and other miscellaneous surfaces.
7. All sheet metal pipe enclosures in finished spaces to be painted to match adjacent surfaces.
8. Convector cabinets, fin pipe enclosures and cabinet unit heaters.
9. All supply, return and exhaust grilles painted to match adjoining surfaces.
10. All roof mounted ventilation equipment.
11. All access panels.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code – Steel".

3.10 CONCRETE HOUSEKEEPING PADS

A. Install housekeeping pads below all equipment located in Mechanical Room.

B. Pads shall be constructed of poured-in-place concrete, Nominal 6" thick (form using standard 2" x 6" lumber) with 1" chamfer on all horizontal edges.

C. Pads shall extend a minimum of 6" beyond equipment in all directions or as detailed on the Drawings.

D. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

E. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

F. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

G. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 GROUTING

A. Install nonmetallic, non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer’s written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout. To ensure complete grout base, with no voids, pack grout from one side until grout is forced out of opposite side of base.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer’s written instructions.

3.12 EXCAVATION AND BACKFILLING

A. Properly support banks of excavation with safety sheet pile. Install barricades, fences, guards, etc. as required for safety and by OSHA.

B. Provide adequate pumping equipment and keep excavation free of water.

C. Excavate pipe trenches to proper depth and slope as required for piping.

D. Pipes passing under or through footings shall be sleeved (minimum two pipe sizes larger than pipe).

E. Pipes passing under or through corrosive fills shall have external coating to protect from corrosion.

F. Support and protect underground piping so it remains in place without settling and without damage during and from backfilling. Replace any piping so settled or damaged. Pipe shall not be supported on blocks to grade.

G. Lay underground piping on 6” bed of sand. Sand to fill from trench bottom to 6” above top of pipe. Carefully fill sand around pipe being sure that there is a complete smooth layer below pipes with no voids.

H. Backfill with clean earth, crushed rock, gravel or sand. Use only sand inside buildings. Fill first two feet in 6” lifts and remainder in 12” lifts. Tamp and puddle each layer.

I. Provide 6” wide marker tape buried directly underground above utility lines continuously along length of pipe. Marker tape shall be a minimum of 12” above utility line. Marker tape shall be a minimum of 6” wide.

J. Replace all surfaces with like, kind, i.e. grass, road, sidewalk, etc., or as specified elsewhere.

3.13 THERMOSTATS AND SENSORS

A. Unless specifically noted otherwise, install all wall-mounted thermostats and sensors required for respective equipment with 48” A.F.F. to top of device box. Closely coordinate rough-in locations with all trades.

END OF SECTION 20 00 50

SECTION 20 00 60 – COMMON PIPE, VALVES, FITTINGS AND HANGERS FOR FIRE SUPPRESSION, PLUMBING AND HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies piping, valves and fittings including piping support for all systems. These systems include the following:

1. System Piping Schedule #1
   Heating Water
   Chilled Water

2. System Piping Schedule #3
   0 to 15 PSIG Steam Supply

3. System Piping Schedule #5
   101 to 150 PSIG Steam Supply

4. System Piping Schedule #8
   Steam Condensate
   Steam Blowoff
   Steam Relief

5. System Piping Schedule #9
   High Pressure Steam Condensate
   High Pressure Steam Blowoff
   High Pressure Steam Relief

6. System Piping Schedule #10
   Generator Exhaust Pipe

7. System Piping Schedule #13
   Coil Condensate

8. System Piping Schedule #14
   Sanitary Inside Building

Vent Inside Building
Storm Gravity Inside Building

9. System Piping Schedule #15
   Sanitary Outside Building
   Vent Outside Building
   Storm Gravity Outside Building

10. System Piping Schedule #17
    Domestic Hot Water Aboveground
    Domestic Cold Water Aboveground

11. System Piping Schedule #19
    Fire Protection

12. System Piping Schedule #20
    Gas Piping

B. All specialty valves for specific systems are listed in specification sections for those systems. Specialty valves for specific systems can be found in the following sections:

1. Plumbing Specialty Valves – 22 00 00 “Plumbing”
2. Fire Protection Specialty Valves – 21 00 00 “Fire Protection”
3. Refrigeration Specialty Valves – 23 00 00
4. Hydronic Specialty Valves – 23 00 00 “Heat Transfer”
5. Control Valves – 23 00 00 “Temperature Controls”

C. Related sections include the following:

1.	20 00 10	Common Work Results for Fire Suppression, Plumbing and HVAC
2.	20 00 50	Common Materials and Methods for Fire Suppression, Plumbing and HVAC
3.	20 01 80	Common Insulation for Plumbing and HVAC
4.	21 00 00	Fire Suppression
5.	Division 22	Plumbing
6.	Division 23	Mechanical

1.3 SUBMITTAL

A. Submit product data for valves and fittings used in each system.

B. Submittal data to be in compliance with Section 20 00 10.

C. Product data shall include pressure and temperature classifications, model numbers, material types, actuators, trim, valve handle extensions and all pertinent data as required for complete evaluation by Engineer.

D. Maintenance data for valves shall include adjusting, servicing, disassembly, exploded view with part numbers and repair instructions.

E. Piping submittals are not required. However, piping to meet all specifications.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

B. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

C. All grooved joint couplings, fittings, valves and specialties shall be products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

D. Welded and Soldered Pipe

1. Pipe welding shall comply with provisions of latest revision of applicable code, whether ASME Boiler & Pressure Vessel Code, ASTM Code for Pressure Piping, or such state or local requirements as may supersede code mentioned above.
2. A copy of his welding procedure specification together with proof of its qualification as outlined and required by most recent issue of code having jurisdiction.
3. Submit Operator's qualification record in conformance with provisions of code having jurisdiction, showing that operator was under proven procedure specifications submitted by Contractor.
4. Standard procedure specifications and operators qualified by National Certified Pipe Welding Bureau shall be considered as conforming to requirements of these specifications.
5. Welders to have ASME test papers not more than 5 years old.
6. Each manufacturer or Contractor shall be responsible for quality of welding done by his organization and shall repair or replace work not in accordance with these specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set globe and gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Set butterfly valves closed or slightly open.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
3. Stack piping above grade and covered.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 PIPE MATERIAL DESIGNATIONS

A. Refer to System Schedules in Execution portion of this Section for designation of pipe types to be used for each piping system. When more than one piping type is designated, contractor may choose which type is installed.

B. Piping Designations

1. CP-2 Steel:

   a. 3/4" to 2" ASTM A53, Type S (seamless) or Type F (furnace-butt welded) Grade A Black steel (galvanized if so noted). U.S. Steel; Laclede; Republic; Youngstown, Jones & Laughlin.
   b. 2-1/2" to 12" ASTM A53, Type E (electric resistance welded) Grade A Black steel (galvanized if so noted).
   c. 14" to 20" ASTM A53, Type E (electric resistance welded) Grade B or Type S (seamless), (galvanized if so noted). U.S. Steel; Laclede; Republic; Youngstown; Jones & Laughlin.

2. CP-8 Copper: ASTM B75, B88, B251 and B447; ASA H23.1-1947 seamless copper tubing, hard temper (soft copper if so noted). Type K or L. (as noted) Chase; Bridgeport, Anaconda; Scovill.

3. CP-20 Ductile Iron Mechanical Joint: AWWA C151 with Mechanical Joint Bell and plain spigot end, cast iron pipe, centrifugally cast with asphaltum coating. Class as noted in schedule. Pipe to be marked and carry nominal weights and dimensions as required by state and local codes. As manufactured by James B. Clow & Sons; American Cast Iron Pipe; Alabama Pipe; U.S. Pipe & Foundry.

4. CP-30 PVC: polyvinylchloride; ASTM D 1785 schedule as noted. As manufactured by A.M. Byers; U.S. Steel; Carlon, Crescent; **normal or high impact as noted**.

5. CP-32 PVC SDR 35: (4" to 15") Polyvinylchloride Pipe, Type PSM conforming to ASTM D 3034. Reworked material is not acceptable. Cell Classification of 12454-B as defined in ASTM D 1782 and SDR (standard dimension ratio) of not greater than 35.

6. CP-33 PVC DWV Drainage Pipe: ASTM D2665, Polyvinylchloride pipe solid-wall, waste, and vent. Schedule as noted.

7. CP-34 ABS Pipe: ASTM D 2661, Solid Wall.

8. CP-40 Cast Iron (HUB) Bell and Spigot: ASTM A74, extra heavy bell and spigot cast iron soil pipe centrifugally metal or sand spun cast with asphaltum coating. American Brass & Iron; Tyler; Charlotte. Pipe and fittings shall be labeled with the trademark of the Cast Iron Soil Pipe Institute.

9. CP-41 Soil Pipe: Cast Iron no hub ASTM A888, CISPI 301. No hub cast iron soil pipe centrifugally metal or sand spun cast with asphaltum coating. American Brass & Iron; Tyler; Charlotte. Pipe and fittings shall be labeled with the trademark of the Cast Iron Soil Pipe Institute.

2.2 PIPE FITTING DESIGNATIONS

A. Refer to System Schedules in Execution portion of this Section for designation of fitting types to be used for each piping system. Fittings to be of the same strength of piping in each respective piping system. When more than one type is designated, contractor may choose which type is installed.

B. Fitting Designations:

1. CF-1 Malleable Iron: ASME B16.3. 300# (or as noted) black band malleable iron threaded fitting (galvanized if so noted). Grinnell; Flagg; Kuhns; Illinois Malleable, Stockham.

2. CF-2 Cast Iron: ASME B16.4; 250# (or as noted) black cast iron threaded fitting (galvanized if so noted). Grinnell; Kuhns, Illinois Malleable; Stockham.

3. CF-4 Flanged: 125# (or as noted) black cast iron, flanged fitting (galvanized if so noted). Grinnell; Kuhns; Stockham; Illinois Malleable.

4. CF-5 Wrought Steel fittings: ASTM, B16.9, B16.11, B16.28. Steel butt welding fitting. All elbows shall be long radius, unless otherwise noted. Tube Turns; Midwest; Taylor Forge; Ladish; NIBCO; Grinnell; Weld Bend; Babcock Wilcox.

5. CF-6 Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47 (ASTM A 47M), Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings. All fittings shall be long radius unless otherwise specified. UL listed, FM approved for fire service. Victaulic; Anvil; Gruvlok.

6. CF-8 Wrought Copper: ASME B16.22. Wrought copper solder joint fitting as manufactured by Flagg; Mueller; Chase, NIBCO; Anaconda; American Brass.

7. CF-8A Wrought Copper Cold Press Fitting: Fitting specifically design to be field installed with handheld portable press tool. Fitting to be certified by NSF, UL and be compliant with ICC, UPC, PHCC, NFPA13, 13D and 13R. Fittings to be ProPress Smart Connect installed by RIGID Portable Press tool.

8. CF-20 Mechanical Joint: AWWA C111 ductile or grey-iron, standard pattern, same class as noted for pipe. Alabama Pipe, U.S. Pipe & Foundry.

9. CF-30 PVC: Polyvinylchloride; same schedule and impact as noted. Schedule 40 ASTM D 2466 Socket Type, Sch 80 ASTM D 2467 Socket. Carlon; Crescent; A.M. Byers; U.S. Steel; Chemtrol.

10. CF-32 PVC Drainage Fitting: ASTM D 3034, SDR 35 for gasketed joints.

11. CF-33 PVC Drainage Fittings: ASTM D2665, socket type, made to ASTM D 3311 drain waste and vent patterns.

12. CF-34 ABS Drainage: ASTM D 2661, made to ASTM D 3311, drain, waste and vent pattern socket fittings.

13. CF-40 (HUB) Bell and Spigot: Cast iron bell and spigot Type fitting DWV configuration, extra heavy duty. American Brass & Iron; Tyler; Charlotte.

14. CF-41 (NO-HUB) Mechanical Joint: Cast iron no hub type fitting - DWV configuration. American Brass & Iron; Tyler; Charlotte.

15. CF-43 Ductile Iron Fitting: AWWA C 110, ductile or grey iron, for push on joints.

2.3 PIPE JOINT DESIGNATIONS

A. Refer to System Schedules in Execution portion of this Section for designations of joint types to be used for each piping system. When more than one type is designated, contractor may choose which type is installed.

B. Piping Joint Designations:

1. CJ-1 Threaded: threads shall conform to ASME B1.20.1, ASTM B16.3, B16.4, B16.12. Remove all burrs. Ream pipe ends to full bore and remove all chips. Use pipe compound on male ends only. Approved pipe compounds: Blue Seal; Key Tite.

2. CJ-5 Welded Pipe: standard specification provision for fabrication and erection of piping systems as recommended by National Certified Pipe Welding Bureau. All welding of pipe, regardless of condition of is to be installed as follows:

a. Pipe welding shall comply with provisions of latest revision of applicable code, whether ASME Boiler & Pressure Vessel Code, ASTM Code for Pressure Piping, or such state or local requirements as may supersede code mentioned above.
b. A copy of his welding procedure specification together with proof of its qualification as outlined and required by most recent issue of code having jurisdiction.
c. Submit Operator's qualification record in conformance with provisions of code having jurisdiction, showing that operator was under proven procedure specifications submitted by Contractor.
d. Standard procedure specifications and operators qualified by National Certified Pipe Welding Bureau shall be considered as conforming to requirements of these specifications.
e. Welders to have ASME test papers not more than 5 years old.
f. Each manufacturer or Contractor shall be responsible for quality of welding done by his organization and shall repair or replace work not in accordance with these specifications.

1. CJ-6: grooved mechanical-joint couplings: Two ductile or iron housing segments and synthetic rubber EPDM (+250^{o}F) gasket of central cavity pressure-response design; with ASTM A449/ASTM A183 nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings; Installation-Ready rigid coupling, or equal by Victaulic, Gruvlok, or engineer approved equal. UL classified in accordance with ANSI / NSF-61 for potable water service and shall meet the low-lead requirements of NSF-372. Torque of fittings, if required, shall be in accordance with the manufactures latest recommendations and each coupling shall be tagged or marked with the specific value of torque attained to confirm joint rigidity and proper installation, when applicable.

2. CJ-8: 95% tin, 4.85% copper, 0.15% selenium. Premium Contractor Grade solder. 410^{o}F Minimum working temperature; 7130 PSI Tensile Strength, ASTM B32. Like Taramet Sterling, Taracorp.IMACO, Winston-Salem, NC. Cut ends of tubing square with wheel type cutter, ream to remove burrs, wipe clean on inside, apply paste type solder flux on external surface. Apply solder (no lead allowed).

3. CJ-8A: Cold Press connection 0-250°F, 200 psig. Connection made using a handheld portable press system. Joint to be certified by NSF, UL and be compliant with ICC, UPC, PHCC, NFPA13, 13D and 139 like RIGID VIEGA ProPress System.

4. CJ-20 Mechanical Joint: AWWA C 111 ductile - or grey – iron glands, rubber gasket and steel bolts. Reinforce joint at hydrants, fittings or valves with heavy wrought iron clamps and wrought iron rods in accordance with standard details of National Board of Fire Underwriters. Apply heavy coat of bituminous solution to assembly.

5. CJ-32 Gasket for PVC Sewer pipe: ASTM F 477 elastomeric seals.

6. CJ-33 PVC/CPVC

a. Solvent Cement: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1) Comply with ASTM F 402 for safe-handling practice of cleaners, primers and solvent cements.
2) ABS piping: ASTM D 2235 and ASTM D 2661.
3) CPVC Piping: ASTM D 2846 and ASTM F-493.
4) PVC Pressure Piping: ASTM D 2672.
5) PVC Nonpressure Piping: ASTM D 2665.
6) PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

b. Heat Welding: ASTM D 2657
c. Threads: Use only where noted on schedules. Install as outlined for steel pipe but only to be used on Schedule 80 or 120 pipe. Use strap wrench for tightening.

7. CJ-40 (HUB) Bell & Spigot: Gasket-ASTM C 564, Rubber. American Brass & Iron; Tyler; Charlotte.

8. CJ-41 (No HUB) Coupling: Stainless steel couplings CISPI 310 with ASTM A 167, Type 301 or ASTM A 666 Type 301 Stainless steel corrugated shield; stainless steel bands and sleeve. American Brass & Iron; Tyler; Charlotte.

9. CJ-43 Wrought Cast-and Forged-Steel Flanges and Flanged Fittings: Class 150 and 300 ASME B16.5, including bolts, nuts, and gaskets of Materials Group: 1.1, Connections Butt Weld, facings: Raised Face; Crane.

10. CJ-44 Flanged Joints:

a. Cast-Iron Flanges and Flanged Fittings: ASME B16.21, Classes 25, 125 and 250; raised ground face, and bolt holes spot faced. Including bolts, nuts and gaskets.
b. Flange bolts and nuts: ASME B18.2, Carbon Steel unless otherwise indicated.

11. CJ-45 Mechanical Grooved Pipe Couplings: Style 107/ W07 rigid couplings, Style 177/ W77 standard couplings. Installation and pipe grooving shall be in accordance with the manufacturer's instructions. Coupling shall be suitable for working pressure and temperature of service. Coupling shall be approved by authorities having jurisdiction. Unions and flanges for servicing and disconnect are not required in installations with grooved mechanical joint couplings. The couplings shall serve as disconnect points.

a. Standard Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183.

Couplings shall comply with ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

b. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, with Victaulic Style 107H/107N (Quick-Vic™) or GruvLok SlideLok, Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C).

c. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source. Victaulic Style 177 (Quick-Vic™) or GruvLok, Installation ready or Style 77 flexible coupling.

d. Victaulic AGS Mechanical Couplings, 14 inch (DN350) through 60 inch (DN1500): Couplings shall consist of two ASTM A-536 ductile iron housing segments with lead-in chamfer on housing key and a wide-width elastomer pressure responsive gasket. Victaulic Style W07 AGS Rigid and Style W77 AGS Flexible Coupling.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimension; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thomson Plastics, Inc.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO, Inc.
b. NIBCO, Inc.; Chemtrol Div.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company/
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300- psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

    a. Calpico, Inc.
    b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Victaulic Co. of America

2.6 UNIONS AND FLANGED CONNECTIONS

A. 150-pound malleable iron with ground joint and brass to iron seats. Crane 1280.

B. 125-pound wrought copper or cast brass union with solder joint fittings. Crane 633.

C. 150-pound forged steel flanges with welding neck. Crane 568.

D. 150-pound bronze flanges with tube stop. Mueller F900.

2.7 VALVE DESIGNATIONS

A. Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

B. All valves shall be compatible with the type of piping material installed in the system.

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-1	CV-2
3	TYPE	Gate	Gate
4	MAXIMUM WORKING		
4.1	Pressure - PSIG	125	125
4.2	Temperature - ^{o}F	Sat. Stm.	Sat. Stm.
5	SIZE LIMITS - Inches	1/2 - 3	2 1/2 - 12
6	DESCRIPTION		
6.1	Body	Bronze	Iron ASTM A-126B
6.2	Trim	Bronze	Bronze
6.3	Gate	Split Wedge	Solid ASTMA-126B
6.4	Bonnet	Screw-in	Bolted
s6.5	Stem	Rising	OS&Y ASTM B-16B
6.6	Seat	Integral	Renewable
6.7	Agency Compliance	MSS SP-80	MSS SP-70
7	APPROVED RODUCTS		
7.1	Nibco	S211, T211, T135	F617-0
7.2	Jenkins	991 AT, 990 AJ	651A, 650A
7.3	Crane	1700S, 1700T	465 - 1/2
8	NOTES		

8.1 Use OS&Y (CV-2) valves when noted on drawings.

8.2 Provide manufacturer's standard stem packing for service intended.

8.3 Valves with rising stems suitable for repacking under pressure.

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-3.1
3	TYPE	Gate
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	250
4.2	Temperature - ^{o}F	450
5	SIZE LIMITS - Inches	2 1/2 - 12
6	DESCRIPTION	
6.1	Body	Cast Iron or Ferrosteel
6.2	Trim	Bronze
6.3	Disc/plug	Solid Wedge
6.4	Bonnet	Bolted
6.5	Stem	OS&Y
6.6	Seat	Renewable rings
7	APPROVED PRODUCTS	
7.1	Crane	7-1/2E
7.2	Lunkenheimer	1436
7.3	Jenkins	204
7.4	Stockham	F667
8	NOTES	
8.1	Provide manufacturer's standard stem packing for service intended.	
8.2	Valves with rising stems suitable for repacking under pressure.	

PART 2 - PRODUCTS (Continued)

VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-1.4
3	TYPE	Gate
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	600
4.2	Temperature - ^{o}F	850
5	SIZE LIMITS - Inches	1/2 - 2"
6	DESCRIPTION	
6.1	Body	Forged Steel
6.2	Trim	Monel
6.3	Disc/plug	Solid
6.4	Bonnet	Bolted
6.5	Stem	OS&Y
6.6	Seat	Renewable
6.7	Agency Compliance	ASME B16.34, API 602
7	APPROVED PRODUCTS	
7.1	Vogt	SW12111 (Socket Weld)
8	NOTES	

8.1 Provide manufacturer's standard stem packing for service intended.
8.2 Valves with rising stems suitable for repacking under pressure.

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-4	
3	TYPE	Globe	
4	MAXIMUM WORKING		
4.1	Pressure - PSIG	125	
4.2	Temperature - ^{o}F	Sat. Stm.	
5	SIZE LIMITS - Inches	1/2 - 2 1/2	
6	DESCRIPTION		
6.1	Body	Bronze	
6.2	Trim	Bronze	
6.3	Disc/plug	Renewable Composite	
6.4	Bonnet	Screw-in	
6.5	Stem	Rising-Silicon Bronze	
6.6	Seat	Integral	
6.7	Agency Compliance	MSS SP-80	
	APPROVED PRODUCTS	Soldered	Threaded
7.1	Nibco	S211	T211
7.2	Crane	1310	1

8 NOTES

8.1 Provide manufacturer’s standard stem packing for service intended.

8.2 Valves with rising stems suitable for repacking under pressure.

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-5	CV-6
3	TYPE	Globe	Angle
4	MAXIMUM WORKING		
4.1	Pressure - PSIG	125	125
4.2	Temperature - ^{o}F	Sat. Stm.	Sat. Stm.
5	SIZE LIMITS - Inches	3 - 12	3 - 12
6	DESCRIPTION		
6.1	Body	Iron ASTM A126	Iron
6.2	Trim	Bronze	ASTM B-584
6.3	Disc/plug	Renewable Composite	Renewable Composite
6.4	Bonnet	Bolted	Bolted
6.5	Stem	OS&Y	OS&Y
6.6	Seat	Renewable Rings	Renewable Rings, ASTM B584
6.7	Agency Compliance	MSS SP-85	MSS SP-85
7	APPROVED PRODUCTS		
7.1	Nibco	F-718-B	F-818-B
7.2	Crane	351	353
7.3	Jenkins	613CJ	615CJ
8	NOTES		
8.1	Provide manufacturer’s standard stem packing for service intended.		
8.2	Valves with rising stems suitable for repacking under pressure.		

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-4.1	CV-5.1
3	TYPE	Globe	Globe
4	MAXIMUM WORKING		
4.1	Pressure - PSIG	150	150
4.2	Temperature - ^{o}F	300	300
5	SIZE LIMITS - Inches	1/2 - 3	2 1/2 - 8
6	DESCRIPTION		
6.1	Body	Bronze	Cast Steel
6.2	Trim	Screwed Bronze	Exelloy
6.3	Disc/plug	Renewable Plug	Renewable Plug
6.4	Bonnet	Union	Bolted
6.5	Stem	Rising	OS&Y
6.6	Seat	Renewable	Renewable
7	APPROVED PRODUCTS		
7.1	Crane	14 - 1/2P	143XR (Flange)
			143 -1/2 XR (Weld)
7.2	Jenkins	546P	1040-CM
			2040-CM
7.3	O.I.C.	559	1542-N
8	NOTES		
8.1	Provide manufacturer’s standard stem packing for service intended.		

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-7		CV-8	
3	TYPE	Horizontal Swing Check		Horizontal Swing Check	
4	MAXIMUM WORKING				
4.1	Pressure - PSIG	125		125	
4.2	Temperature - °F	Sat. Stm.		Sat. Stm.	
5	SIZE LIMITS - Inches	0 - 3		2 1/2 - 12	
6	DESCRIPTION				
6.1	Body	Bronze ASTM-B62		Iron ASTM A-126	
6.2	Trim	Bronze		Bronze	
6.3	Disc/plug	Bronze		Renewable Bronze	
6.4	Bonnet	Screw-in		ASTM B-584	
6.5	Seat	Integral		Renewable Rings	
6.6	Agency Compliance	MSS SP-80		MSS SP-71 TYPE I	
7	APPROVED PRODUCTS	Soldered	Threaded	Threaded	Flanged
7.1	Crane	1342	37	372	373
7.2	Nibco	S41BB	T-413B	T-918-B	F-918-B
7.3	Jenkins	762A			
7.4	Victaulic	Series 716		Series 779	

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-9
3	TYPE	Non-Slam Wafer Check
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	150 (WOG)
4.2	Temperature - ^{o}F	100
5	SIZE LIMITS - Inches	2 - 12
6	DESCRIPTION	
6.1	Body	Semi-Steel, ASTM A-126
6.2	Trim	Bronze ASTM B-62
6.3	Disc/plug	Center Guided
6.4	Bonnet	
6.5	Seat	Renewable Rings
6.6	Agency Compliance	
7	APPROVED PRODUCTS	
7.1	Crane	1400
7.2	Lunkenheimer	-
7.3	Nibco	W910
7.4	Mueller	91 AP, 92 AP
7.5	Victaulic	Series 779

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-10	CV-11
3	TYPE	Lubricated Plug Cock	Lubricated Plug Cock
4	MAXIMUM WORKING		
4.1	Pressure - PSIG	200	175
4.2	Temperature - ^{o}F	150	150
5	SIZE LIMITS - Inches	1/2 – 2 (Threaded)	2 1/2 – 4 (Flanged)
6	DESCRIPTION		
6.1	Body	Iron	Iron
6.2	Trim	Iron	Iron
6.3	Disc/plug	100% Pipe Area Plug	100% Pipe Area Plug
6.4	Seat	Integral	Integral
7	APPROVED PRODUCTS		
7.1	Nordstrum	114	142, 143
7.2	Walworth	1700	1796, 1797
8	NOTES		
8.1	Provide manufacturer’s standard stem packing for service intended.		

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-15
3	TYPE	Globe Non-Slam Check
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	125
4.2	Temperature - ^{o}F	200
5	SIZE LIMITS - Inches	4 - 12
6	DESCRIPTION	
6.1	Body	Cast Iron
6.2	Trim	Bronze
6.3	Disc/plug	Center Guided
6.4	Bonnet	
6.5	Seat	Bronze
7	APPROVED PRODUCTS	
7.1	Crane	
7.2	Lunkenheimer	
7.3	Jenkins	
7.4	Nibco	**F-910**
7.5	Victaulic	
	Mueller	**105M-AP**
7.6	Centerline	
8	NOTES	
8.1	Use lift check valves only when noted on Drawings.	
8.2	Use viton seat on CV-15 for temperatures above 250^{o}F.	

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-16		CV-17
3	TYPE	Eccentric Plug		Eccentric Plug
4	MAXIMUM WORKING			
4.1	Pressure - PSIG	125		150
4.2	Temperature - ^{o}F			
5	SIZE LIMITS - Inches	1/2 - 2 (Threaded)	2 1/2 - 4 (Flanged)	5 - 12 (Flanged)
6	DESCRIPTION			
6.1	Body	Iron		Semi-Steel
6.2	Trim	St. Steel		Iron
6.3	Disc/plug	Dezurik Bronze with FS55 (250)		Dezurik Resilient Faced Plug RS55 (250)

7 NOTES

7.1 Provide manufacturer's standard stem packing for service intended.

7.2 Provide lever actuator for each valve except where special actuator is noted on Drawings.

7.3 Where eccentric plug valves are noted on Drawings as balancing valves, they are to have position stop, plastic cap and 1/8" downstream tap.

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1	Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.	
2	CLASS NO.	CV-20
3	TYPE	Ball - Full Port
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	600
4.2	Temperature - ^{o}F	Sat. Stm.
5	SIZE LIMITS - Inches	1/2 – 2 1/2”
6	DESCRIPTION	
6.1	Body/End Piece	2-Piece Construction - ASTM B 584 Bronze Body Alloy 844 Forging Brass ASTM B-124 Alloy 377
6.2	Ball	Chromeplated Brass Conventional Port
6.3	Stem	Bronze or Brass
6.3.1		Provide with Stem Extension on insulated pipes
6.4	Seats/Seals	Teflon
6.5	Agency Compliance	MSS SP-110
7	APPROVED PRODUCTS	Threaded
7.1	Nibco	T-585-70
7.2	Crane/Capri	9202
7.3	Conbraco Industries, Inc.	70-100
	Apollo Series	
8	NOTES	
8.1	Soldered valves are not allowed.	
8.2	Provide stem extension or valve manufacturers insulated extension handle system on all valves installed in insulated systems and specified to be insulated.	

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1	Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.	
2	CLASS NO.	CV-22
3	TYPE	Ball - Full Port - AGA Gas Ball Valve
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	5 psig Ambient - Valve Rated at 600 psig at 250^{o} F
5	SIZE LIMITS - Inches	1/2 - 2
6	DESCRIPTION	
6.1	Body/End Piece	Cast Brass ASTM B684 - C85700 Forged Brass ASTM B124 - C37700
6.2	Ball	Chromeplated Brass Conventional Port
6.3	Stem	Bronze or Brass
6.4	Seats/Seals	PTFE
6.5	Agency Compliance	
6.5.1	ANSI	Z21.15
6.5.2	FM	1/4" - 2"
6.5.3	UL	MHKZ; YSTD: VOGU (1/2" - 1"); YRBX (1 1/4" - 2"); YRPV (1 1/4" - 2")
7	APPROVED PRODUCTS	Threaded
7.1	McDonald	#10710

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1	Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.	
2	CLASS NO.	CV-23
3	TYPE	Butterfly
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	300
4.2	Temperature - ^{o}F	200
5	SIZE LIMITS - Inches	3 – 6 (see note below)
6	DESCRIPTION	
6.1	Body/End Piece	Duct. Iron ASTM A-126 Threaded Lug for dead end service
6.2	Disc	AL. Bronze ASTM B-148 Alloy 954/955; Coated Ductile Iron
6.3	Stem	416 Stainless steel ASTM A-582 Collar bushings upper and lower bushing Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.
6.4	Seats	Pressure Responsive EPDM
6.5	Agency Compliance	MSS SP-67
7	OPERATOR	
7.1	**Self-locking worm gear type actuator with adjustable stops and disc position indicator.**	
8	APPROVED PRODUCTS	
8.1	Nibco	LD 2000-3
8.2	Crane	14-TL
8.3	Apollo	6L-31
8.4	Lunkenheimer	FIG. 4735
8.5	Stockham	LD-711-BS3-E
8.6	Victaulic	VIC300 Series
8.7	Bray	Series 31
9	NOTES	
9.1	Do not use butterfly valves on pipes size 2 1/2” and smaller.	

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	CLASS NO.	CV-24
3	TYPE	Butterfly
4	MAXIMUM WORKING	
4.1	Pressure - PSIG	150
4.2	Temperature - ^{o}F	200
5	SIZE LIMITS - Inches	8 - 12
6	DESCRIPTION	
6.1	Body/End Piece	Duct. Iron ASTM A-536 Threaded Lug for dead end service
6.2	Disc	AL. Bronze ASTM B-148 Alloy 954/955; Coated Ductile Iron
6.3	Stem	416 Stainless steel ASTM A-582 Collar bushings upper and lower bushing
6.4	Seats	EPDM Rubber
6.5	Agency Compliance	MSS SP-67
7	OPERATOR	
7.1	Self-locking worm gear type actuator with adjustable stops and disc position indicator.	
7.2	**Provide with chain wheel where noted on Drawings.**	
8	APPROVED PRODUCTS	
8.1	Nibco	LD 2000-5
8.2	Crane	14-TL
8.3	Apollo	6L-31
8.4	Lunkenheimer	FIG. 4735
8.5	Stockham	LD-711-B53-E
8.6	Victaulic	300 Series
8.7	Bray	Series 31

PART 2 - PRODUCTS (Continued) VALVE SCHEDULES

1 Refer to System Schedules in Execution portion of this Section for designation of valve types to be used for each piping system.

2	VALVE DESIGNATION	CV-26	CV-27
3	TYPE	Blowoff	Blowoff
4	MAXIMUM WORKING		
4.1	Pressure - PSIG	250	250
4.2	Temperature - ^{o}F	450	450
5	SIZE LIMITS - Inches	1 ½ – 2 (Screwed)	1 ½ –2 ½ (Screwed)
6	DESCRIPTION		
6.1	Body	Iron	Iron
6.2	Trim	Bronze	Bronze
6.3	Disc and Packing Manufacturer’s Standard		
6.4	All Parts Renewable		
7	APPROVED PRODUCTS		
7.1	Crane	393	393-1/2
7.2	Lunkenheimer	1351	1352
7.3	Walworth	180	
7.4	Powell	544	545
7.5	Or approved equal		
8	NOTES		
8.1	ASME approved for intended use.		

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pipe, valves and fittings for each system as designated in the System Schedules on the following pages.

B. Reference Products, Part 2 of this Section for specifications and manufacturers of pipes, valves and fittings designated to be installed in System Schedules.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 1
HEATING & CHILLED WATER

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE		
2.1	Minimal Diameter	1/2"	2 1/2"
2.2	Maximum Diameter	2”	8”
3	DESIGN		
3.1	Working Pressure PSIG	160	160
3.2	Working Temperature °F	250	250
4	PIPING MATERIAL DESIGNATIONS		
4.1	Soft “K” Copper (See Notes)	CP-8	-
4.2	Hard “L” Copper	CP-8	CP-8
4.3	Sch. 40 Bl. St. (See Notes)	Not Allowed	CP-2
5	FITTING DESIGNATIONS		
5.1	Cold Press	CF-8A	CF-8A
5.2	Wrought	CF-8-	CF-8-
5.3	Cast Iron Threaded	CF-2	-
5.4	Flanged	Not Allowed	CF-4
5.5	Butt Welded	Not Allowed	CF-5
5.6	Grooved	Not Allowed	CF-6
6	JOINT DESIGNATIONS		
6.1	Cold Press	CJ-8A	CJ-8A
6.2	Solder	CJ-8	CJ-8
6.3	Threaded	CJ-1	-
6.4	Welded	Not Allowed	CJ-5
6.5	Flanged 125#	Not Allowed	CJ-44
6.6	Grooved	Not Allowed	CJ-45
7	VALVE DESIGNATIONS		
7.1	Ball	CV-20	CV-20
7.2	Butterfly	-	CV-23, 24
7.3	Globe	CV-4	CV-4, 5
7.4	Wafer Check	-	CV-9
7.5	Globe Check	-	CV-15

8 NOTES

8.1 Pipe installed below grade shall be continuous soft copper. No piping joints allowed below grade. All pipes above grade shall be straight lengths.

8.2 Buried piping shall be CP-80, no exceptions. See Section 3, Underground Piping for installation requirements.

8.4 Use 1/2" pipe only if shown on Drawings.

8.5 Mechanical T-bolted branch outlets not approved.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 3
0 to 15 PSIG STEAM SUPPLY

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE		
2.1	Minimum Diameter	3/4"	2 1/2"
2.2	Maximum Diameter	2”	12”
3	DESIGN		
3.1	Working Pressure PSIG	125	125
3.2	Working Temperature °F	250	250
4	PIPING DESIGNATIONS		
4.1	Sch. 40 Bl. St.	CP-2	CP-2
5	FITTING DESIGNATIONS		
5.1	Cast Iron Threaded	CF-2	-
5.2	125# Cast Iron Flanged	-	CF-4
5.3	Sch. 40 Wrt. St.	-	CF-5
6	JOINT DESIGNATIONS		
6.1	Threaded	CJ-1	-
6.2	Butt Welded	-	CJ-5
6.3	125# Flanged	-	CJ-44
7	VALVE DESIGNATIONS		
7.1	Gate	CV-1	CV-2
7.2	Globe	CV-4	CV-4, 5
7.3	Angle	-	CV-6
7.4	Check	-	-
8	NOTES		
8.1	Use Schedule 30 black steel on all sizes over 12”.		
8.2	See Division 23, “Heating Ventilating and Air Conditioning” for special valves.		

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 5
101 to 150 PSIG STEAM SUPPLY

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE		
2.1	Minimum Diameter	3/4"	2 1/2"
2.2	Maximum Diameter	2”	20”
3	DESIGN		
3.1	Working Pressure PSIG	150	150
3.2	Working Temperature °F	350	350
4	PIPING DESIGNATIONS		
4.1	Sch. 40 Bl. St.	CP-2	CP-2
5	FITTING DESIGNATIONS		
5.1	250# Cast Iron Screwed	CF-2	-
5.2	250# Cast Iron Flanged	-	CF-43
5.3	Sch. 40 Wrt. St.	-	CF-5
6	JOINT DESIGNATIONS		
6.1	Threaded	CJ-1	-
6.2	Butt Welded	-	CJ-5
6.3	300# Flanged	-	CJ-43
7	VALVE DESIGNATIONS		
7.1	Gate	CV-1.4	CV-3.1
7.2	Globe	CV-4.1	CV-4.1, 5.1

8 NOTES

8.1 Use Schedule 40 unless otherwise noted.

8.2 See Division 23, “Heating Ventilating and Air Conditioning” for special valves.

8.3 Use Schedule 80 black steel pipe on 2” and smaller piping.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 8
STEAM CONDENSATE, BLOWOFF AND RELIEF

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE		
2.1	Minimum Diameter	3/4"	2 1/2"
2.2	Maximum Diameter	2”	12”
3	DESIGN		
3.1	Working Pressure PSIG	125	125
3.2	Working Temperature °F	250	250
4	PIPING DESIGNATIONS		
4.1	Sch. 80 Bl. St.	CP-2	CP-2
5	FITTING DESIGNATIONS		
5.1	125# Cast Iron	CF-2	-
5.2	Sch. 80 Wrt. St.	-	CF-5
6	JOINT DESIGNATIONS		
6.1	Threaded	CJ-1	-
6.2	Butt Weld	-	CJ-5
6.3	150# Flanged	-	CJ-43
7	VALVE DESIGNATIONS		
7.1	Gate	CV-1	CV-2
7.2	Globe	CV-4	CV-4, 5
7.3	Angle	-	CV-6
7.4	Blowoff	CV-26	CV-27
7.5	Swing Check	CV-7	CV-8
8	NOTES		
8.1	See Division 23 “Heating Ventilating and Air Conditioning” for special valves.		

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 9
HIGH PRESSURE STEAM CONDENSATE,
BLOWOFF AND RELIEF

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE	
2.1	Minimum Diameter	3/4"
2.2	Maximum Diameter	2”
3	DESIGN	
3.1	Working Pressure PSIG	125
3.2	Working Temperature °F	250
4	PIPING DESIGNATIONS	
4.1	Sch. 80 Bl. St.	CP-2
5	FITTING DESIGNATIONS	
5.1	125# Cast Iron	CF-2
6	JOINT DESIGNATIONS	
6.1	Threaded	CJ-1
6.2	Butt Weld	-
6.3	150# Flanged	-
7	VALVE DESIGNATIONS	
7.1	Gate	CV-1.4
7.2	Swing Check	CV-7
8	NOTES	
8.1	See Division 23 “Heating Ventilating and Air Conditioning” for special valves.	
8.2	See Division 23 “Conduit Encased Pipe” for buried condensate pipe system.	

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 10
GENERATOR EXHAUST PIPE

1	Install pipe, valves and fittings as designated in this Schedule for this System.	
2	NOMINAL SIZE RANGE	
2.1	Minimum Diameter	3”
2.2	Maximum Diameter	12”
3	DESIGN	
3.1	Working Pressure PSIG	125
3.2	Working Temperature °F	1000
4	PIPING DESIGNATIONS	
4.1	Sch. 40 Bl. St.	CP-2
5	FITTING DESIGNATIONS	
5.1	Sch. 40 Wrt. St.	CF-5
6	JOINT DESIGNATIONS	
6.1	Butt Weld	CJ-5

PART 3 - EXECUTION (Continued)

PIPING SCHEDULE 13
COIL CONDENSATE

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE	
2.1	Minimum Diameter	1”
2.2	Maximum Diameter	4”
3	DESIGN	
3.1	Working Pressure Ft. Hd.	10
3.2	Working Temperature °F	Ambient
4	PIPING DESIGNATIONS	
4.1	Hard “L” Copper	CP-8
4.2	Sch. 40 PVC	CP-30
5	FITTING DESIGNATIONS	
5.1	Wrought	CF-8
5.2	Sch. 40 PVC	CF-30
6	JOINT DESIGNATIONS	
6.1	Solder	CJ-8
6.2	Solvent Cement	CJ-33

7 NOTES

7.1 PVC piping installed above ceilings and within all plenum types shall be insulated. Reference Insulation Section 20 01 80.

7.2 All coil condensate piping shall be installed with slope of not less than 1/8” per foot.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 14
SANITARY, VENT AND STORM GRAVITY-INSIDE BUILDING

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2 ABOVE GRADE

2.1	SANITARY & STORM PIPE DESIGNATIONS		FITTING DESIGNATIONS		JOINT DESIGNATIONS	
2.1.1	1 1/2” and Larger					
2.1.1.1	Cast Iron No Hub	CP-41	No Hub	CF-41	Coupling	CJ-41
2.1.1.2	Sch. 40 DWV PVC	CP-33	PVC	CF-33	Solvent	CJ-33
2.2	VENT PIPE DESIGNATIONS					
2.2.1	1 1/2" and Larger					
2.2.1.1	Cast Iron No Hub	CP-41	No Hub	CF-41	Coupling	CJ-41
2.2.1.3	Sch. 40 DWV PVC	CP-33	PVC	CF-33	Solvent	CJ-33
3	BELOW FLOOR					
3.1	SANITARY, STORM AND VENT					
3.1.1	2” and Larger					
3.1.1.1	Cast Iron Hub	CP-40	Hub	CF-40	Gasket	CJ-40
3.1.1.2	Sch. 40 DWV PVC	CP-33	PVC	CF-33	Solvent	CJ-33

4 NOTES

4.1 PVC piping installed above ceilings and within all plenum types shall be insulated. Reference Insulation Section 20 01 80.

4.2 All waste pipe for kitchens shall be cast iron under entire footprint of the kitchen.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 15
SANITARY, VENT AND STORM
GRAVITY-OUTSIDE BUILDING

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	SANITARY & STORM PIPE DESIGNATIONS		FITTING DESIGNATIONS		JOINT DESIGNATIONS	
2.1	2” and 3”					
2.1.1	Sch. 40 DWV PVC	CP-33	PVC	CF-33	Solvent	CJ-33
2.1.2	Sch. 40 ABS	CP-34	ABS	CF-34	Solvent	CJ-33
2.2	4” to 15”					
2.2.1	PVC SDR 35	CP-32	PVC	CF-32	Gasket	CJ-32

3 NOTES

3.1 Use concrete pipe below roads and driveways.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 17
DOMESTIC HOT & COLD WATER
ABOVE GROUND

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE		
2.1	Minimum Diameter	1/2"	4”
2.2	Maximum Diameter	3”	8”
3	DESIGN		
3.1	Working Pressure PSIG	125	125
3.2	Working Temperature °F	250	250
4	PIPING DESIGNATIONS		
4.1	Hard “L” Copper	CP-8	CP-8
5	FITTING DESIGNATIONS		
5.1	Cold Press	CF-8A	CF-8A
5.2	Wrought	CF-8	-
5.3	Grooved Mech.	-	CF-6
6	JOINT DESIGNATIONS		
6.1	Cold Press	CJ-8A	CJ-8A
6.2	Solder	CJ-8	-
6.3	Grooved	-	CJ-6
7	VALVES		
7.1	Ball	CV-20	
7.2	Angle	-	CV-6
7.3	Globe	CV-4, 5	CV-5
7.4	Check Horizontal Swing	CV-7, 8	CV-8
7.5	Butterfly	-	CV-23, 24
8	NOTES		
8.1	Install ball valves for balancing services.		
8.2	Use flange joint on 3” and larger pipe when connection to equipment or valves.		
8.3	Saddle type fittings are prohibited.		
8.4	See Division 22 “Plumbing” for special valves.		
8.5	Mechanical T-bolted branch outlets not approved.		

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 19
FIRE PROTECTION

1 Install pipe, valves and fittings as designated in this Schedule for this System

2	LOCATION LIMITES	BELOW GROUND	ABOVE GROUND	
3	NOMINAL SIZE RANGE			
3.1	Minimum Diameter	4”	1”	2 1/2"
3.2	Maximum Diameter	12”	2”	8”
4	DESIGN			
4.1	Working Pressure PSIG	175	175	175
4.2	Working Temperature °F	WOG	WOG	WOG
5	PIPING DESIGNATIONS			
5.1	Ductile Iron	CP-20	-	-
5.2	Sch. 40 Bl. St.	-	CP-2	-
5.3	Sch. 10 Bl. St.	-	-	CP-2
6	FITTING DESIGNATIONS			
6.1	Ductile Iron Mech. Joint	CF-20	-	-
6.2	Class 125 Cast Iron	-	CF-2	-
6.3	Class 150 Malleable Iron	-	CF-1	-
6.4	Steel Grooved	-	-	CF-6
7	JOINT DESIGNATIONS			
7.1	Mechanical Joint	CJ-20	-	-
7.2	Threaded	-	CJ-1	-
7.3	Mech. Grooved	-	-	CJ-6

8 NOTES

8.1 Valves are specified in Fire Protection Section 21 10 00.

8.2 Provide manufacturer’s standard gasket for service intended on mechanical joint pipe.

8.3 Provide thrust blocks, tie-rods on fittings below grade as required by NFPA #24, Chapter 8.

8.4 The minimum burial depth of exterior fire protection systems shall be 5’-0”.

8.5 Saddle type fittings are prohibited.

8.6 Mechanical T-bolted branch outlets not approved.

PART 3 - EXECUTION (Continued)

SYSTEM PIPING SCHEDULE 20
GAS PIPING

1 Install pipe, valves and fittings as designated in this Schedule for this System.

2	NOMINAL SIZE RANGE		
2.1	Minimum Diameter	1/4"	2 1/2"
2.2	Maximum Diameter	2”	12”
3	DESIGN		
3.1	Working Pressure PSIG	5	5
3.2	Working Temperature °F	150	150
4	PIPING DESIGNATIONS		
4.1	Sch. 40 Bl. St.	CP-2	CP-2
5	FITTING DESIGNATIONS		
5.1	150# Mal. Iron	CF-1	-
5.2	Wrought St.	-	CF-5
6	JOINT DESIGNATIONS		
6.1	Threaded	CJ-1	-
6.2	Welded	-	CJ-5
7	VALVE DESIGNATIONS		
7.1	Cock	CV-10	CV-11
7.2	Eccentric Plug	CV-16	CV-16, 17
7.3	Ball	CV-22	-
7.4	Crane 270 Gas Cock in 1 1/2" and Under		

8 NOTES

8.1 Unions shall be malleable iron railroad unions for 500# WOG.

8.2 Pipe buried below ground to be Dupont Aldyl A or approved AGA equal.

8.3 Steel piping shall connect to plastic piping just below ground. Coat steel pipe which extends into ground with cold asphalt Reilly Tar & Chemical Enamel CA-50; Glass Fiber and Mat Ros-kote Glasswrap with coat enamel or approved equal.

8.4 Underground piping within building shall be installed in underground conduit, in accordance with National Fire Code 54. Conduit used to encasing gas pipe shall be Schedule 40 steel pipe, well wrapped or plastic coated. All joints to be welded. Provide cathode protection for electrolytic action. Conduit shall extend to outside for venting.

8.5 Inspection, testing and purging shall be done as set forth in NFPA #53, Part 4.

3.2 PIPE SUPPORT

A. Pipe Support

1. Furnish and install supports, guides, anchors and swaybraces required for proper installation and support of pipelines except supports noted to be furnished by others.
2. Pipe suspension shall prevent excessive stress and excessive variation in supporting force. Fabrication and installation of supports for pipelines shall not constrain piping to cause excess transfer of load from supports to piping or from support to support when expansion or contraction occurs. Supports shall be capable of taking entire piping load imposed by expansion or contraction.
3. Where pipe vibration transmits objectionable vibration to building structure or attached equipment, hangers shall be supplemented by spring cushions or an energy absorbing means in the supports themselves, or through the addition of flexible piping connectors or other auxiliary equipment.
4. Piping system where flexibility is not desired shall be supported by rigid hangers.
5. See Section 20 00 10, “Attaching to Building Construction” for attaching pipe support to structure.

B. Vertical Pipe Risers

1. Support vertical runs under 15' long with hanger adjacent to elbows.
2. Support vertical runs over 15' with steel riser clamps. Weld clamps to pipe and support on building structure. Space clamps at every floor with maximum spacing of 28'.

C. Hanger Rods

1. Support horizontal pipe with hot rolled steel rod manufactured in accordance with ASTM A107. Space hanger rods to eliminate pipe sagging. Space hangers as listed below. Place hangers within 12" of each horizontal elbow.
2. Steel and Copper Hanger Spacing

PIPE SIZE (NPS)	ROD SIZE (DIAMETER)	MAXIMUM HANGER SPACING
1/2" thru 1-1/4"	3/8"	6'0"
1-1/2" and 3"	1/2"	10'0"
4" and 5"	5/8"	10'0"
6"	3/4"	10'0"

3. PVC Pipe Support Spacing

PIPE SIZE (NPS)	ROD SIZE (DIAMETER)	MAXIMUM HANGER SPACING
1/2" thru 1"	3/8"	3'0"
1-1/4" thru 3"	3/8"	4'0"
4" thru 5"	1/2"	4'0"
6”	1/2"	4’0”

4. Piping with caulked joints to be supported at each joint.

D. Pipe Hangers (Pipe Suspended from Above)

1. For Hot Lines or Combination Hot and Cold Lines

a. 2" and smaller iron or steel pipe: adjustable steel clevis hangers. Elcen 12; Grinnell 260; Fee & Mason 239; Crawford 11.
b. 2" and smaller copper pipe: adjustable copper pipe ring. Elcen 394; Grinnell 97CP; Fee & Mason 365; Crawford.
c. 2-1/2" thru 12" iron, steel and copper pipe: adjustable steel clevis hangers. Elcen 12; Grinnell 260; Fee & Mason 239; Crawford 11.
d. 2-1/2" thru 12" iron, steel and copper pipe: adjustable swivel pipe roll (one hanger rod). Elcen 14; Grinnell 174; Fee & Mason 272; Crawford 129.
e. 14" thru 24" o.d. iron or steel pipe: single pipe roll with adjustable sockets (two hanger rods). Elcen 15; Grinnell 171; Fee & Mason 170; Crawford 15.

2. For Cold Lines

a. All sizes iron or steel pipe: Elcen 12; Grinnell 260; Fee & Mason 239; Crawford 11.
b. All sizes copper pipe: adjustable copper-plated ring. Elcen 394; Grinnell 97CP; Fee & Mason 365; Crawford.

3. All hangers used on lines requiring insulation and vapor barrier shall have hangers oversized to allow insulation to pass thru hanger. Install insulation cradles or wood blocks the same thickness as insulation so insulation will not be crushed. Insulation cradles or wood blocks shall be designed for this specific use.

E. Pipe Carriers (Pipe Supported from Below on Racks, Piers, Stands or Trapeze Support)

1. For Hot Lines or Combination Hot and Cold Lines

a. 3” and smaller Pipe: roller chair with steel U bar support. Elcen 16; Grinnell 176; Fee & Mason 168; Crawford 130.
b. 4” and larger Pipe: adjustable pipe roll stand with base plate. Elcen 20; Grinnell 274; Fee & Mason 161; Crawford 19.

2. For Cold Lines: all pipe sizes supported on steel pipe chair designed to contain pipe movement in direction perpendicular to pipe run but allow some movement in direction of pipe run.
3. All hangers used on lines requiring insulation and vapor barrier shall have hangers oversized to allow insulation to pass thru hanger. Install insulation cradles or wood blocks the same thickness as insulation so insulation will not be crushed. Insulation cradles or wood blocks shall be designed for this specific use.

F. For sprinkler piping support refer to NFPA#13 (3-10 hangers).

G. Supports for sprinkler piping to be in conformance with NFPA 13, if modified by this section.

H. For piping hanger rod attachment to building, see Section 20 00 10 “Attaching to Building Construction.”

3.3 UNDERGROUND PIPING

A. See Excavation and Backfilling Section 20 00 50.

3.4 ESCUTCHEONS

A. See Escutcheons, Section 20 00 50.

3.5 INSTALLATION OF VALVES

A. Locate valves accessibly and arrange to permit easy removal of fixtures and equipment they serve.

B. Unless otherwise noted, all valves shall be full size of lines in which they are placed.

C. Install all piping and shut-off valves full pipe size as shown on Drawings. Reduce at control valves to control valve size.

D. Valves mounted in horizontal lines shall not have their stems and bonnets pointed below horizontal position unless indicated on Drawings.

E. Provide valves with 3/4" garden hose adaptor for draining low points, boilers, chillers, coils, etc. with cap and chain. Use ball valves for systems which operate below 120^{o}F. Use gate (Crane 431) or globe valves for systems which operate above 121^{o}F.

F. Mount all globe valves to close against flow pressure. Flow should be against bottom of plug.

G. Remove bonnets and trim from all valves before soldering, brazing or welding in piping system. Protect seating surfaces during installation. Clean valve parts thoroughly before reassembling. Install bonnet with valve in open position. Follow manufacturers written instructions to protect valves from overheating during installation.

H. Install all valves with discs or plugs in open position. Close only when assured that sealing parts are free from foreign material. Weld scale or similar foreign materials found embedded in sealing surfaces will require installation of new trim or complete valve.

I. **If grooved piping system is used, then only grooved end valves shall be used.** I**t <u>is</u> <u>not</u> acceptable to use grooved to flanged adapters to install flanged valves.**.

J. Install valves as required by control contractor.

3.6 INSTALLATION OF PIPING

A. Offset piping to avoid interference with other work to increase head room under piping.

B. Contractor may, at his option, use pipe bending equipment to form full lengths of pipe to proper configuration indicated on Drawings.

C. Remove raised face from flanges that are to match cast iron flat face patterns.

D. Coat studs, nuts, flange faces and metallic gaskets with material similar to molybdenum disulphide before assembly.

E. Pipe sizes refer to nominal inside pipe diameter except on copper refrigeration lines and steel and wrought iron pipe 14" and larger.

F. Bonney Weldolet Forge Branch Outlet Fittings may be used where steel with welding fittings are specified in lieu of branch outlet tees, provided branch tee is 2 sizes smaller than main. Nipples welded into mains not acceptable.

G. Use galvanized fittings and unions with galvanized pipe.

H. Caulk clearance space in floor sleeves with plastic compound or fire stop material as required.

I. Caulk exterior wall sleeves with thiokol.

J. Install chromeplated pipe escutcheons on bare exposed pipe at wall, floor and ceiling penetrations. Reference 20 00 50 Escutcheons.

K. Use dielectric couplings when joining dissimilar piping materials.

L. Piping shall not pass over electrical apparatus. If conflict is shown on Drawings, notify Engineer prior to installing pipe.

M. Refer to General Requirements for installation of sleeves, escutcheons, cutting and fitting and attaching to building construction.

N. Refer to Insulation Section 20 01 80 for insulation data. PVC piping installed above ceilings and within all plenum types shall be insulated.

O. Conceal all pipes where provisions have been made for this purpose.

P. In case of conflict on Drawings as to pipe size, the larger pipe size shall be installed.

Q. Joints shall be approved type, gas and watertight for system pressure.

R. All pipes shall be cut square, reamed, chamfered and free of all burrs and obstructions. Pipe ends shall have full-bore openings and not be undercut.

S. Piping not serving elevator equipment rooms shall not pass through elevator equipment rooms. If conflict is shown on drawings, notify Engineer prior to installing pipe.

T. Install wells, thread-o-lets and T's as required by control contractor.

U. Copper pipe shall not come in direct contact with mortar or grout. Where copper pipes are exposed to mortar or grout, pipes shall be wrapped with duct tape. This typically happens when pipes pass through masonry walls.

V. All pipes to equipment and isolation valves shall be full pipe size as shown on Drawings regardless of equipment connection size. Use reducers at equipment to reduce to equipment size.

W. Grooved product must be installed per manufacturer's written instructions, which may or may not include extreme lubricant, torque wrench and specified torque ratings. Manufacturer's representative must provide on-site training to field personnel on installation of product.

X. No pulled "T" drilling of copper piping for branch takeoff's allowed.

Y. Condensate piping shall be installed with slope of not less than 1/8" per foot.

Z. If grooved piping system is used, it <u>is</u> <u>not</u> acceptable to use mechanical-T bolted branch outlet fittings.

3.7 PIPE CLEANING

A. Swab to remove dirt or scale.

B. Flush water system until water runs clear.

C. Operate steam systems until condensate runs clear.

D. Clean all strainers and traps.

3.8 TESTING PIPING

A. Test all piping at 1 1/2 times operating pressure.

B. Test all concealed work before covering with earth, insulation or furring.

C. Notify Engineer not less than 24 hours in advance of all tests.

D. Furnish all fuel and necessary equipment required for tests.

E. Promptly repair all leaks and reapply tests.

F. Install blind flanges or plugs in order to make tests.

G. See Specification Divisions 22 and 23 for additional pressure testing requirements.

3.9 STERILIZATION OF DOMESTIC WATER SYSTEM

A. Flush system thoroughly until water runs clear.

B. Entire system shall be filled with a water/chlorine solution containing 50 parts per million of chlorine. The system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for three hours.

C. Following the allowed standing time, the system shall be flushed with clean potable water until chlorine does not remain in the water coming from the system.

D. After the above requirements are satisfied, submit samples to local Board of Health for approval.

E. Sterilization shall be redone until approval from the State Board of Health is obtained.

3.10 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook", using lead-free solder alloy complying with ASTM C 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook", "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 “Quality Assurance” Article.

H. Flanged Joints: Select appropriate gasket material, size, type and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Non-pressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer’s written instructions.

N. Cold Press – Submit written Quality Assurance Plan to ensure fittings are properly crimped and tested. Review at each and every progress meeting.

3.11 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
5. “Pulled Tee’s” in copper piping are not allowed.

3.12 GROOVED PIPING

A. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks. Gaskets shall be molded and produced by the coupling manufacturer, and shall be verified as suitable for the intended service. A factory-trained field representative (direct employee) of the mechanical joint manufacture shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. The factory-trained representative shall periodically review the product installation and ensure best practices are being followed. Contractor shall remove and replace any improperly installed products. A distributor's representative is not considered qualified to conduct the training.

B. For applicable projects, the grooved coupling manufacturer shall provide inspection services and/or certify the installing contractor for the installation of their product. The manufacturer's factory trained representative shall provide certification training for the installing contractor's field personnel in the use of grooving tools, application of groove, and product installation. The training program shall be designed, developed, administered and evaluated in accordance to the ANSI/IACET Standard for Continuing Education and Training. (IACET-International Association for Continuing Education and Training)

END OF SECTION 20 00 60

SECTION 20 01 80 – COMMON INSULATION FOR PLUMBING AND HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This section includes field applied insulation and jacket materials for all systems. These systems include:

1. System Insulation Schedule 1:
   Heating Water Pipe
   Low Pressure Steam Pipe
   Steam Condensate Pipe

2. System Insulation Schedule 1A:
   Medium and High-Pressure Steam Pipe

3. System Insulation Schedule 2:
   Chilled Water Pipe

4. System Insulation Schedule 3:
   Domestic Cold Water Pipe
   Domestic Hot Water Pipe

5. System Insulation Schedule 5:
   Shell and Tube Heat Exchanger

6. System Insulation Schedule 6:
   Generator Exhaust

7. System Insulation Schedule 7:
   Storm Water Pipe

8. System Insulation Schedule 8:
   Roof Drain Basins

9. System Insulation Schedule 9:
   Heating and Air Conditioning:
   Supply Air Ductwork

B. Any equipment that is to be factory insulated is specified with respective equipment.

C. All PVC piping installed in a ceiling plenum shall be insulated to provide a flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

D. Any piece of equipment, pipe, or duct, installed in this contract, which is typically insulated to prevent condensation, shall be insulated unless specifically noted otherwise.

E. Internally lined sheet metal is specified in Metal Ducts, Section 23 31 13.

F. Related sections include all applicable Mechanical Sections.

1.3 SUBMITTALS

A. Submit product data for insulation, jacket materials and fittings used in each system as required in Section 20 00 10, “Shop Drawings”.

B. Product data shall include thermal conductivity, thickness, jacket material, insulation material, sealing compounds, flame-spread and smoke-developed ratings for each type of product to be used.

C. Submit test reports of independent testing agency showing conformance with flame-spread and smoke-developed ratings.

1.4 QUALITY ASSURANCE

A. Insulation Contractor shall have completed a minimum of two (2) projects of similar scope. Upon request, the Insulation Contractor shall provide a list of similar projects and references to the Engineer. The engineer may wish to inspect work previously installed by the Insulation Contractor.

B. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

C. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All insulation to be shipped to site in unopened containers as packaged by Insulation Manufacturers.

B. All containers shall state contents within.

C. Store in clean dry area properly protected from weather and physical damage.

D. Open only containers required to be opened as construction progresses.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers and insulation shields.

B. Coordinate hanger sizes and piping penetrations for pipes requiring insulation, wood blocking and saddles with piping installer.

1.7 SCHEDULING

A. Schedule insulation application after pipe testing and heat trace has been installed.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Refer to Insulation Material Schedules in Execution portion of this Section for Insulation types to be used for each system. When more than one is shown, contractor may choose which type is to be installed.

B. Fiberglass Insulation

1. Glass fiber bonded with a thermosetting resin with thermal conductivity of .27 or less @ 75°F. Designed for use to 650°F.

a. Preformed Pipe Insulation with Jacket: 3 lb/ft^3, ASTM C547, Type 1, Class 1 with factory applied all-purpose, vapor-retarder ASJ jacket, 0.02 perm max water vapor permeance. Designed for use to 850°F max.
b. Board Insulation: 3 lb/ft^3, ASTM C 612, Type IB, without facing and with FSK jacket manufactured from kraft paper, reinforcing scrim, aluminum foil and vinyl film. Verify jacketing with Engineer prior to insulating exposed ductwork with board insulation within finished spaces. Design for use to 450°F max.
c. Blanket Insulation: 3/4 lb/ft^3, ASTM C 553, Type II, without facing and with FSK manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. Designed for use to 250°F max.

2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

a. Class 1, Grade A for bonding glass cloth and tape to un-faced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to un-faced glass-fiber insulation.
b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
5. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
6. Mineral-Fiber, hydraulic-setting insulating and finishing cement: Comply with ASTM C 449/C 449M.
7. Manufacturers:

    a. CertainTeed Manson
    b. Knauf Insulation.
    c. Owens-Corning Fiberglas Corp.
    d. Schuller International, Inc.
    e. Johns Manville

C. Foamglass Insulation

1. Inorganic cellular glass insulating material with hermetically sealed cells, non-absorptive and noncombustible. Designed for use from 35°F to 350°F.

    a. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class I.
    b. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.
    c. Block Insulation: ASTM C 552, Type I.
    d. Special-Shaped Insulation: ASTM C 552, Type III.
    e. Board Insulation: ASTM C 552, Type IV.

2. Manufacturers:

    a. Pittsburgh - Corning Corporation

D. Flexible Elastomeric Insulation

1. Closed cellular or expanded rubber material of high insulating efficiency (K of .25 or better @ 75°F) and designed for use with temperatures from -40°F to 210°F. Odorless, self-extinguishing and vapor resistant in compliance with ASTM E-84, 25/50 flame smoke rating. Approved for use in return air plenums.

    a. Preformed pipe insulation: ASTM C 534, Type I.
    b. Sheet insulation: ASTM C 534, Type II.

2. Adhesive: As recommended by Insulation Material Manufacturer.
3. Ultraviolet – Protective Coating: As recommended by Insulation Manufacturer.
4. Manufacturers:

    a. Armacell AP
    b. K-Flex
    c. Aeroflex

E. Calcium Silicate

1. Rigid hydrous calcium silicate heat insulating block with thermal conductivity of .4 or less @ 300°F. 15 pounds per cubic foot density. Designed for use to 1200°F. ASTM E 84 - 0 Flame Spread; 0 Smoke Developed.

   a. Preformed Pipe and Block Insulation: ASTM C 533, Type I.

2. Insulating Cements: ASTM C 195.
3. Manufacturers:

   a. Owens-Corning Fiberglas Corp.
   b. Pabco
   c. Schuller International, Inc.

F. Duct Liner: See Section 23 31 13.

G. Flexible EPDM Rubber Sheet

1. Flexible closed cell, lightweight elastomeric EPDM material with Ultraviolet resistance and insulating qualities for use outdoors.
2. Technical Data

Property	**Test Method**	**Result**
Thickness	-	1 ½".
Thermal Conductivity	ASTM C177/C518	0.245 k-value
Service Temperature	ASTM C 411	-297 F to +300 F
Surface Burning Charac-	ASTM D 635	Self-Extinguishing
teristics	ASTM E 84	Flame 25, Smoke 50
Water Absorption	ASTM C 209	0.2% max
Vapor Permeance	ASTM E 96	.03 perms
UV Resistance	ASTM G 7/G90	Excellent
Ozone Resistance	ASTM D 1171	No Cracking
Water Vapor Sorption	ASTM C 1104	0.00 %
Fungi Resistance	ASTM C 1338/ G21 /UL181	No Growth
Dimensional Stability	ASTM C 356	7 % max

3. Manufacturers:

   a. Aeroflex USA, Inc. – Aerocel.

2.2 ADHESIVES

A. Adhesives or mastics used in the application or manufacture of insulating materials shall be fire retardant with UL flame rating not exceeding 25 and smoke developed rating not exceeding 50

(on dry film) when tested in accordance with ASTM E 84. All adhesives specifically designed for respective application as noted by insulation manufacturer.

2.3 JACKETS

A. PVC Jacket

1. High-impact

a. Fittings – Gloss White, preformed, 30 Mill, PVC jacket designed for use with and provided by same manufacturer of insulation. Fiberglass insert wrapped around fitting and covered by PVC preformed jacket piping insulation system.
b. Sheet – Gloss White, preformed, pre-cut and curled 20 mil PVC jacket designed for use with and provided by same manufacturer of piping insulation system. Ultraviolet-resistant suitable for outdoor service and temperature range 0 – 150°F. Jacket to be completely sealed with solvent weld for vapor proof barrier where noted in schedule.

B. Foil, Scrim and Kraft-Paper (FSK) Jacket

1. Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil. Maximum of .02 perms moisture vapor transmission, ASTM C 921, Type I, Max 25/50 flame smoke rating.

C. All-Service Jacket (ASJ)

1. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type 1.

D. Aluminum Jacket

1. Aluminum roll stock .020" thick, ready for shop or field cutting and forming. ASTM B209, 3003 alloy, H-14 temper.
2. Aluminum Fittings - Preformed - same thickness and finish as jacket.
3. Jacket Bands - Aluminum 3/4" wide.

E. Stainless Steel Jacket

1. Stainless steel roll stock .020" thick, ready for shop or field cutting and forming. ASTM A66, Type 304 or 316.
2. Stainless steel fittings - Gore Type, same thickness and finish as jacket.
3. Jacket Bands - Stainless steel, Type 304, 3/4" wide.

F. Multilayer Weatherproof Jacket:

1. Prefabricated self-adhering, sheet-type protective membrane. The outer (exposed) layer shall be an embossed, UV-resistant aluminum weathering surface. Under the aluminum

shall be multiple layers of tough, high-density cross-linked polymer film. Under the polymer film shall be a uniform layer of aggressive rubberized asphalt adhesive which sticks directly to metal, insulation facers and most other clean, dry surfaces. The self-adhesive surface shall be protected by a disposable release liner. Exterior layer shall be brown in color.

2. Technical Data

Property	Test Method	Result
Material Thickness	ASTM D 1970	25 Mils Nom.
Flexibility @ -20°F	ASTM D 1970	Pass
Vapor Permeance	ASTM E 96	.01 perms
Nail Sealability	ASTM D 1970	Pass
Heat Aging	ASTM D 794	Pass
Ultimate Elongation MD	ASTM D 412	434%
Ultimate Elongation CMD	ASTM D 412	246%

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape

1. Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz./sq. yd. (270 g/sq. m). Tape Width: 4 inches (100 mm).

B. Bands

1. 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

a. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
b. Aluminum: 0.007 inch (0.18 mm) thick.

C. Wire

1. 0.080-inch (2.0 mm), nickel-copper alloy; 0.062-inch (1.6 mm), soft-annealed, stainless steel; or 0.062-inch (1.6 mm), soft-annealed, galvanized steel.

D. Welded-Attached Anchor Pins and Washers

1. Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

a. Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.

E. Adhesive-Attached Anchor Pins and Speed Washers

1. Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

a. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperature of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

F. Removable Insulation Jackets for Steam Applications

1. Manufacturers:

a. Thermaxx Jackets. West Haven CT
b. Megawrap. Louisville KY
c. Approved Equal

2. Materials:

a. All insulation materials shall be non-asbestos.
b. Material layers shall be selected based on location profile (Dry, Wet/Damp, Steam Pit/Vault) and operating temperature per sections 1/3(C), 1.3 (D), 1.3€ from the "Jacket Material Selections" table:

Layer	Name	Description
Jacket	EJ	PTFE Fiberglass Composite, 16.5 oz/yd^2, rated to 550°F
Jacket	Crossfilm	Laminated PTFE (Pure PTFE), 13.5 oz/yd^2, rated to 600°F
Jacket	Silicone	Silicone Fiberglass Composite Jacketing, 17 oz/yd^2, rated to 500°F
Thread	Kevlar Thread	Kevlar, 0.114" diameter, 35lb breakpoint, rated to 800°F
Thread	Fiberglass Thread	Fiberglass, 0.023" diameter, 29lb breakpoint, rated to 1400°F
Thread	Inconel Thread	Fiberglass & Inconel, 0.019" diameter, 25lb breakpoint, rated to 2000°F
Insulation	Utilicore	Needled fiberglass, 5 lb/ft^3, rated to 1100°F
Insulation	Tempmat	Needled fiberglass, 9-11 lb/ft^3, rated to 1200°F
Insulation	Pyrogel	Pyrogel XT-E
Insulation	CP	Ceramic Paper
Fasteners	Nylon Straps	Nylon with D-Rings, Velcro
Fasteners	PTFE Straps	Laminated PTFE with D-Rings, Velcro
Fasteners	EJ Straps	PTFE Fiberglass Composite with D-Rings, Velcro
Seal Flaps	Hybrid 7.0	Hybrid 7.0 (rated to 600°F) with Kevlar cord (rated to 900°F)

Table 1: Jacket Material Selections

3. Jacket Materials per Operating Temperature for Dry Locations:

100-349°F	*350-424°F*	*425-475°F*

Jacket - Hot Side	Silicone	Silicone	Silicone or EJ
Thread	Kevlar Thread	Kevlar Thread	Kevlar Thread
Insulation Layer 1	1" Tempmat	1" Utilicore	1" Utilicore
Insulation Layer 2	-	0.25" CP or 5mm Pyrogel	0.5" CP or 10mm Pyrogel
Jacket - Cold Side	Silicone	Silicone	Silicone or EJ
Fasteners	Nylon Straps	Nylon Straps	EJ Straps
Seal Flaps	Hybrid 7.0	Hybrid 7.0	Hybrid 7.0

4. Jacket Materials per Operating Temperature for Wet or Damp Locations:

	100-299°F	*300-374°F*	*375-450°F*
Jacket - Hot Side	Silicone	Silicone	Silicone or EJ
Thread	Kevlar Thread	Kevlar Thread	Kevlar Thread
Insulation Layer 1	10mm Pyrogel	15mm Pyrogel	20mm Pyrogel
Jacket - Cold Side	Silicone	Silicone	Silicone or EJ
Fasteners	Nylon Straps	Nylon Straps	EJ Straps
Seal Flaps	Hybrid 7.0	Hybrid 7.0	Hybrid 7.0

5. Jacket Materials per Operating Temperature for Steam Pits and Vaults:

	100-299°F	*300-374°F*	*375-450°F*
Jacket - Hot Side	PTFE	PTFE	PTFE
Thread	Kevlar Thread	Kevlar Thread	Kevlar Thread
Insulation Layer 1	10mm Pyrogel	15mm Pyrogel	20mm Pyrogel
Jacket - Cold Side	PTFE	PTFE	PTFE
Fasteners	PTFE Straps	PTFE Straps	PTFE Straps
Seal Flaps	Hybrid 7.0	Hybrid 7.0	Hybrid 7.0

6. Construction:

   a. Sewn with lock stitch at a minimum of 4 to 6 stitches per inch. Jackets shall be sewn using specified thread in section 1.3D. The thread must be able to withstand the skin temperatures without degradation.
   b. Hog rings, staples and wire are not acceptable methods of closure.
   c. No raw cut jacket edges shall be exposed after install.
   d. Jackets shall be fastened using a combination of hook and loop (i.e., Velcro), straps, and D-rings depending on application temperature.
   e. The insulation shall be designed to minimize the convection current in the space between the hot metal surface and the inner layer of insulation.
   f. All jacket pieces which match mating seams must include an extended 2" flap constructed from the exterior fabric (or equivalent) and shall be secured using hook & loop closure (i.e., Velcro) parallel to the seam or straps and/or D-Rings depending on application temperature.

g. Insulation shall be sewn as an integral part of the jacket to preventshifting of the insulation. Insulation pins are NOT an allowable method of preventing the insulation from shifting and shall NOT be used.
h. Steam Trap Jackets must be constructed in a box shape for removal and replacement inspection ease.
i. Exterior touch temperature shall not exceed 120°F.
j. Warranty: All materials and labor for five years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Insulation for each system as designated in the Insulation Material Schedules on the following pages.

B. When more than one type of insulation system is specified, contractor may choose which type is installed.

C. Reference Products, Part 2 of this Section for specifications and manufacturers of insulation materials designated to be installed in Insulation Material Schedules.

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 1:
HEATING WATER PIPE
LOW PRESSURE STEAM PIPE
STEAM CONDENSATE PIPE

1	Install insulation materials as designated in this schedule for system(s) listed.			
2	LOCATION	INSIDE		
3	INSULATION			
3.1	Pipe	Fiberglass-Preformed with Jacket		
3.2	Fitting	Fiberglass Blanket		
4	INSULATION THICKNESS			
4.1	Pipe Size	≤2"	2 ½ ", 3"	≥4"
4.2	Insulation Thickness	1 ½"	1 ½"	2 ½"
5	JACKETS			
5.1	Pipe	Integral to Insulation		
5.2	Fittings	Preformed PVC (See Note 6.3)		
5.3	Vapor-Retardant	No		
6	NOTES			

6.1 On VAV Boxes with heating coils, wrap ends of coils, exposed to space adjacent to coils with blanket type insulation. Secure with tape for vapor retarder surface.

6.2 Where pipe insulation is to be painted, install glass cloth jacket. Prior to finish paint, paint with one coat of fire retardant, washable, white liquid plastic coating. Confirm compatibility with finish paint prior to painting.

6.3 Steam Valves, PRV's, traps, and similar devices which require service shall have removable insulation jacket. Refer to product requirements within this specification.

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 1A:
MEDIUM AND HIGH PRESSURE STEAM PIPE

1	Install insulation materials as designated in this schedule for system(s) listed.			
2	LOCATION	INSIDE		
3	INSULATION			
3.1	Pipe	Fiberglass-Preformed with Jacket		
3.2	Fitting	Fiberglass Blanket		
4	INSULATION THICKNESS			
4.1	Pipe Size	≤2"	2 ½ ", 3"	≥4"
4.2	Insulation Thickness	1 ½"	2 ½"	3"
5	JACKETS			
5.1	Pipe	Integral to Insulation		
5.2	Fittings	Preformed PVC (See Note 6.3)		
5.3	Vapor-Retardant	No		

6 NOTES

6.1 Steam Valves, PRV's, traps, and similar devices which require service shall have removable, reusable insulation covers, fabricated with core insulation that are manufactured from fabrics, suitable for high steam temperatures, fiberglass blanket rated to 1000ºF, securement systems consisting of Velcro flap at parting seam, circumferential belts, and rope draw cords at terminal ends. Removable covers as manufactured by Mega-Wrap by MINCO, Louisville KY, or equal.

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 2:
CHILLED WATER PIPE

1	Install insulation materials as designated in this schedule for system listed.	
2	LOCATION	INSIDE
3	INSULATION	
3.1	Pipe	Fiberglass-Preformed with Jacket
3.2	Fitting	Fiberglass Blanket
4	INSULATION THICKNESS	
4.1	Pipe Size	All
4.2	Thickness	1"
5	JACKETS	
5.1	Pipe	Integral to Insulation
5.2	Fittings	Preformed PVC
5.3	Vapor-Retardant	Yes
6	NOTES	

6.1 All chilled water pump bodies, air separators, miscellaneous chilled water equipment, and terminal unit coil specialties (valves, strainers, coil packs, etc.) to be insulated.

6.2 Where pipe insulation is to be painted, install glass cloth jacket. Prior to finish paint, paint with one coat of fire retardant, washable, white liquid plastic coating. Confirm compatibility with finish paint prior to painting.

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 3:
DOMESTIC COLD WATER PIPE
DOMESTIC HOT WATER PIPE

1	Install insulation materials as designated in this schedule for system(s) listed.	
2	LOCATION	INSIDE
3	INSULATION	
3.1	Pipe	Fiberglass-Preformed with Jacket
3.2	Fitting	Fiberglass Blanket
4	INSULATION THICKNESS	
4.1	Pipe Size	All
4.2	Thickness	1"
5	JACKETS	
5.1	Pipe	Integral to Insulation
5.2	Fittings	Preformed PVC
5.3	Vapor-Retardant	Yes
6	NOTES	
6.1	Application of insulation on sanitary waste pipe shall be as follows:	
6.1.1	Piping installed above ground floor.	
6.1.2	Serving discharge from cooling coils or electric water coolers.	
6.1.3	Piping installed in return air plenum.	
6.1.4	Where insulation is required, install along pipe lengths connecting fixture to waste stack/main building drain only.	

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 5:
SHELL AND TUBE HEAT EXCHANGER

1 Install insulation materials as designated in this schedule for system(s) listed.

2	LOCATION	INSIDE		INSIDE		
3	INSULATION MATERIAL	Calcium Silicate		9# Rigid Fiberglass		
4	INSULATION THICKNESS					
4.1	Temperature	300°F	500°F	200°F	300°F	500°F
4.2	Thickness	2"	4"	2"	3"	4"
5	JACKETS					
5.1	Type	Glass Cloth		Glass Cloth		
5.2	Vapor-Retardant	No		No		
6	NOTES					

6.1 Where pipe insulation is to be painted, install glass cloth jacket. Prior to finish paint, paint with one coat of fire retardant, washable, white liquid plastic coating. Confirm compatibility with finish paint prior to painting.

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 6:
GENERATOR EXHAUST

1 Install insulation materials as designated in this schedule for system(s) listed.

2	LOCATION	INSIDE
3	INSULATION MATERIAL	
3.1	Pipe	Calcium Silicate
3.2	Fittings	Calcium Silicate
4	INSULATION THICKNESS	
4.1	Pipe Size	12"
4.2	Thickness	3"
5	JACKETS	
5.1	Pipe	Glass Cloth
5.2	Fittings	Glass Cloth
5.3	Vapor-Retardant	No

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 7:
STORM WATER

1 Install insulation materials as designated in this schedule for system(s) listed.

2	SERVICE	INSIDE - HORIZONTAL
3	INSULATION MATERIAL	
3.1	Pipe	Preformed Fiberglass with Jacket
3.2	Fitting	Fiberglass Blanket
4	INSULATION THICKNESS	
4.1	Pipe Size	All
4.2	Thickness	1"
5	JACKETS	
5.1	Pipe	Integral to Insulation
5.2	Fittings	Preformed PVC
5.3	Vapor-Retardant	Yes
6	NOTES	
6.1	Vertical runs of storm pipe shall be insulated if installed in return air plenum.	
6.2	Horizontal runs to be insulated.	

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 8:
ROOF DRAIN BASINS

1 Install insulation materials as designated in this schedule for system(s) listed.

2	LOCATION	INSIDE
3	INSULATION MATERIAL	Elastomeric
4	INSULATION THICKNESS	3/4"
5	JACKETS	
5.1	Pipe	
5.2	Fittings	
5.3	Vapor-Retardant	Yes

3.1 EXECUTION (Continued)

SYSTEM INSULATION SCHEDULE 9:
HEATING AND AIR CONDITIONING:
SUPPLY AIR DUCTWORK

1 Install insulation materials as designated in this schedule for system.

2	LOCATION	INSIDE	INSIDE	INSIDE
3	INSULATION MATERIAL	Flexible Fiber-glass	Rigid Fiber-glass	Flexible Elastomeric
4	INSULATION THICKNESS	1 1/2"	1 1/2"	3/4"
5	JACKETS	FSK	FSK	FSK
5.1	Vapor-Retardant	Yes	Yes	Yes

6 NOTES

6.1 Use rigid or flexible elastomeric insulation in mechanical rooms. All other areas may be flexible fiberglass.

6.2 Where smaller diameter round ductwork is to be insulated and then painted, utilize pre-formed pipe insulation of required thickness with paper jacketing.

6.3 Insulate ends of reheat coils including VAV box reheat coils in all applications where heating coils are in air conditioning supply ductwork. Install vapor barrier over insulation and seal watertight to adjacent insulation vapor barrier.

6.4 Externally insulate supply air slot diffuser plenums with flexible fiberglass.

6.5 External insulation to have a 1” crown on top to shed water.

6.6 **Where supply and return air branch ducts containing volume dampers are covered using duct wrap, expose volume damper actuator through duct wrap and “spot” paint the duct wrap around the actuator a bright and contrasting color for ease in visually locating the actuator while standing on the floor below the duct.**

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.4 GENERAL APPLICATION REQUIREMENTS

A. All insulation that is to be painted shall be covered with glass cloth jacket unless noted otherwise.

B. Apply insulation only after pipes, ducts and equipment have been tested and cleaned.

C. Protect furniture, equipment, ducts, pipes, etc. with tarpaulins. Keep premises clean.

D. Apply insulation materials, accessories and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the entire length.

E. Refer to schedules at the beginning of this Section for insulation materials and thickness, jackets, and fittings required for each system. Unless otherwise indicated, insulation shall be the same type throughout the same service.

F. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

G. Where insulation is applied on ducts, pipes and equipment which are against columns, walls or other equipment without adequate space for insulation, finish off insulation in workmanlike manner to meet approval of Engineer.

H. Apply multiple layers of insulation with longitudinal and end seams staggered.

I. Seal joints, seams and ends of insulation with vapor-retardant mastic on insulation with a compound recommended by the insulation material manufacturer on systems indicated to receive a vapor retardant.

J. Keep insulation materials dry during application and finishing.

K. Insulation shall be applied by craftsmen who are qualified to install insulation.

L. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

M. Apply insulation with the least number of joints practical.

N. Apply insulation over fittings and specialties, with continuous thermal and vapor-retardant integrity, on systems noted to have vapor-retardant jacket.

O. Provide removable sections of insulation or insulation boxes at all points where access is required for servicing of equipment on systems not requiring vapor-retardant jacket.

P. Exposed is defined to mean visible from working zones of finished building. Concealed signifies opposite. Pipes and ducts above ceilings and in crawl tunnels are considered to be concealed. Finished rooms are defined as office, workrooms, instruction, storeroom areas, equipment rooms, walking tunnels, etc.

Q. Aluminum jackets shall be installed in high traffic areas subject to damage.

R. On systems not requiring vapor-retardant, neatly bevel insulation at all flanges, access cover plates, etc. so that bolts may be removed without disturbing insulation.

S. All hangers used on lines requiring insulation and vapor barrier shall have hangers oversized and insulation cradles to allow insulation to pass thru hanger.

T. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

U. Whenever Insulation Jacket is noted as Vapor Retardant: Overlap insulation facing at seams a minimum of one inch and secure with pressure-sensitive tape or adhesive as recommended by Manufacturer.

V. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

W. Seal penetrations with vapor-retardant mastic.

X. Apply insulation for exterior applications tightly joined to interior insulation ends.

Y. Seal insulation to roof flashing with vapor-retardant mastic.

Z. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions.

AA. Insulation Terminations: For insulation application where vapor retardants are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retardant.

BB. Do not insulate over equipment name plate data.

CC. Seal all punctures in vapor retardant jacket with vapor-barrier adhesive on cooling piping and air conditioning ducts.

DD. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

EE. Do not weld brackets, clips, or other attachment devices to item being insulated unless specifically noted to do so.

3.5 DUCTWORK AND EQUIPMENT INSULATION

A. Blanket Insulation Application

1. Apply insulation with integral jackets as follows:

    a. Pull jacket tight and smooth.
    b. Install anchor pins and speed washers to keep insulation from sagging when duct width exceeds 22".
    c. Joints and Seams: Cover with tape and vapor retardant as recommended by insulation material manufacturer to maintain vapor seal.
    d. Vapor-Retardant Mastics: Where vapor retardants are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

2. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire-rated wall and partition penetrations. Maintain vapor-retardant barrier.
3. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor. Provide vapor-retardant mastic on insulation indicated to receive vapor-retardant.

B. Board and Block Insulation Application

1. Blankets, Board, and Block Applications: Secure insulation with adhesive and anchor pins with speed washers.

    a. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of surfaces to be insulated.
    b. Groove and score insulation materials to fit as closely as possible to the surfaces, including contours. Bevel insulation edges for cylindrical surfaces for tight joint. Stagger end joints.
    c. Protect exposed corners with secured corner angles.
    d. Install adhesive-attached or self-adhesive anchor pins and speed washers on sides and bottoms of surfaces to be insulated as follows:

        1) Do not weld anchor pins to ASME-labeled pressure vessels.
        2) 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
        3) Do not over-compress insulation during installation.
        4) Cut and miter insulation segments to fit curved sided and dome heads of tanks and vessels.

2. Impale insulation over anchor pins and attach speed washers.
3. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. Secure each layer of insulation with stainless-steel bands.
5. Stagger joints between insulation layers at least 3 inches (75 mm).
6. Apply insulation in removable segments on access doors and other elements that require removal for service.
7. Bevel and seal insulation ends around access panels, manholes, hand holes, ASME stamps, and nameplates.
8. Apply vapor-retardant mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retardant.

C. Flexible Elastomeric Thermal Insulation Applications:

1. Apply insulation over entire surface to be insulated according to the manufacturer's written instructions.
2. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
3. Seal longitudinal seams and end joints for Vapor Retardant installation.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.7 PIPING APPLICATION REQUIREMENTS

A. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. Exception: Do not staple longitudinal laps on insulation having a vapor retardant.

4. Vapor-Retardant Mastics: Where vapor retardants are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.

5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retardant mastic.

B. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation where scheduled. Secure according to manufacturer's written instructions.
2. Apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Apply jacket material overlapping seams at least 1 inch (25 mm) at each end. Secure with manufacturer's recommended adhesive, attachments and accessories. Seal seams with tape. Use vapor-retardant mastic on insulation indicated to receive vapor-retardant.

C. Apply insulation to valves and specialties as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For strainers, arrange insulation for access to strainer basket without disturbing insulation.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape. Also, seal seams with vapor-retardant mastic on insulation indicated to receive vapor-retardant.
4. On piping 3" and smaller, not requiring vapor-retardant, fittings may be insulated with insulating cement equal in thickness to adjoining pipe insulation and troweled to smooth even finish. Do not insulate heating water pipe valves or unions.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.
6. For steam and steam condensate piping, install removable, reusable insulation covers. Secure according to manufacturer's written instructions.

D. Floor Penetrations: Apply insulation continuously through floor assembly. Seal insulation with vapor-retardant mastic where floor supports penetrate vapor-retardant.

E. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retardant mastic.

F. Hangers and Anchors: All hangers used on lines requiring insulation shall have hangers oversized and insulation support shield to allow insulation to pass continuously thru hanger.

1. Install insert materials on all piping 1 1/2" and larger. Apply insulation to tightly joint the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
2. Fabricate inserts of heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:

1 1/2" to 2 1/2" pipe size	10" long
3" to 6" pipe size	12" long
8" to 10" pipe size	16" long
12" and over	22" long

3. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

G. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply jacket material with manufacturer’s recommended adhesive, overlapping seams at least 2 inch (50 mm), and seal joints with vapor-retardant mastic.

END OF SECTION 20 01 80

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SECTION 20 05 48 – SEISMIC CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and all sections of Division 23 and Division 26 apply to this Section.

1.2 SUMMARY

A. General: Subject project is located in Seismic Zone 2A. Provide Seismic restraint for all equipment, pipe, duct, etc. installed in this contract as noted here in and as required by applicable code:

1. Seismic control shall include but not be limited to the following items.

a. Tanks
b. Electrical Switchgear
c. Piping
d. Unit Heaters
e. Steam Condensate Pump
f. Condensing Units
g. Water Heater
h. Fans
i. Air Handling Units
j. Ductwork

1.3 RELATED WORK

A. All Mechanical and Electrical sections of this specification. Each trade is responsible for their own seismic protection.

1.4 SUBMITTALS

A. Submit seismic protection devices to be used for equipment duct, pipe and conduit as noted in Section 20 00 10, “Shop Drawings”.

B. Seismic protection devices shall include method, size of devices and anchoring methods as well as a list of all items requiring restraint.

1.5 QUALITY ASSURANCE

A. Contractors Qualifications: Firms regularly engage in installation of seismic protection devices and have installed at least five (5) similar projects.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall conform to the respective Specifications and other requirements specified below:

1. Bolts and Nuts:

a. Square head bolts and heavy hexagon nuts, ANSI B18.2 and ASTM A307 or A 576.
b. Bolts, underground, ASTM A325.

B. Sway brace details shall conform to all applicable requirements of MSS Pub. SP-58 cited therein.

C. Flexible couplings shall be those specified for the piping system covered by other sections of these Specifications, provided they will maintain a tight, flexible joint under all reasonable conditions of pipe displacements.

PART 3 - EXECUTION

3.1 SWAY BRACES

A. Sway braces shall be installed on piping and electrical conduit not otherwise rigidly anchored to preclude damage during seismic activity as follows:

1. All piping in Mechanical Equipment Room 1-1/4" and larger.

a. All other piping 2-1/2" and larger.
b. All rectangular ducts 6 square feet in cross sectional area and larger.

2. Pipes, conduits, and ducts suspended by individual hangers 12" or less in length from the top of pipe, conduit, or duct to the bottom of the structural support for the hanger, do not require sway braces.
3. Bracing will generally conform to the details shown in Figure 1 herein, or to an approved alternate which shall be demonstrated to be its equivalent. Piping and electrical conduit grouped for support on trapeze type hangers will be braced at the same intervals as hereinafter provided for individual pipe or conduit runs, with details increased in cross sectional area proportionate to the increased weight per linear foot of pipe or conduit

and contents supported at each trapeze hanger. No trapeze type hanger will be secured with less than two 1/2" bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of hot water piping operating at temperature above 140° F.

4. Sway Braces for Pipe and Conduits:

   a. Transverse sway bracing shall be provided at 30' intervals for pipes and conduits 8" size and smaller and at 20' intervals for larger pipes and conduits except for cast iron soil which shall be braced at 10' intervals.
   b. Longitudinal sway bracing shall be provided at 40' intervals.
   c. Vertical runs of copper piping 4" and smaller and steel or cast-iron piping 2" and smaller, extending between floor levels or between floor and roof shall be braced at midpoint.
   d. Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry inserts or clip angles bolted to the steel structure on the other end. Rods may be solid metal or pipe as specified hereinafter.
   e. Clamps on uninsulated pipes and conduit shall be applied direct. Insulated piping shall have clamps applied over insulation vapor barrier with high density inserts and metal protection shields under each clamp.
   f. Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2" in diameter.
   g. Anchor rods, angles, and bars shall conform to details shown in Table I, depending on length, seismic zone, etc.

TABLE I – SIZE OF ANCHOR BRACES REQUIRED

Type Brace	Maximum Actual Length
Angles	
1-1/2 x 1-1/2 x 1/4"	4'-10"
2 x 2 x 1/4"	6'-6"
2-1/2 x 2-1/2 x 1/4"	7'-0"
2-1/2 x 2-1/2 x 1/4"	8'-2"
3 x 2-1/2 x 1/4"	8'-10"
3 x 3 x 1/4"	9'-10"
Rods	
3/4"	3'-1"
7/8"	3'-7"
Flat Bars	
1-1/2 x 1/4"	1'-2"
2 x 1/4"	1'-2"
2 x 3/8"	1'-9"

Pipe	
1" (Sch 40)	7'-0"
1-1/4" (Sch 40)	9'-0"
1-1/2" (Sch 40)	10'-4"
2" (Sch 40)	13'-1"

5. Sway Braces for Ducts:

   a. Transverse sway bracing shall be provided at each horizontal turn of 45° or more, at the end of each duct run, and otherwise at each 30' interval. Walls which ducts penetrate may be considered transverse brace.
   b. Longitudinal sway bracing shall be provided at 60' intervals. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it, if the bracing is installed within 4' of the intersection, and it is sized for the larger duct.
   c. Bracing angles and details for bracing shall be in accordance with Table II below and Figures 2 and 3 herein.

TABLE II
SCHEDULE FOR BRACING FOR RECTANGULAR DUCTS

Size*	Longitudinal Angles	Angles	Angles	Size
30" sq.	2x2x16 ga	2x2x16 ga	2x2x16 ga	1/4"
42" sq.	2-1/2x2-1/2x16 ga	2-1/2x2-1/2x16 ga	2-1/2x2-1/2x16 ga	1/4"
54" sq.	2-1/2x2-1/2x16 ga	2-1/2x2-1/2x14 ga	2-1/2x2-1/2x16 ga	3/8"
60" sq.	3x3x16 ga	3x3x14 ga	3x3x16 ga	3/8"

*The ducts' maximum dimension shall govern what bracing is required.
Example: A 36" x 60" duct shall be braced as a 60" square duct

B. Spreaders: Spreaders shall be provided between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 2" apart. Spreaders to be applied at same interval as sway braces. Spreaders shall be applied to surface of bare or insulated hot pipe and over insulation utilizing high density inserts and pipe protection shields where vapor barrier type insulation is employed.

C. Resilient Vibration Isolation Devices:

1. When resilient and spring-type vibration devices are used to support equipment located in Seismic Zones 1 and 2, they shall be capable of restraining the equipment from a horizontal force equivalent to 1/4 the total weight of equipment it supports without permanent deformation or other permanent impairment of its vibration isolating function.

D. Anchor Bolts: All floor- or pad-mounted packaged mechanical or electrical equipment required by any section of these specifications will have a minimum of four anchor bolts securely fastened through bases. Anchor bolts shall have straight length equal to at least 10 times the nominal diameter of the bolt and shall conform to the following table of sizes for various equipment weights.

Maximum Equipment Weight	Minimum Bolt Sizes*
500 pounds	3/8"
1,000 pounds	1/2"
5,000 pounds	5/8"
10,000 pounds	3/4"

*Based on four bolts per item, use equivalent total cross-sectional areas when more than four bolts per item are provided.

1. Anchor bolts which exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor, or the foundation shall be increased in depth to accommodate bolt lengths.

E. Equipment Sway Bracing: Equipment sway bracing shall be provided for all items supported by off-the-floor structures or structures suspended from floors or roof above. Braces shall consist of angles, rods, bars, or pipes run at a 45-degree angle from the equipment frame to the building structure secured at both ends with not less than 1/2" bolts. Braces shall conform to Table I hereinbefore. Bracing shall be provided in two planes of directions, 90 degrees apart, for each item of equipment. In lieu of diagonal bracing applied to vertical support structures from floor or roof above, items may be supported with hangers inclined at 45 degrees, provided supporting members are sized properly to support full operating weight of equipment when hangers are inclined at a 45-degree angle.

F. Equipment to be furnished under this Contract shall be constructed and assembled so as to be capable of withstanding the following horizontal equivalent static force at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage which would render the equipment inoperative for significant periods of time following a seismic event.

Location	Equivalent Static Force
Seismic Zone 2	0.25 x weight

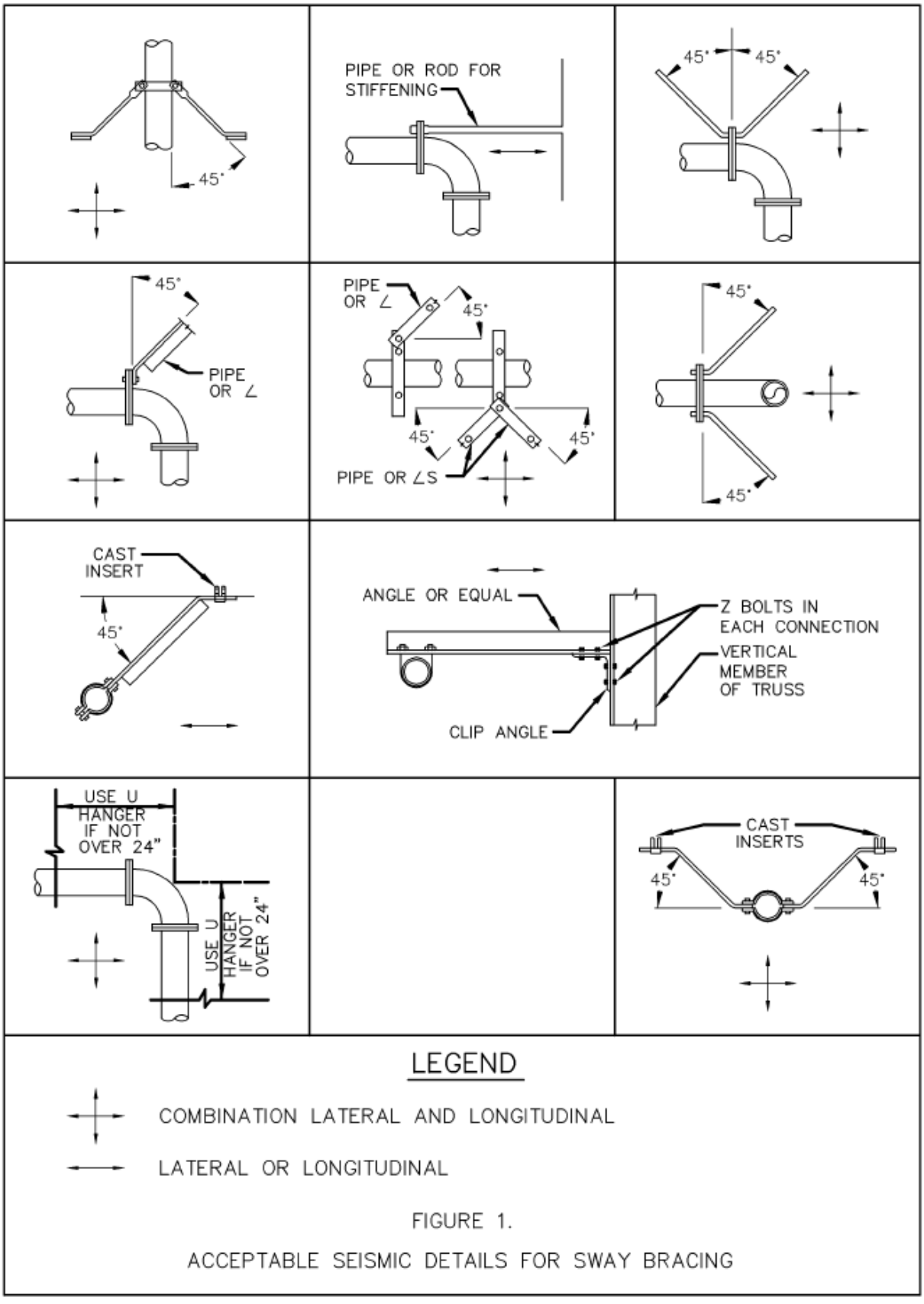

FIGURE 1.

ACCEPTABLE SEISMIC DETAILS FOR SWAY BRACING

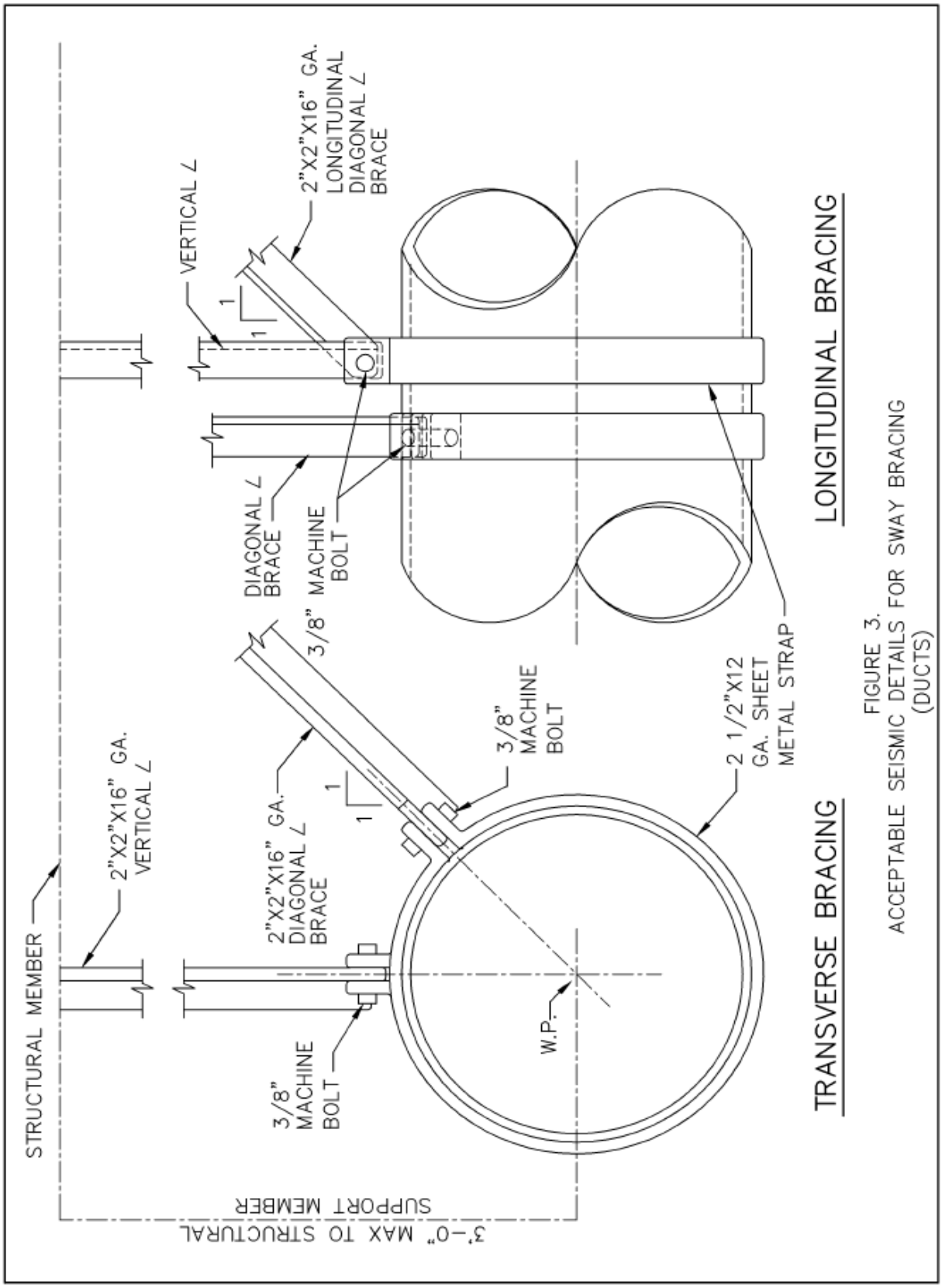

FIGURE 3.
ACCEPTABLE SEISMIC DETAILS FOR SWAY BRACING (DUCTS)

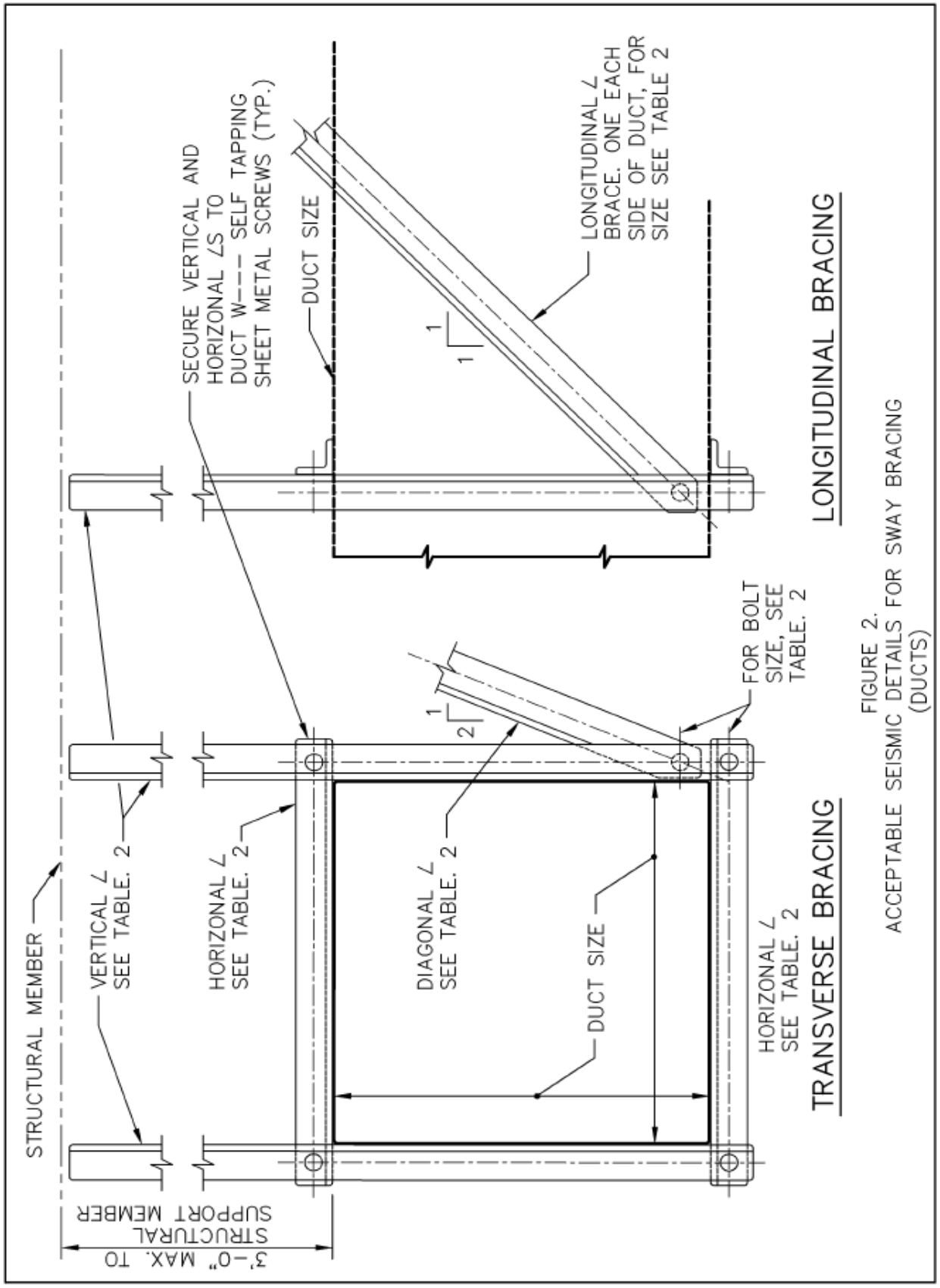

FIGURE 2.
ACCEPTABLE SEISMIC DETAILS FOR SWAY BRACING
(DUCTS)

END OF SECTION 20 05 48

SECTION 21 10 00 – WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Manual wet-type standpipe systems.
2. Wet-pipe sprinkler systems.

B. See Division 10 Sections "Fire Extinguisher Cabinets" and "Fire Extinguishers" for cabinets and fire extinguishers.

C. See Division 21 Section "Electric-Drive, Centrifugal Fire Pumps" for fire pumps, pressure-maintenance pumps, and pump controllers.

D. See Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.

1.2 SYSTEM DESCRIPTIONS

A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.

B. Standpipe System: An arrangement of piping, valves, hose connections, and all equipment installed in a building or structure, with the hose connections located in such a manner that water can be discharged in streams or spray patterns through attached hose and nozzles, for the purpose of extinguishing a fire, thereby protecting a building or structure and its contents in addition to protecting the occupants.

1. Manual Wet-Type: A wet standpipe connected to a small water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. Manual wet standpipe systems need water from a fire department pumper to be pumped into the system in order to supply the system demand.
2. Class I System: A standpipe system with 2 1/2" hose connections to supply water for used by fire departments that those trained in handling heavy fire streams.

C. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.3 GENERAL

A. Provide all material, labor, engineering and operations for the installation of complete and operable fire suppression system as shown on the Drawings and as specified herein.

B. Provide all equipment and materials including pipes, valves, fittings, sprinkler heads, fire department connections, backflow preventer, pipe supports, specialties and accessories necessary for a complete and approved fire suppression system.

C. This Contractor shall be completely responsible for the design, layout, submittals, installation, testing, certification and acceptance of the fire suppression system by the Indiana Department of Homeland Security Division for Fire and Building Safety.

1.4 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.

1. Minimum Residual Pressure at the Hydraulically Most Remote Class I Hose-Connection.

C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Auditoriums: Ordinary Hazard, Group 1.
b. Building Service Areas: Ordinary Hazard, Group 1.
c. Classrooms: Light Hazard.
d. Corridors: Light Hazard.
e. Display Cases: Light Hazard.
f. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
g. General Storage Areas: Ordinary Hazard, Group 1.
h. Janitors: Ordinary Hazard, Group 1.
i. Laundries: Ordinary Hazard, Group 1.
j. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
k. Office and Public Areas: Light Hazard.
l. Restaurant Service Areas: Ordinary Hazard, Group 1.
m. Restrooms: Light Hazard.
n. Stairs: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft.
b. Ordinary-Hazard, Group 1 Occupancy: 0.20 gpm/sq. ft. over 2500 sq. ft.

c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 2500 sq. ft. (stage calculation should be over entire area of stage, up to max 2500 sq. ft.).
d. Remote area may NOT be reduced where listed quick response sprinklers are used.

4. Maximum Protection Area per Sprinkler:

a. Light Hazard: 225 sq. ft.
b. Ordinary Hazard: 130 sq. ft.
c. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
d. When using extended coverage sprinkler heads, maximum protection area per sprinkler may be increased up to 400 sq. ft. in unobstructed light hazard and ordinary hazard locations and as allowable based on hydraulic calculations.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.5 SUBMITTALS

A. Product Data: For each product indicated.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable, and as follows:

1. Areas to be sprinkled.
2. Type of hazards and hazard locations.
3. Type and locations of valves, drains, and test pipes.
4. Alarm devices.
5. Riser diagrams.
6. Fire department connections.
7. Location and coordination of electrical connections.
8. Coordination with other trades.
9. Seismic restraints.

C. Field test reports and certificates.

D. Field quality-control test reports.

E. Operation and maintenance data.

F. Submit shop drawings to Insurance Carrier first. Then, submit approved shop drawings to the Indiana Department of Homeland Security for approval. Submit shop drawings bearing stamp of Insurance Carrier and Department of Homeland Security to the Engineer for approval.

G. Shop Drawings must be created in a format compatible with AutoCad .dwg extension.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test. Work shall be performed by a Sprinkler Contractor engaged in the fire suppression industry for a minimum of five (5) years.

B. Equipment Qualifications

1. Each item of equipment shall be capable of performing its function over an extended period of time with a minimum of attention and maintenance. All equipment shall be constructed using new materials designed and built in accordance with the best practices of the industry.
2. The equipment manufacturer shall have been engaged in the fire suppression industry for a minimum of five (5) years.
3. All equipment and components shall bear UL and FM label or marking and shall be FM approved for fire service.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. FM, “Factory Mutual Approval Guide”.
2. UL, “Underwriters Laboratory Fire Protection Equipment Directory.
3. Local Fire Department requirements.
4. Local, city, state, or any other requirements of the Authority Having Jurisdiction.
5. NFPA 13, "Installation of Sprinkler Systems"; 2010 version.
6. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height"; 2010 version.
7. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems"; 2000 version.
8. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances"; 1995 version.

1.7 EXTRA MATERIALS

A. For Projects requiring more than thirty (30) sprinkler heads, provide 10% extra sprinkler heads and head wrench.

B. For Projects requiring three (3) or more flow and/or tamper switches, provide 10% (or a minimum of 1) extra for each device.

C. Provide fifty (50) spare concealed sprinkler head cover plates for the Owner's future use.

1.8 IMPAIRING THE FIRE PROTECTION SYSTEM

A. Coordinate with Owner all existing fire protection systems.

B. Use the FM Global Red Tag Regulations.

C. Plan and coordinate work to minimize the period of time which the system is impaired.

D. In general, reactivate system at the end of each workday, under the supervision of Facilities Management. System may be left impaired overnight only if explicitly authorized by Owner.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. STEEL PIPE AND FITTINGS

1. Schedule 40: ASTM A53, Type E, Grade B or ASTM A135, Grade A joined by welded joints, mechanical grooved couplings, or threaded joints.
2. Schedule 10: ASTM A135, Grade A joined by welded joints, or mechanical grooved couplings.
3. The manufacturer's name or brand and applicable ASTM standard shall be marked on each length of pipe.
4. Pipe shall have a factory applied protective coating to provide resistance to microbiologically influenced corrosion (MIC).
5. Pipe grooves shall be rolled and shall be compatible with the coupling. Cut grooves are not allowed.
6. Lightwall pipe (i.e. Schedule 30 threaded, Schedule 7 grooved) is not acceptable.
7. The following pipe shall be galvanized:

    a. Pipe exposed to weather.
    b. Drain pipe exposed to atmosphere.
    c. Pipe from fire department connection to check valve.
    d. Pipe indicated on Drawings to be galvanized.

8. Cast iron threaded fittings: ASME B16.4, Class 125, standard pattern.
9. Malleable iron threaded fittings: ASME B16.3, Class 150, standard pattern.
10. Cast iron flanges: ASME 16.1, Class 125.

    a. Gaskets shall be full face of 1/8" minimum thickness, red sheet rubber.
    b. Flange bolts shall be hexagon head machine bolts with heavy semi-flushed hexagon head nuts, cadmium plated, with dimensions in accordance with ASME B18.2.

11. Grooved joint fittings: ASTM A536 ductile iron casting, minimum 175 psig rated pressure, with dimensions matching steel pipe.
12. Grooved pipe couplings: AWWA C606 and UL 213 rigid pattern, ductile iron housing sections, EPDM rubber gasket, 2-bolt pattern, cadmium plated bolts and nuts. Flexible and 1-bolt pattern couplings are not allowed.
13. Saddle type fittings are prohibited.

B. HANGERS AND SUPPORTS

1. Clevis or Band Hangers: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
3. Trapeze Hangers: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.2 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.

B. Outlet Specialty Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Central Sprinkler Corp.
c. National Fittings, Inc.
d. Star Pipe Products; Star Fittings Div.
e. Victaulic Co. of America.
f. Ward Manufacturing.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.

a. Saddle Type fittings are prohibited.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Central Sprinkler Corp.
b. Fire-End and Croker Corp.
c. Viking Corp.

d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Co.
b. Central Sprinkler Corp.
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CECA, LLC.
b. Merit.

2.3 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Butterfly Valves: UL 1091.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Global Safety Products, Inc.
2) Milwaukee Valve Company.

2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with grooved ends.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Central Sprinkler Corp.
2) McWane, Inc.; Kennedy Valve Div.
3) Mueller Company.
4) NIBCO.
5) Victaulic Co. of America.

C. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Central Sprinkler Corp.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Grinnell Fire Protection.
e. Hammond Valve.
f. McWane, Inc.; Kennedy Valve Div.
g. Mueller Company.
h. NIBCO.
i. Potter-Roemer; Fire Protection Div.
j. Reliable Automatic Sprinkler Co., Inc.
k. Star Sprinkler Inc.
l. Stockham.
m. Victaulic Co. of America.
n. Watts Industries, Inc.; Water Products Div.

D. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Hammond Valve.
3) NIBCO.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Crane Co.; Crane Valve Group; Jenkins Valves.
3) Hammond Valve.

4) Milwaukee Valve Company.
5) Mueller Company.
6) NIBCO.

E. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Milwaukee Valve Company.
2) NIBCO.
3) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Central Sprinkler Corp.
2) Grinnell Fire Protection.
3) McWane, Inc.; Kennedy Valve Div.
4) Milwaukee Valve Company.
5) NIBCO.
6) Victaulic Co. of America.

2.4 UNLISTED GENERAL-DUTY VALVES

A. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

B. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

C. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.5 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AFAC Inc.
    b. Central Sprinkler Corp.
    c. Grinnell Fire Protection.
    d. Reliable Automatic Sprinkler Co., Inc.
    e. Star Sprinkler Inc.
    f. Victaulic Co. of America.
    g. Viking Corp.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

    a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AFAC Inc.
    b. Grinnell Fire Protection.

C. Double-Check Backflow-Prevention Assemblies; DCDV-A :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Capacity: Size, location, capacity, and model as indicated on Drawings.
3. Standard: ASSE 1015, UL listed and FMG approved, USC approved, Indiana Department of Environmental Management approved.
4. Operation: Continuous-pressure applications, unless otherwise indicated.
5. Body: Cast iron with FDA approved interior lining complying with AWWA C550 or stainless steel. Stainless-steel springs and corrosion resistant materials throughout.
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow. Unit consists of two resilient seated full flow isolation valves, two independently operating spring loaded poppet-type check valves.
8. Accessories:

a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet. Four resilient seated test cocks for field testing.

2.6 AIR VENT

A. Automatic Air Vent:

1. Description: Automatic air vent that automatically vents trapped air without human intervention.
2. Standard: UL listed or FM Global approved for wet-pipe fire sprinkler systems.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.7 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco International.
3. Victaulic Co. of America.
4. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories:

1. Nominal 1/2-inch orifice for standard flow sprinkler head.
2. Nominal 17/32-inch orifice extended coverage sprinkler head.
3. "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Pendent sprinklers.
3. Quick-response sprinklers.
4. Recessed sprinklers, including escutcheon.
5. Sidewall sprinklers.
6. Upright sprinklers.

7. Dry sidewall sprinklers.
8. Dry pendent sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, painted, custom-color painted where indicated on Drawings.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, sidewall, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards: Wire-cage type when head is installed below 7’-6” or in areas subject to physical damage, including fastening device for attaching to sprinkler.

J. Flexible Sprinkler Hose Fittings:

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with manufacturer furnished bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.8 HOSE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Central Sprinkler Corp.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire-End and Croker Corp.
4. Grinnell Fire Protection.
5. McWane, Inc.; Kennedy Valve Div.
6. Mueller Company.
7. Potter-Roemer; Fire-Protection Div.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
2. Finish: Rough bronze.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell: UL 464, vibrating type with metal alarm bell, 6-inch diameter, cast-aluminum alarm gong with red-enamel factory finish, suitable for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Central Sprinkler Corp.
b. Grinnell Fire Protection.
c. Reliable Automatic Sprinkler Co., Inc.
d. Star Sprinkler Inc.
e. Viking Corp.

C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ADT Security Services, Inc.
b. Grinnell Fire Protection.
c. ITT McDonnell & Miller
d. Potter Electric Signal Company.
e. System Sensor.
f. Viking Corp.
g. Watts Industries, Inc.; Water Products Div.

D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McWane, Inc.; Kennedy Valve Div.
b. Potter Electric Signal Company.
c. System Sensor.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspect preceding work. Verify all dimensions before proceeding with work and coordinate all work and placement of components with other trades.

B. Be responsible for all measurements, fitting and assembly of all work. Prefabrication is done at the Contractor's risk.

C. Installation

1. Drawings indicate general intent and location. Piping shall be installed in the most direct and straight manner as possible. All lines shall be run high enough to permit relocation of lights without moving ceiling grid.
2. Coordinate exact pipe locations with Drawings and other trades before design approval and fabrication of piping. This Contractor shall be responsible for any redesign and fabrication required to fit system into allowable space.
3. Sprinkler piping that passes through a non-sprinkled area shall be adequately protected as required by NFPA 13.
4. Do not route any piping over electrical panels, transformers, or other equipment requiring a clear space above per NEC and NFPA Codes.
5. All piping in finished areas shall be concealed unless shown otherwise on the Drawings.
6. All vertical lines shall be plumb and horizontal lines shall run parallel to building construction.
7. Install horizontal piping to slope to low points so that entire system may be emptied to facilitate testing.
8. Pipe drains to terminate outside the building wherever possible. Location of drains to the building exterior shall be as shown on Drawings or as approved by the Owner.
9. Pipe and fittings shall be inspected for soundness and cleaned of all dirt and other foreign matter prior to be installed. All damaged pipe and fittings will be rejected.
10. Protect open pipe ends whenever work is suspended during construction to prevent foreign material from entering.
11. Chrome plated or other polished finished components shall be installed with care so that marring does not occur to the finish.

D. Zoning

1. Sprinkler system shall be zoned on a floor-by-floor basis. In addition, systems protecting special hazards shall be zoned separately.
2. Refer to Drawings for sprinkler zone locations.

E. Connection To Utilities

1. Contractor shall make all connections to utilities as required to install the system. All connections to utilities and their shutdown shall be arranged with the Owner. Existing system(s) will be shutdown and drained by the Contractor.

F. Pipe Supports

1. All piping shall be supported from the structure above with UL approved hangers. Sizing, spacing, and installation shall be in accordance with NFPA 13 except as otherwise shown on the Drawings or specified herein. Comply with other sections of this specification relating to Basic Mechanical Materials and Methods for basic pipe installation.
2. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 250 lb.

G. Main Riser and/or Header Assembly

1. Provide main riser or header assembly consisting of double check backflow preventer, fire department connection, drain valve, pressure gauge and flow switch.

H. Backflow Preventers

1. Install in compliance with state regulations. Mount horizontal, maximum 4 ft. above the floor.
2. Test backflow preventer to ensure proper operation. Inspection shall be performed by a registered inspector in accordance with the Indiana Department of Environmental Management. Submit reports to the Owner and include a copy in the Operation and Maintenance manuals.

I. Fire Department Inlet Connection

1. Provide a check valve with ball drip valve in line connecting fire department connection to fire protection system.

J. Inspectors Test Connection

1. Inspector test connections shall be installed at the most remote point of each sprinkler zone system. Test connections shall be provided with a 1" pipe and valve. Test pipe shall discharge to the outside through a corrosion resistant orifice of the proper size, where it can easily be seen. Location of discharge shall be as approved by the Owner.

K. Sectional Control Assembly

1. Provide and install sectional control assembly for each sprinkler zone. Sectional control assembly shall include supervised shut off valve, pressure gauge, water flow indicator, test valve, drain valve, sight glass, and orificed union of the proper size.

L. Ball Drip Valves

1. Provide where shown and as required. Locate ball drips in accessible locations and pipe discharge full size to nearest floor drain.

M. Valve Supervisory Switches

1. Provide valve supervisory switches for all water supply shut-off valves.

N. Sprinkler Heads

1. Sprinkler heads shall be installed per manufacturer's recommendations. Heads shall be installed to satisfy all code requirements for head spacing and as herein specified.
2. Finishes shall be protected against scratches, dents and discoloration. Defective items will not be acceptable.

O. Wet Sprinkler System

1. Fire sprinklers shall be provided for the entire building except as follows:

   a. Do not install sprinkler piping or heads in elevator shafts or elevator equipment rooms.
   b. Do not install sprinkler heads in transformer vaults.

2. Air Vent:

   a. Provide at least one air vent in each wet pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping. Where trapped portion of pipe exists, provide air vent for each location.
   b. Provide dielectric union for dissimilar metals, ball or globe valve, and strainer upstream of automatic air vent.

P. Standpipe System(s)

1. Provide a Class I manual-wet standpipe in accordance with NFPA 14 - 2000. System shall be hydraulically designed to provide the required minimum pressure and flow rate.
2. Standpipes shall be installed in each stairway and where shown on the Drawings.
3. Provide a 2-1/2" hose valve at the following locations. Valve shall be installed 4 ft. above the floor unless shown otherwise on the Drawings.

   a. At each intermediate landing between floor levels in every stairway.
   b. At the highest landing of stairways with stairway access to the roof.
   c. Elsewhere as shown on the Drawings.

4. At each standpipe where stairway does not access the roof, provide a roof manifold when the roof has a slope of less than 4" in 12". Where lines pass through the roof, provide flashing and counterflashing as required for a watertight installation.
5. All standpipes shall be interconnected at the bottom. Provide isolation valve at all risers.
6. Provide drain valves with hose connection at the low point of all standpipes downstream of the isolation valve.
7. Provide a 3/4" water connection with shut-off valve and check valve for maintaining water within a manual-wet system. Water supply connection shall be made downstream of backflow preventer.

8. Provide sign at each hose connection for manual standpipes "Manual Standpipe For Fire Department Use Only".

Q. Instructions

1. When required approvals of this work have been obtained, and at time designated by the Owner, demonstrate to the Owner's personnel the operation and maintenance of the systems.

3.2 PIPING SCHEDULE

A. Wet Pipe Sprinkler System

1. Pipe 1¼" and larger: Schedule 10 black-steel pipe with roll-grooved ends, grooved-end fittings for steel piping, grooved-end couplings.
2. Pipe 1" and smaller: Schedule 40 black-steel pipe with threaded ends, threaded cast iron or malleable iron fittings, threaded joints.
3. Pipe between Fire Department Connection and check valve: Schedule 40 galvanized-steel pipe with threaded ends, galvanized threaded cast iron or malleable iron fittings, threaded joints; or roll-grooved ends, galvanized grooved-end fittings for steel pipe, grooved-end couplings.

3.3 PIPING INSTALLATION

A. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install drain valves on standpipes.

J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

K. Install alarm devices in piping systems.

L. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
2. Install sprinkler system piping according to NFPA 13.

M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

O. Fill wet-standpipe system piping with water.

P. Fill wet-pipe sprinkler system piping with water.

3.4 JOINT INSTALLATION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

D. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

E. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

F. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.

G. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

a. Shutoff Duty: Use butterfly or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.

a. Shutoff Duty: Use butterfly or gate valves.
b. Throttling Duty: Use globe valves.

3.6 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install backflow preventers in potable-water supply sources.

D. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.7 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Sprinkler Finishes:

a. Upright Sprinklers: Rough bronze; wax coated where exposed to acids, chemicals, or other corrosive fumes.
b. Recessed Pendent, and Sidewall Sprinklers: Factory painted white, with white escutcheon.
c. Concealed Sprinklers: Rough brass, with factory-painted cover plate. Finish shall be white unless custom-color cover plate is indicated on Drawings.
d. Residential Sprinklers: Factory painted white.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of both dimensions of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.9 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes, unless otherwise indicated.

B. Install freestanding hose connections for access and minimum passage restriction.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 26.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.11 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Coordinate with fire alarm tests. Operate as required.
5. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

C. Sterilization

1. Contractor shall sterilize all piping upstream of fire protection backflow preventer.

a. Flush system thoroughly until water runs clear.
b. Entire system shall be filled with a water/chlorine solution containing 50 parts per million of chlorine. The system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for three hours.
c. Following the allowed standing time, the system shall be flushed with clean potable water until chlorine does not remain in the water coming from the system.
d. After the above requirements are satisfied, submit samples to Indiana State Board of Health for approval.
e. Sterilization shall be redone until approval from the State Board of Health is obtained. Include copies of the approval in the Operations and Maintenance Manuals.

D. Testing

1. Testing to comply with NFPA 13 Standard.

2. Test backflow preventer to ensure proper operation. Inspection shall be performed by a registered inspector in accordance with the Indiana Department of Environmental Management. Submit reports to the Owner and include a copy in the Operations and Maintenance manuals.
3. Test all piping hydrostatically at not less than 200 psi for 2 hours without loss of pressure.
4. Retest piping that initially fails after corrective actions have been made.
5. All tests shall be made in the presence of the Owner's Representative or as directed by the Engineer. Allow for at least 24-hour notice of all tests.
6. Complete and sign "Contractor's Material and Test Certificates". Make arrangements and pay for all costs for all inspections by the authority having jurisdiction and obtain approval of the installation. Include copies of the certificates in the Operations and Maintenance Manuals.

END OF SECTION 21 10 00

SECTION 21 31 13 – ELECTRIC-DRIVE, VERTICAL FIRE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes electric-drive, vertical fire pumps and the following:

1. Full-service fire-pump controllers.
2. Fire-pump accessories and specialties.
3. Pressure-maintenance pumps, controllers, accessories, and specialties.
4. Alarm panels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, certified pump performance curves with each selection point indicated, operating characteristics, and furnished accessories and specialties for each fire pump and pressure-maintenance pump.

B. Product Certificates: For each type of fire pump and fire-pump controller, signed by product manufacturer.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire pumps, pressure-maintenance pumps, and controllers through one source from a single manufacturer for each type of equipment.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.

D. Comply with NFPA 20, "Stationary Pumps for Fire Protection," for fire pumps, drivers, controllers, accessories, and their installation.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FIRE PUMPS

A. General

1. Contractor shall supply the pumps furnished for fire protection service with the specified drivers, controls and pump accessory items. The pump, driver and control will be Underwriters Laboratories (ULI) Listed(x) Factory Mutual Research Corporation (FM) Approved for fire protection service. The pumping equipment will be installed as recommended in the National Fire Protection Association (NFPA) Pamphlet 20, Standard for the Installation of Centrifugal Fire Pumps.
2. Capacity

    a. Size, location, capacity, and model as indicated on Drawings.
    b. The fire pump shall also be capable of delivering not less than 150% of rated flow at not less than 65% of rated head.

3. The pump manufacturer will have unit responsibility for the proper operation of the complete unit assembly as indicated by field acceptance tests.
4. Manufacturer's Factory Tests

    a. Each individual pump shall be hydrostatically tested and run tested prior to shipment. The pump will be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump's maximum diameter impeller plus the maximum allowable suction head but in no case less than 250 psig.

5. Field Acceptance Test

    a. A field acceptance performance test shall be conducted upon completion of pump installation.
    b. The test will be made by flowing water through “Hose Monster” calibrated nozzles with a remote reading “Monster Tester” assembly.
    c. The test will be conducted as recommended in NFPA Pamphlet 20 by the pump manufacturer’s representative and the installing contractor in the presence of the authority having jurisdiction and with that authority's final approval and acceptance.
    d. Failure to submit documentation of factory and field tests will be just cause for equipment rejection.

6. Acceptable manufacturers

    a. SyncroFlo/SPP
    b. AC/Xylem
    c. Armstrong

B. Vertical In-line Centrifugal Pumps

1. The fire pump shall be of vertical single stage construction specifically labeled for fire service.
2. The pump casing will be cast iron with 6-inch 125-pound ANSI rated suction and 5-inch (125) ANSI rated discharge flanges machined to American National Standards Institute (ANSI) dimensions.

C. Fittings

1. The pump manufacturer shall furnish piping accessory items for the pump installation which will adapt the pump connections to the fire protection system and test connection as follows.

a. Fittings subjected to pump discharge pressure shall be ANSI (125) pound rating.
b. Fittings subjected to suction pressure shall be ANSI 125-pound rating.
c. Eccentric tapered suction reducer.
d. Concentric tapered discharge increaser.
e. Polished chrome inline hose valve test head.
f. Hose valves with caps and chains.
g. Automatic air release valve.
h. Hose valve head drain valve.
i. Suction and discharge pressure gauges.
j. 6” fire pump suction control valve.
k. 6” Bypass piping.

D. Electric Motor

1. The pump driver shall be a vertical type and shall be listed for FIRE PUMP SERVICE.

2.2 ELECTRIC FIRE PUMP CONTROLLERS

A. General

1. The main fire pump controller shall be factory assembled and wired for fire pump service. The fire pump controller shall be factory assembled, wired and tested as a single unit and shall conform to all requirements of the latest edition of NFPA20, Centrifugal Fire Pumps and NFPA 70, National Electrical Code.
2. The controller shall be listed by Underwriters Laboratories, Inc., in accordance with UL218*, Standard for Fire Pump Controllers*, CSA, and Canadian Standards Association CSA-C22.2, *Standard for Industrial Control Equipment* (cULus), approved by Factory Mutual and approved by the City of New York for fire pump service.

B. Starting Method

1. The controller shall be of the combined manual and automatic type designed for Across The Line Starting of the fire pump motor having the horsepower, voltage, phase and

frequency rating shown on the plans and drawings. The controller components shall be housed in a NEMA Type 12 (IEC IP11) drip-proof, wall mounted enclosure.

C. Withstand Ratings (Short Circuit Current Ratings)

1. All controller components shall be front mounted, wired and front accessible for maintenance. The minimum withstand rating of the controllers shall not be less than 100,000 Amps RMS Symmetrical at 600 Volts.

D. Isolation Switch and Circuit Breaker

1. The controller shall include a motor rated combination isolating disconnect switch/circuit breaker, mechanically interlocked and operated with a single, externally mounted handle. When moving the handle from OFF to ON, the interlocking mechanism shall sequence the isolating disconnect switch ON first, and then the circuit breaker. When the handle is moved from ON to OFF, the interlocking mechanism shall sequence the circuit breaker OFF first, and then the isolating disconnect switch.
2. The isolating disconnect switch/circuit breaker shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the ON position except by a hidden tool operated defeater mechanism. The isolating disconnect switch/circuit breaker shall be capable of being padlocked in the OFF position for installation and maintenance safety, and shall also be capable of being locked in the ON position without affecting the tripping characteristics of the circuit breaker. The controller door shall have a locking type handle and three-point cam and roller vault type hardware. The circuit breaker trip curve adjustment shall be factory set, tested and sealed for the full load amps of the connected motor. The circuit breaker shall be capable of being field tested to verify actual pick up, locked rotor, and instantaneous trip points after field installation without disturbing incoming line and load conductors.

E. Operator Interface

1. The fire pump controller shall feature an operator interface with user keypad. The interface shall monitor and display motor operating conditions, including all alarms, events, and pressure conditions. All alarms, events, and pressure conditions shall be displayed with a time and date stamp. The display shall be a 2-line, 20-character, vacuum fluorescent, dot matrix type designed to allow easy viewing from all angles and in all light conditions. The display and interface shall be NEMA rated for Type 2, 3R, 4, 4X, and 12 protection and shall be fully accessible without opening the controller door. The display and user interface shall utilize multiple levels of password protection for system security. A minimum of 3 password levels shall be provided. The display shall be capable of being programmed for any language.
2. Ammeter/Voltmeter

a. The fire pump controller operator interface shall be capable of displaying true RMS digital motor voltage and current measurements for all three phases simultaneously. Displays requiring push-button and selector switches to toggle between phases or current and voltage shall not be accepted.

b. Voltage and current shall be measured by True RMS technology to provide the most accurate measurement for all sine waves, including non-sinusoidal waveforms. Average responding meters will not be accepted.

3. Digital Status/Alarm Messages

a. The digital display shall indicate text messages for the status and alarm conditions of:

1) Motor On
2) Sequential Start Time
3) Minimum Run Time
4) Local Start / Off Delay Time
5) Remote Start
6) Fail to Start
7) System Battery Low
8) Under Voltage
9) Over Voltage
10) Locked Rotor Trip
11) Low Suction Pressure
12) Over Frequency
13) Emergency Start
14) Motor Over 320
15) Drive Not Installed
16) Motor Overload
17) Disk Error
18) Printer Error
19) Disk Near Full
20) Pressure Error

b. The Sequential Start Timer and Minimum Run Timer/ Off Delay Timer shall be displayed as numeric values reflecting the value of the remaining time.

4. LED Visual Indicators

a. LED indicators, visible with the door closed, shall indicate:

1) Power On
2) Emerg. Isolating Switch Open
3) Pump Running
4) Low System Pressure
5) Alarm
6) Deluge Open
7) Phase Failure
8) Phase Reversal
9) Interlock On

5. In addition to the standard alarm contacts required by NFPA20, the digital display module shall have N.O. and N.C. contacts for remote indications of any digitally displayed alarm and N.O. and N.C. contacts for remote indication up to EIGHT, specified, programmable alarm.

F. Data Logging

1. The digital display shall monitor the system and log the following data:

a. Motor Calls/Starts
b. Elapsed Motor Run Time
c. Last Trip Currents
d. Elapsed Power On Time
e. Last Breaker Trip
f. Maximum Run Currents
g. Minimum Voltages
h. Minimum Run Currents
i. Maximum Voltages
j. Last Motor Run Time
k. Last Phase Failure
l. Last Start Currents
m. Last Phase Reversal
n. Min/Max Frequency
o. Min/Max Pressure

G. Event Recording

1. Memory

a. The controller shall record all operational and alarm events to system memory. All events shall be time and date stamped and include an index number. The system memory shall have the capability of storing 3000 events and allow the user access to the event log via the user interface. The user shall have the ability to scroll through the stored messages in groups of 1, 10, or 100.

2. Flash Drive

a. The controller shall include a USB flash drive to save all operational and alarm events. The flash drive shall have the ability to store up to 1 year's worth of data (under normal operating conditions) in individual monthly files. Each event shall be time and date stamped. The controller shall also have the capability to save settings and values to flash drive through the user interface.

3. Communications

a. The controller shall feature two independent communications ports to allow connectivity to computers, modems, or building management systems.

b. An Ethernet Adapter Communications Module Shall Be Included in the fire pump controller for remote monitoring of alarm conditions.

H. Solid State Pressure Transducer

1. The controller shall be supplied with a solid-state pressure transducer with a range of 0-300 psi (0-20.7 bar) ±1 psi. The solid state pressure switch shall be used for both display of the system pressure and control of the fire pump controller. Systems using analog pressure devices or mercury switches for operational control will not be accepted.
2. The START, STOP and SYSTEM PRESSURE shall be digitally displayed and adjustable through the user interface. The pressure transducer shall be mounted inside the controller to prevent accidental damage. The pressure transducer shall be directly pipe mounted to a bulkhead pipe coupling without any other supporting members. Field connections shall be made externally at the controller coupling to pre-vent distortion of the pressure switch element and mechanism.
3. Operation

    a. A digitally set On Delay (Sequential Start) timer shall be provided as standard. Upon a call to start, the user interface shall display a message indicating the remaining time value of the On Delay timer.
    b. The controller shall be field programmable for manual stop and automatic stop. If set for automatic stopping, the controller shall allow the user to select either a Minimum Run Timer or an Off Delay Timer. Both timers shall be programmable through the user interface. The automatic stop feature must be disabled per FM Global requirements.
    c. The controller shall be fully programmable to allow up to 8 custom alarm messages to be displayed on the user interface.
    d. A nonadjustable restart delay timer shall be provided to allow the residual voltage of the motor to decay prior to restarting the motor. At least 2 seconds, but no more than 3 seconds, shall elapse between stopping and restarting the pump motor.
    e. A weekly test timer shall be provided as standard. The controller shall have the ability to program the time, date, and frequency of the weekly test. In addition, the controller shall have the capability to display a preventative maintenance message for a service inspection. The message text and frequency of occurrence shall be programmable through the user interface.
    f. A Lamp Test feature shall be included. The user interface shall also have the ability to display the status of the system inputs and outputs.
    g. The controller shall not start the fire pump motor under a single-phase condition. If the motor is already running when a phase loss occurs, the controller shall continue to run the motor, but still display a Phase Failure alarm.

I. Acceptable Manufacturers

1. Firetrol
2. Master Controls
3. Eaton
4. Tornatech

2.3 PRESSURE-MAINTENANCE PUMPS

A. General

1. Description: Multistage, pressure-maintenance pumps having multiple impeller and complying with HI 1.1-1.2 and HI 1.3 requirements for multistage centrifugal pumps. Include base. Pressure-maintenance pumps shall be factory assembled and tested and have electric-motor driver, controller, and accessories and specialties. Include cast-iron or stainless-steel casing and bronze or stainless-steel impellers, mechanical seals, and suction and discharge flanges machined to ASME B16.1, Class 125 dimensions unless Class 250 flanges are indicated and except that connections may be threaded in sizes where flanges are not available.
2. Capacity

    a. Size, location, capacity, and model as indicated on Drawings.

3. Acceptable manufacturers

    a. A-C Pump
    b. Goulds
    c. Webtrol

B. Jockey Pump

1. Finish: Manufacturer's standard color paint applied to factory-assembled and -tested unit before shipping.
2. Nameplate: Complete with capacity, characteristics, and other pertinent data.
3. Driver: NEMA MG 1, open-dripproof, squirrel-cage, induction motor complying with NFPA 20 and NFPA 70. Include wiring compatible with controller used.

C. Controllers: UL 508; factory-assembled, -wired, and -tested, across-the-line type for combined automatic and manual operation.

1. Enclosure: UL 508 and NEMA 250, Type 2, wall-mounting type for field electrical wiring.

    a. Finish: Manufacturer's standard color paint applied to factory-assembled and -tested unit before shipping.

2. Rate controller for scheduled horsepower and include the following:

    a. Fusible disconnect switch.
    b. Pressure switch.
    c. Hand-off-auto selector switch.
    d. Pilot light.
    e. Running period timer.

3. Acceptable manufacturers

a. Firetrol
b. Master Controls
c. Eaton
d. Tornatech

D. Accessories and Specialties: Match pressure-maintenance-pump suction and discharge ratings as required for pump capacity rating. Include the following:

1. Circulation relief valve.
2. Suction and discharge pressure gages.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect fire pumps with their controllers according to NFPA 20 for certified shop tests.

B. Verification of Performance: Rate fire pumps according to requirements indicated.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated for fire pumps, pressure-maintenance pumps, and controllers. Refer to Division 20 Section "Common Materials and Methods for Fire Suppression, Plumbing and HVAC."

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

A. Install and align fire pump, pressure-maintenance-pump, and controller according to NFPA 20.

B. Install pumps and controllers to provide access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Set base-mounting-type pumps on concrete bases. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.

1. Support pump baseplate on rectangular metal blocks and shims or on metal wedges having small taper, at points near anchor bolts to provide 3/4- to 1-1/2-inch gap between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Verify that coupling faces and pump suction and discharge flanges are level and plumb.

D. Install suction and discharge piping equal to or greater than diameter of fire-pump nozzles.

E. Install valves that are same size as piping connecting fire pumps, bypasses, test headers, and other piping systems.

F. Install pressure gages on fire-pump suction and discharge at pressure-gage tappings.

G. Support pumps and piping separately so weight of piping does not rest on pumps.

H. Install piping accessories, hangers and supports, anchors, valves, meters and gages, and equipment supports.

I. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

J. Align split-case fire-pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

K. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

L. Align piping connections.

M. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

N. Piping installation requirements are specified in Division 20 Section "Common Pipe, Valves, Fittings and Hangers for Fire Suppression, Plumbing and HVAC”; Division 21 Section “Water-Based Fire Suppression Systems”; and National Fire Protection Association (NFPA) Chapter 13. Drawings indicate general arrangement of piping, fittings, and specialties.

O. Install piping adjacent to pumps and equipment to allow service and maintenance.

P. Connect relief-valve discharge to point of disposal.

Q. Connect controllers to pumps.

R. Connect fire-pump controllers to building fire-alarm system. Refer to Division 28 Section "Fire Detection and Alarm."

S. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

T. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform field tests for each fire pump when installation is complete. Comply with operating instructions and procedures in NFPA 20 to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be satisfactorily corrected or that does not perform as indicated, then retest to demonstrate compliance. Verify that each fire pump performs as indicated.

C. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Final Checks before Startup: Perform the following preventive-maintenance operations and checks:

    a. Lubricate oil-lubrication-type bearings.
    b. Remove grease-lubrication-type bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
    c. Disconnect coupling and check electric motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
    d. Verify that pump is free to rotate by hand. If pump is bound or if it drags even slightly, do not operate until cause of trouble is determined and corrected.

3. Starting procedure for pumps is as follows:

    a. Prime pump by opening suction valve and closing drains, and prepare pump for operation.
    b. Open sealing-liquid supply valves if pump is so fitted.
    c. Start motor.
    d. Open discharge valve slowly.
    e. Observe leakage from stuffing boxes and adjust sealing-liquid valve for proper flow to ensure lubrication of packing. Do not tighten gland immediately, but let packing run in before reducing leakage through stuffing boxes.
    f. Check general mechanical operation of pump and motor.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Fire hoses are for field-acceptance tests only and are not property of Owner.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps, drivers, controllers, and pressure-maintenance pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 21 31 13

SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Backflow preventers.
2. Balancing valves.
3. Expansion tanks.
4. Strainers.
5. Hose bibbs.
6. Wall hydrants.
7. Drain valves.
8. Water hammer arresters.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers; BFP-C- : **(2" and smaller)**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Capacity: Size, location, capacity, and model as indicated on Drawings.
5. Body: Bronze with stainless steel trim.
6. End Connections: Threaded.
7. Configuration: Designed for horizontal, straight through flow.
8. Relief Valve: Designed to admit air directly into the reduced pressure zone via separate channel from the water discharge.
9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
    c. Strainer: Bronze 'Y'-pattern strainer.

B. Reduced-Pressure-Principle Backflow Preventers; BFP-A and BFP-B : **(2½" and larger)**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Capacity: Size, location, capacity, and model as indicated on Drawings.
5. Body: Cast iron with FDA approved epoxy lining complying with AWWA C550.
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow.

8. Relief Valve: Designed to admit air directly into the reduced pressure zone via separate channel from the water discharge.
9. Accessories:

    a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
    c. Strainer: FDA approved epoxy coated strainer.

2.2 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bell & Gossett Circuit Setter Plus or a comparable product by one of the following:

    a. Conbraco Industries, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: Equal to pipe-size.
5. Body: Copper alloy with 1/4-inch NPT tapped drain/purge port.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device. Nameplate to be calibrated to assure specific setting.
11. Operation: Valve to have differential pressure read-out ports across seat area and memory stop feature to allow it to be closed for service and then reopened to set point without disturbing balance position.

2.3 EXPANSION TANKS

A. Thermal Expansion Tank; ET-A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amtrol.
    b. Bell & Gossett.
    c. Calefactio

d. Taco.

2. Capacity: Size, location, capacity, and model as indicated on Drawings.
3. Pressure Rating: 150 psig maximum working pressure.
4. Construction: Diaphragm type expansion tank with polypropylene liner, or full acceptance bladder type.
5. Tank: Welded steel with stainless steel system connection.
6. Factory charge: 40 psig, field adjustable.
7. Finish: Resistant electrostatic paint, beige color.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with FDA-approved interior lining complying with AWWA C550 for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.100 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.5 HOSE BIBBS

A. Hose Bibbs; HB-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Woodford Model 24 or a compatible product by one of the following:

   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Brass.
4. Seat: Standard ‘O’ size washer, replaceable. Quarter-turn valves and/or ceramic cartridge valves are not acceptable.
5. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish: Rough brass.
10. Operation: Optional metal wheel handle.

2.6 WALL HYDRANTS

A. Non-freeze Wall Hydrants; HYD-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Woodford Model B65 or a compatible product by one of the following:

    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Body Material: Brass.
4. Seat: Standard 'O' size washer, replaceable. Quarter-turn valves and/or ceramic cartridge valves are not acceptable.
5. Pressure Rating: 125 psig.
6. Operation: Self draining design with a drainage tube that is pitched to the faceplate to provide positive drainage when water is shut off. Single tube hydrants that require the installation to be sloped to the exterior wall are not acceptable.
7. Operating Rod: Solid brass rod, of length required to match wall thickness.
8. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
9. Outlet Connection: Concealed, with garden-hose thread complying with ASME B1.20.7.
10. Vacuum Breaker: Integral, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
11. Box: Cast brass, flush mounting with cover.
12. Box and Cover Finish: Chrome plated.
13. Wall Clamp: Required.
14. Operating Keys(s): One with each wall hydrant.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.

6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters; WHA:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. PPP Inc.
    d. Sioux Chief Manufacturing Company, Inc.
    e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Tyler Pipe; Wade Div.
    g. Watts Drainage Products Inc.
    h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Stainless-steel bellows with factory pressurized and sealed cushion chamber.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
2. Do not install bypass piping around backflow preventers.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

E. Install water hammer arresters in water piping as follows:

1. In accordance to PDI-WH 201.
2. In upright position.
3. At any fixture having quick-closing valves.
4. In an accessible location. Provide access panels as required. Coordinate with Architectural Drawings.

F. Piping installation requirements are specified in other Division 20 Sections. Drawings indicate general arrangement of piping and specialties.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Test domestic water piping specialties under pressure. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC" for pressure test requirements.

C. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves. Refer to Plumbing Equipment Schedule on Drawings for set points.

B. Set field-adjustable flow of balancing valves. Refer to Circuit Setter Schedule on Drawings for flow rates.

C. Adjust expansion tank pre-charge pressure (40 psig) to match water system pressure.

END OF SECTION 22 11 19

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SECTION 22 11 23 – DOMESTIC CIRCULATION PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:

1. Close-coupled, horizontally mounted, in-line centrifugal pumps.

1.2 SUBMITTALS

A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Circulation Pump; CP-A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Grundfos Pumps.
b. Armstrong Pumps Inc.
c. Bell & Gossett Domestic Pump; ITT Industries.
d. Taco.

2. Description: Factory-assembled and -tested, overhung impeller, single-stage, close-coupled, horizontally mounted, in-line centrifugal pumps as defined in HI 1.1-1.2 and HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.
3. Pump Construction: All bronze.

    a. Casing: Radially split, bronze, with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
    b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
    c. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
    d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
    e. Bearings: Oil-lubricated; bronze-journal or ball type.
    f. Capacity: Size, location, capacity, and model as indicated on Drawings.

4. Shaft Coupling: Rigid type if pump is provided with coupling.
5. Motor: Single speed, with grease-lubricated ball bearings.

2.2 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Honeywell International, Inc.
    b. Square D.
    c. White-Rodgers Div.; Emerson Electric Co.

2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
3. Range: 65 to 200 deg F.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac. Coordinate wiring with E.C.
7. Settings: Start pump at 110 deg F and stop pump at 117 deg F.
8. Settings: Start pump at 130 deg F and stop pump at 137 deg F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Install close-coupled, horizontally mounted, in-line centrifugal pumps with motor and pump shafts horizontal.

E. Install continuous-thread hanger rods and/or fabricate brackets as required. Hanger and support materials are specified in Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC."

F. Install immersion-type thermostats in hot-water return piping.

G. Piping installation requirements are specified in other Division 20 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

H. Install piping adjacent to pumps to allow service and maintenance.

I. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC."

    1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC" for general-duty valves for domestic water piping and for strainers.
    2. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 20 Section "Common Materials and Methods for Fire Suppression, Plumbing, and HVAC" for pressure gages and gage connectors.

J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

L. Connect thermostats to pumps that they control.

END OF SECTION 22 11 23

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SECTION 22 13 19 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Miscellaneous sanitary drainage piping specialties.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide MIFAB #BV1006 or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with accessible check valve.
6. End Connections: No-hub.

7. Type Check Valve: Removable, bronze, swing check, factory assembled, or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Cleanouts for Vinyl Tile Floor:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 4141S or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron
5. Outlet Connection: Spigot.
6. Closure: Bronze plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Material and Finish: Nickel-bronze with 1/8-inch tile recess.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Light duty.

B. Cleanouts for Terrazzo Floor:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 4181S or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron
5. Outlet Connection: Spigot.
6. Closure: Bronze plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Material and Finish: Nickel-bronze with 1/2-inch terrazzo recess.
9. Frame and Cover Shape: Round.

10. Top Loading Classification: Light duty.

C. Cleanouts for Carpet Floor:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 4021S-Y or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron
5. Outlet Connection: Spigot.
6. Closure: Bronze plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Material and Finish: Scoriated nickel-bronze with carpet marker.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Light duty.

D. Cleanouts for Concrete Floor:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 4101S or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron
5. Outlet Connection: Spigot.
6. Closure: Bronze plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with setscrews.
8. Frame and Cover Material and Finish: Scoriated nickel-bronze.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Extra heavy duty.

E. Exterior Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 4251S or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron cleanout and cast iron double flanged housing.
5. Outlet Connection: Spigot.
6. Closure: Bronze plug with straight threads and gasket.
7. Frame and Cover Material and Finish: Scoriated cast iron with lifting device.
8. Frame and Cover Shape: Round.
9. Top Loading Classification: Heavy duty.

F. Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 4531S-Y or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping.
4. Body: Hub-less, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains; FD-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 2005Y-A or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.

4. Body Material: Gray iron.
5. Seepage Flange: Combination flashing collar and clamp with seepage openings.
6. Outlet: Bottom, no-hub.
7. Coating on Interior and Exposed Exterior Surfaces: Not required.
8. Sediment Bucket: Not required.
9. Top or Strainer Material: Nickel bronze.
10. Top Description: Adjustable, round, heel-proof, flat.
11. Top Loading Classification: Light Duty.

B. Cast-Iron Floor Drains; FD-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 2310Y or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Combination flashing collar and clamp with seepage openings.
6. Outlet: Bottom, no-hub.
7. Coating on Interior and Exposed Exterior Surfaces: Not required.
8. Sediment Bucket: Not required.
9. Top or Strainer Material: Nickel bronze.
10. Top Description: Adjustable, round, bar grate.
11. Top Loading Classification: Medium duty.

C. Floor Sink; FS-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 3120Y-12 or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.6.3.
3. Pattern: 8-inch-deep floor sink.
4. Body Material: Gray iron.
5. Seepage Flange: Flanged receptor with seepage openings.
6. Outlet: Bottom, no-hub.

7. Coating on Interior and Exposed Exterior Surfaces: Acid resistant coating.
8. Sediment Bucket: Bottom dome strainer.
9. Top or Strainer Material: Nickel bronze.
10. Top Description: 1/2 grate with nickel bronze rim.
11. Top Loading Classification: Light duty.

D. Floor Sink; FS-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith 3200Y-12-CI-No ARE or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.6.3.
3. Pattern: 12-inch-deep floor sink.
4. Body Material: Gray iron.
5. Seepage Flange: Flanged receptor with seepage openings.
6. Outlet: Bottom, no-hub.
7. Coating on Interior and Exposed Exterior Surfaces: Not required.
8. Sediment Bucket: Bottom dome strainer.
9. Top or Strainer Material: Cast Iron.
10. Top Description: 1/2 grate with cast iron rim.
11. Top Loading Classification: Heavy duty.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Assemble open drain fittings and install with top of hub 2 inches above floor.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 20 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 31 00 – DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Water Softeners
2. Chemicals.
3. Water testing kits.

1.2 SUBMITTALS

A. Product Data: For each type of water softener and water testing kit indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and connections to piping systems.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within specified warranty period.

1. Water Softener, Warranty Period: Five years from date of Substantial Completion.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Salt for Brine Tanks: Furnish same form as, up to 2500 lb, as required to fill brine tank. Deliver on pallets in 40- or 50-lb packages.
2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

PART 2 - PRODUCTS

2.1 COMMERCIAL WATER SOFTENERS

A. Pressure-type water softener; WS-A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aqua Systems*.
b. Culligan International Company*.
c. Marlo, Inc*.
d. Process Solutions*.

* All systems shall use Fleck control valves.

2. General:

a. Comply with NSF 61, "Drinking Water System Components--Health Effects."
b. Capacity: Size, location, capacity, and model as indicated on Drawings.
c. Configuration: Twin alternating unit with two mineral tanks and one brine tank.

3. Mineral Tanks: Fiberglass reinforced polyester; pressure-vessel quality.

a. Construction: The mineral tank shall be “polyglass” consisting of an inner shell of virgin polyethylene and an external shell of continuous fiberglass roving.
b. Pressure Rating: 150 psig minimum.
c. Wetted Components: Suitable for water temperatures from 40 to at least 120 deg F.
d. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
e. Support Legs or Skirt: Constructed of PVC, bonded to tank before testing and labeling.
f. Upper Distribution System: Single, point type, fabricated from PVC pipe and fittings.

g. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, non-clogging PE strainers; arranged for even flow distribution through resin bed.

4. Controls: Fully automatic; factory mounted on unit and factory wired.

   a. Adjustable duration of various regeneration steps.
   b. Push-button start and complete manual operation.
   c. Sequence of Operation: Program multiport pilot-control valve to automatically pressure-actuate main operating valve through steps of regeneration and return to service.
   d. Pointer on pilot-control valve shall indicate cycle of operation.
   e. Means of manual operation of pilot-control valve if power fails.
   f. Main Operating Valves: Automatic, multiport, diaphragm type with the following features:

      1) Slow opening and closing, non-slam operation.
      2) Diaphragm guiding on full perimeter from fully open to fully closed.
      3) Isolated dissimilar metals within valve.
      4) Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
      5) Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
      6) Sampling cocks for soft water.
      7) Special tools are not required for service.

   g. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressures, and that does not require field adjustments.

      1) Demand-Initiated Control: Equip each mineral tank of twin mineral-tank units with automatic-reset-head water meter in common outlet header that electrically activates cycle controller to automatically regenerate one mineral tank at preset total in gallons and divert flow to other tank. Set to repeat with other tank. Include electrical lockout to prevent simultaneous regeneration of both tanks.

5. Brine Tank: Combination measuring and wet-salt storing system.

   a. Tank and Cover Material: Molded PE, 3/8 inch thick.
   b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
   c. Size: Large enough for at least four regenerations at full salting.

6. Factory-Installed Accessories:

   a. Piping, valves, tubing, and drains.
   b. Sampling cocks.
   c. Main-operating-valve position indicators.

d. Water meters.

2.2 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.

B. Salt for Brine Tanks: High-purity sodium chloride; free of dirt and foreign material. Rock and granulated forms are not acceptable.

1. Form: Processed, plain salt pellets.

2.3 WATER TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

PART 3 - EXECUTION

3.1 WATER SOFTENER INSTALLATION

A. Install commercial water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

D. Install water testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.2 CONNECTIONS

A. Refer to Division 20 Section “Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC” for piping joining materials, joint construction, and basic installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings.

D. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.

E. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank.

F. Install valved bypass water piping around water softeners.

G. Install drains as indirect wastes to spill into open drains or over floor drains.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with salt.

1. Commercial Water Softeners: Plain salt pellets.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples) and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D 859, "Test Method for Silica in Water."

2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D 1068, "Test Methods for Iron in Water."
4. ASTM D 1126, "Test Method for Hardness in Water."
5. ASTM D 1129, "Terminology Relating to Water."
6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water softeners.

END OF SECTION 22 31 00

SECTION 22 35 00 – DOMESTIC WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Domestic-water, instantaneous heat exchangers.

1.2 SUBMITTALS

A. Product Data: For each type and size of heat exchanger indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

D. Warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of heat exchangers that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of controls.

c. Deterioration of metals, finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:

a. Instantaneous Heat Exchangers: One (1) year.

PART 2 - PRODUCTS

2.1 INSTANTANEOUS HEAT EXCHANGERS

A. Domestic-Water, Instantaneous Heat Exchangers; WH-A :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thrush Co. Inc.
b. Approved equal.

2. Description: Fully packaged, high-efficiency, instantaneous steam-to-liquid, ASME heat exchanger.
3. Capacity:

a. Size, location, capacity, and model as indicated on Drawings and herein specified.
b. Steam pressure on system to be no more than 15 PSIG. Designed to generate 41 GPM (redundant) 73 GPM (parallel) with a 40˚F entering cold water temperature, a 140˚F mixed water set point utilizing 20 PSIG steam at a maximum of 2185 lbs/hr (redundant) 3883 lbs/hr (parallel) steam load.

4. Construction:

a. Duplex/316SS shell.
b. 18ga Cu/Ni Leak Detection Tubing.
c. PTEE Baffles.
d. 316ss Inner (water/shell side) Tubesheet.
e. Carbon Steel Outer (steam/tube side) Tubesheet.
f. Carbon Steel Head/Channel
g. Mounted in the vertical configuration.
h. The assembly shall comprise domestic side check valves, strainers, DRV, thermometers, ball valves, safety shut-off valve, shell and tube exchanger all pre-piped with type L copper on a painted carbon steel frame.
i. Complete assembly to be Lead Free compliant.

5. Control:

a. Reuse existing Armstrong DRV-40 controller.

6. Water heater assembly shall have all of the following operational capabilities:

    a. +/- 2F water temperature control from 0 to full system demand.
    b. 2˚F minimum inlet to outlet water temperature differential.
    c. Automatic shutoff of hot water flow upon cold water inlet supply failure.
    d. Automatic shutoff of hot water flow in the event of a power failure.
    e. Programmable set point range of 81-158°F (27-70°C).
    f. Programmable 1st level hi/lo temp alarm display.
    g. Programmable error temperature error level for double safety shutdown.
    h. LCD display which indicates: set point, delivered temperature, error codes and alarm conditions.
    i. Isolation valves and clean in place connections to chemically clean the exchanger without disassembly of the exchanger.
    j. ¼" domestic side pressure relief pop-off valve with 165 psig crack pressure. Self-seating.

7. Water heater assembly shall have the following connectivity capabilities:

    a. SPCO relay outputs which are energized during operation.
    b. RS485 Serial Port for connection to Modbus RTU (on board) and BrainScan® (optional adder).

8. Warranty

    a. Water heater assembly shall have a 2-year warranty from date of installation but not longer than 27 months from date of shipment. DRV shall have a 5-year all component parts warranty.

PART 3 - EXECUTION

3.1 HEAT-EXCHANGER INSTALLATION

A. Install heat exchangers on concrete bases. Concrete base construction requirements are specified in Division 20 Section "Common Work Materials and Methods for Fire Suppression, Plumbing, and HVAC."

B. Install heat exchangers level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install combination temperature and pressure relief valves in water piping for heat exchangers without storage. Extend relief-valve outlet, with drain piping same as water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install heat-exchanger drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for heat

exchangers that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

E. Install thermometer on each heat-exchanger domestic-water inlet and outlet piping. Refer to Division 20 Section "Common Work Materials and Methods for Fire Suppression, Plumbing, and HVAC" for thermometers.

F. Fill heat exchangers with water.

3.2 CONNECTIONS

A. Install piping adjacent to heat exchangers to allow service and maintenance. Arrange piping for easy removal of heat exchangers.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace heat exchangers that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 35 00

SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Faucets.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Disposers.
7. Water closets.
8. Urinals.
9. Lavatories.
10. Sinks.
11. Ice maker boxes.
12. Clothes washer boxes.

B. Related Sections include the following:

1. Division 22 Section "Healthcare Plumbing Fixtures."
2. Division 22 Section "Emergency Plumbing Fixtures."
3. Division 22 Section "Security Plumbing Fixtures."
4. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with the latest adopted version of NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Shower Enclosures: ANSI Z124.2.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Slip-Resistant Bathing Surfaces: ASTM F 462.
5. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
6. Stainless-Steel Sinks: ASME A112.19.3.
7. Vitreous-China Fixtures: ASME A112.19.2M.
8. Water-Closet, Flush Valve Trim: ASME A112.19.5.
9. Water-Closet, Flushometer Tank Trim: ASSE 1037.

G. Comply with the following applicable standards and other requirements specified for lavatory/sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
7. NSF Potable-Water Materials: NSF 61.
8. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

H. Comply with the following applicable standards and other requirements specified for bathtub/shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1.
4. Hand-Held Showers: ASSE 1014.
5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
6. Manual-Control Antiscald Faucets: ASTM F 444.

7. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
8. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
9. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Brass Waste Fittings: ASME A112.18.2.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
7. Supply Fittings: ASME A112.18.1.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Flexible Water Connectors: ASME A112.18.6.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. Water Closets; WC-1: **(floor mount)**

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard “Madera FloWise 15” 2234.001 or a comparable product by one of the following:

   a. Kohler Co.
   b. Sloan.
   c. Zurn Plumbing Products Group.

2. Description: Floor-mounting, bottom-outlet, vitreous-china fixture designed for flushometer valve operation.

   a. Style: Flushometer valve.
   b. Bowl Type: Elongated with siphon-jet design.

c. Height: 15” to rim.
d. Design Consumption: 1.28 gal./flush.
e. Color: White.

B. Water Closets; WC-2: **(floor mount, ada)**

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard “Madera FloWise 16-1/2” 3043.001 or a comparable product by one of the following:

a. Kohler Co.
b. Sloan.
c. Zurn Plumbing Products Group.

2. Description: Floor-mounting, bottom-outlet, vitreous-china fixture designed for flushometer valve operation.

a. Style: Flushometer valve.
b. Bowl Type: Elongated with siphon-jet design.
c. Height: 16-1/2” to rim.
d. Design Consumption: 1.28 gal./flush.
e. Color: White.

2.2 WATER CLOSET FLUSHOMETERS

A. Water Closet; WC-1 and WC-2: **(manual flush valve)**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan 111-1.28-DFB or a comparable product by one of the following:

a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Flushometer for water-closet type fixture. Include brass body with corrosion and chlorine resistant internal components, dual-filtered bypass, synthetic rubber diaphragm assembly, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

a. Internal Design: Diaphragm operation.
b. Style: Exposed.
c. Inlet Size: NPS 1.
d. Trip Mechanism: Oscillating, lever-handle actuator.
e. Consumption: 1.28 gal/flush.
f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.

2.3 TANK TYPE WATER CLOSETS

A. Water Closets; WC-3: **(floor mount, tank type)**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mansfield “Elementry” #4321, or approved equal.
2. Description: Floor-mounting, bottom-outlet, vitreous-china fixture.

   a. Style: 2” piston-action flushometer tank.
   b. Bowl Type: round with siphon-jet design.
   c. Trapway: Fully-glazed 1-5/8” trapway.
   d. Trim: Chrome plated metal trip lever.
   e. Accessories: Color matched bowl caps.
   f. Height: 10-3/8” to rim.
   g. Design Consumption: 1.28 gal./flush.
   h. Slow closing toilet seat with cover lock.
   i. Color: White.
   j. Warranty: 10 years.

3. Subject to compliance with requirements, provide trim products by one of the following:

   a. McGuire Manufacturing Company.
   b. Engineered Brass Company.
   c. Keeney Manufacturing Company.

4. Water Closet Trim

   a. Supplies: Chrome-plated copper with 1/2" NPT x 3/8” OD wheel handle stops.

2.4 TOILET SEATS

A. Toilet Seats; WC-1 and WC-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Bemis Manufacturing Company.
   b. Church Seats.
   c. Olsonite Corp.

2. Description: Toilet seat for water-closet-type fixture.

   a. Material: Molded, solid plastic.
   b. Configuration: Open front less cover.
   c. Size: Elongated.
   d. Hinge Type: Stainless steel, self-sustaining check hinge.
   e. Class: Extra heavy-duty, commercial.

f. Color: White.

2.5 URINALS

A. Urinals; UR-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard "Washbrook FloWise" 6590.001 or a comparable product by one of the following:

   a. Kohler Co.
   b. Sloan.
   c. Zurn Plumbing Products Group.

2. Description: Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.

   a. Type: Washout.
   b. Strainer or Trapway: Stainless steel strainer with integral trap.
   c. Design Consumption: 0.5 gal./flush.
   d. Color: White.
   e. Supply Spud Size: NPS 3/4.
   f. Outlet Size: NPS 2.

2.6 URINAL FLUSHOMETERS

A. Urinal; UR-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan 186-0.5-DFB or a comparable product by one of the following:

   a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Flushometer for urinal type fixture. Include brass body with corrosion and chlorine resistant internal components, dual-filtered bypass, synthetic rubber diaphragm assembly, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

   a. Internal Design: Diaphragm operation.
   b. Style: Exposed.
   c. Inlet Size: NPS 3/4.
   d. Trip Mechanism: Oscillating, lever-handle actuator.
   e. Consumption: 0.5 gal./flush.
   f. Tailpiece Size: NPS 3/4 and standard length to top of bowl.

2.7 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Urinal Supports; UR-1:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.

2.8 LAVATORIES

A. Lavatories; L-1 and L-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard “Lucerne” 0355.012 or a comparable product by one of the following:

   a. Kohler Co.
   b. Sloan.
   c. Zurn Plumbing Products Group.

2. Description: Accessible, wall-mounting, vitreous-china fixture.

   a. Size: 20 by 18 inches rectangular.
   b. Faucet Hole Punching: Three holes, 2-inch centers.
   c. Color: White.
   d. Overflow: Front.
   e. Construction: Self-draining deck area with contoured back and side splash shields.

3. Subject to compliance with requirements, provide trim products by one of the following:

   a. McGuire Manufacturing Company.
   b. Engineered Brass Company.
   c. Keeney Manufacturing Company.

4. Lavatory Trim

   a. Supplies: Chrome-plated copper with 1/2" NPT x 3/8” OD loose key stops.
   b. Drain: Grid with ADA compliant offset waste.

c. Drain Piping: NPS 1-1/4 chrome-plated cast-brass P-trap with cleanout; NPS 1-1/4 17-gauge tubular brass waste to wall; and wall escutcheon.

2.9 LAVATORY FAUCETS

A. Lavatory Faucets; L-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 5500.145.002, or a comparable by the following:

   a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Manual-control mixing valve. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

   a. Body Material: Commercial, solid brass.
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: 0.5 gpm.
   d. Mixing Valve: Two-handle.
   e. Centers: 4-inch.
   f. Mounting: Deck, exposed.
   g. Handle(s): Lever with color coded index button.
   h. Inlet(s): NPS 1/2 male shank.
   i. Spout Outlet: Aerator.
   j. Operation: Quarter-turn ceramic, manual.

B. Lavatory Faucets; L-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 6114120.002, or a comparable by the following:

   a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Manual-control mixing valve. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

   a. Body Material: Commercial, solid brass.
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: 0.5 gpm.
   d. Mixing Valve: Single-handle.
   e. Centers: 4-inch.
   f. Mounting: Deck, exposed.
   g. Handle: Lever with color coded index button.
   h. Inlet(s): NPS 1/2 male shank.
   i. Spout Outlet: Aerator.
   j. Operation: Quarter-turn ceramic, manual.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers; L-1 and L-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Truebro 103 E-Z or a comparable product by one of the following:

   a. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
   b. Plumberex Specialty Products Inc.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

   a. Material: Molded vinyl.
   b. Nominal Thickness: 1/8” constant wall.
   c. UV Protection: Required.
   d. Fasteners: Internal, reusable fasteners.
   e. Color: White.

2.11 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Lavatory Supports; L-1:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.

2.12 KITCHEN SINK FAUCETS

A. Kitchen Sink Faucets; SK-3:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 4275.551.F15, or a comparable by the following:

   a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Kitchen faucet with spray. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

    a. Body Material: Commercial, solid brass.
    b. Finish: Polished chrome plate.
    c. Maximum Flow Rate: 1.5 gpm.
    d. Mixing Valve: Two-handle.
    e. Centers: 8-inch.
    f. Mounting: Deck, exposed.
    g. Handle(s): Lever.
    h. Inlet(s): NPS 1/2 male shank.
    i. Spout Type: Swing, solid brass.
    j. Spout Outlet: Aerator.
    k. Operation: Ceramic, manual.
    l. Vegetable Spray: Color matched side spray required.

2.13 DISPOSERS

A. Disposers, GD-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide In-Sink-Erator Badger1WC Plus or a comparable product by one of the following:

    a. American Standard Companies, Inc.
    b. KitchenAid.
    c. Maytag Co.

2. Description: Batch-feed household, food-waste disposer. Include reset button; wall switch; plastic chamber with jam-resistant, stainless-steel lugs; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.

    a. Model: Sound-insulated chamber.
    b. Motor: 115-V ac, 1725 rpm, 1/3 hp with overload protection.
    c. Accessories: 3-prong plug-in cord.

2.14 SINK FAUCETS

A. Classroom Sink Faucet; SK-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 4275.551.F15 or a comparable by the following:

    a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Kitchen faucet with spray. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 1.5 gpm.
d. Mixing Valve: Two-handle.
e. Centers: 8-inch.
f. Mounting: Deck, exposed.
g. Handle(s): Lever.
h. Inlet(s): NPS 1/2 male shank.
i. Spout Type: Swing, solid brass.
j. Spout Outlet: Aerator.
k. Operation: Ceramic, manual.
l. Vegetable Spray: Color matched side spray required.

B. Classroom Sink Faucets with Bubbler; SK-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 4275.550.F15, or a comparable by the following:

a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Kitchen faucet without spray. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 1.5 gpm.
d. Mixing Valve: Two-handle.
e. Centers: 8-inch.
f. Mounting: Deck, exposed.
g. Handle(s): Lever.
h. Inlet(s): NPS 1/2 male shank.
i. Spout Type: Swing, solid brass.
j. Spout Outlet: Aerator.
k. Operation: Ceramic, manual.

3. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago 748-665FHABCP or a comparable product by one of the following:

a. Zurn Plumbing Products Group; Commercial Brass Operation.

4. Description: Classroom sink bubbler. Coordinate faucet inlet with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Volume Control: Vandal resistant, recessed.
d. Mounting: Deck, anti-rotational pins.

e. Handle(s): 1-3/4" round metering button.
f. Inlet(s): NPS 1/2 male shank.
g. Spout Type: Anti-microbial flexible projector head.
h. Spout Outlet: Straight stream nozzle.
i. Operation: Metering, non-adjustable self-closing cartridge.

C. Mothers Room Sink Faucet; SK-4:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 6114120.002, or a comparable by the following:

a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Manual-control mixing valve. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 0.5 gpm.
d. Mixing Valve: Single-handle.
e. Centers: 4-inch.
f. Mounting: Deck, exposed.
g. Handle: Lever with color coded index button.
h. Inlet(s): NPS 1/2 male shank.
i. Spout Outlet: Aerator.
j. Operation: Quarter-turn ceramic, manual.

2.15 LAUNDRY TUBS

A. Laundry Tubs; LT-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fiat L-1 or a comparable product by one of the following:

a. Swan.
b. Stern-Williams.

2. Description: One-bowl, wall-mounting, molded stone utility tub.

a. Overall Dimensions: 23 by 21 by 13-7/16 inches.
b. Faucet Hole Punching: Two holes, 4-inch centers.
c. Mounting: Wall mounting bracket.

3. Subject to compliance with requirements, provide trim products by one of the following:

a. McGuire Manufacturing Company.
b. Engineered Brass Company.

c. Keeney Manufacturing Company.

4. Sink Trim

a. Drain: Chrome plated brass tray plug with rubber stopper and chain.
b. Supplies: Chrome-plated copper with 1/2" NPT x 3/8” OD loose key stops.
c. Drain Piping: NPS 1-1/2 chrome-plated cast-brass P-trap with cleanout; NPS 1-1/2 17-gauge tubular brass waste to wall; and wall escutcheon(s).

2.16 LAUNDRY TUB FAUCETS

A. Laundry Tub Faucets; LT-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 2475.540, or a comparable by the following:

a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Manual-control mixing valve with double bend spout. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Mixing Valve: Two handle.
d. Centers: 4 inches.
e. Mounting: Deck, exposed.
f. Handle(s): Lever.
g. Inlet(s): NPS 1/2 male shank.
h. Spout Type: Swing, solid brass.
i. Spout Outlet: Aerator.
j. Operation: Ceramic, manual.

2.17 MOP SINKS

A. Mop Sinks; MS-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fiat MSB-2424 or a comparable product by one of the following:

a. Swan.
b. Stern-Williams.

2. Description: One-bowl, floor-mounting, molded stone utility sink.

a. Overall Dimensions: 24 by 24 by 10 inches.

b. Drain: 3-inch I.P.S. cast brass with 16-gauge stainless steel dome strainer and lint basket.
c. Accessories:

1) Hose and Bracket: Stainless steel hose bracket, spring-loaded rubber grip, 30" long heavy duty 5/8-inch rubber hose; Fiat 832 AA.
2) Mop Hanger: Stainless steel mop hanger bracket, 24 by 3 inches, 3-spring loaded rubber grips; Fiat 889 CC.
3) Stainless steel wall guards: Heavy gauge stainless steel, two/three panels as required; Fiat MSG 2424.

2.18 MOP SINK FAUCETS

A. Mop Sink Faucets; MS-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard 8344.012.004, or a comparable by the following:

a. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Service sink faucet with check stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Rough chrome plate.
c. Mixing Valve: Two-handle.
d. Centers: 8 inches.
e. Mounting: Back/wall, exposed.
f. Handle(s): Lever.
g. Inlet(s): NPS 1/2 male shank, with integral check stops.
h. Spout Type: Rigid, solid brass with wall brace and bucket hook.
i. Spout Outlet: Hose thread.
j. Vacuum Breaker: Integral with spout.
k. Operation: Ceramic, manual.

2.19 ICE MAKER BOXES

A. Ice Maker Boxes; IMB-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Guy Gray MIB1HAAB or a comparable product by one of the following:

a. Acorn Engineering Company.
b. IPS Corporation.

2. Description: Recessed wall-mounting water supply box.

    a. Overall dimension: 4-3/4 by 4-1/8 by 3-1/2 inches.
    b. Metal Thickness: 20 gauge cold rolled steel.
    c. Supplies: 1/2" sweat inlet.
    d. Valve: Integral hammer arrester quarter turn, 1/4" O.D. outlet.
    e. Finish: White powder coat.

2.20 CLOTHES WASHER BOXES

A. Washer Boxes; WB-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Guy Gray MWB19 or a comparable product by one of the following:

    a. Acorn Engineering Company.
    b. IPS Corporation.

2. Description: Recessed wall-mounting water supply box.

    a. Overall dimension: 8-1/4 by 5-5/8 by 3-1/2 inches.
    b. Metal Thickness: 20 gauge cold rolled steel.
    c. Supplies: 1/2" sweat inlet.
    d. Valve: Integral hammer arrester quarter turn, 3/4" O.D. outlet.
    e. Drain: 2” slipnut drain kit.
    f. Finish: White powder coat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation. All exposed supply piping shall be chrome-plated copper.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

N. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

O. Connect drain outlet hose from dishwasher to drain connection on disposer.

P. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 20 Section "Common Work Materials and Methods for Fire Suppression, Plumbing, and HVAC."

Q. Set bathtubs, showers, mop sinks in leveling bed of cement grout. Grout is specified in Division 20 Section "Common Work Materials and Methods for Fire Suppression, Plumbing, and HVAC."

R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 20 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

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SECTION 22 47 00 – DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

E. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Water Coolers; EWC-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Halsey Taylor HTHB-HAC8BLWF, Elkay, Oasis or an approved equal.
2. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler.

    a. Cabinet: Bi-level with two attached cabinets, galvanized steel construction with stainless-steel top.
    b. Color: Brushed stainless steel (optional finish).
    c. Bubbler: One, adjustable stream regulator, located on each cabinet deck.
    d. Control: Push pads on front and sides.
    e. Filter: One installed water filter complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
    f. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

        1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
        2) Electrical Characteristics: 1/4 hp; 120-V ac; single phase; 60 Hz.

    g. Support: Manufacturer furnished wall mounting bracket and hardware.
    h. Accessories:

        1) Provide additional cartridge filter for each installed unit.

    i. HydroBoost Bottle Filling Station

        1) Description: Sensor-activated enhanced with user interface graphics.
        2) Quick-fill rate: 1.1 gpm with laminar flow.
        3) Green counter: Visually displays count of plastic bottles saved from landfills.

3. Subject to compliance with requirements, provide trim products by one of the following:

    a. McGuire Manufacturing Company.
    b. Engineered Brass Company.
    c. Zurn Plumbing Products Group.

4. Water Cooler Trim

    a. Supplies: Chrome-plated copper with 1/2" NPT x 3/8” OD loose key stops.

b. Drain: Grid with NPS 1-1/4 horizontal waste and trap complying with ASME A112.18.1. NPS 1-1/4 chrome-plated cast-brass P-trap with cleanout; NPS 1-1/4 17-gauge tubular brass waste to wall; and wall escutcheon.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

F. Turn over spare supply of water filters (for each unit installed) to Owner.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.
2. Report test results in writing.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

END OF SECTION 22 47 00

SECTION 22 63 15 – NATURAL GAS PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following natural gas piping specialties:

1. Gas regulators.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Natural gas piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 GAS REGULATORS

A. Gas Pressure Reducing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pietro Fiorentini.
b. Cashco.
c. Equimeter
d. Fisher.
e. Rockwell.

2. Construction

a. Valve body: Cast iron.
b. Diaphragm case: Die-cast aluminum.

c. Diaphragm: Buna-N with nylon fabric reinforcement.
d. Orifices: Interchangeable brass.

3. Operation: Single stage diaphragm type.
4. Temperature limits: -20°F to 150°F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 20 Section "Pipe, Valves, Fittings, and Hangers for Fire Suppression, Plumbing, and HVAC." for piping joining materials, joint construction, and basic installation requirements.

B. Piping installation requirements are specified in other Division 20 Sections. Drawings indicate general arrangement of piping and specialties.

C. Were gas pressure reducing valves are not located outdoors and away from building openings, relief vent shall be plumbed directly to outside. Multiple vents may be combined.

3.2 FIELD QUALITY CONTROL

A. Remove and replace malfunctioning natural gas piping specialties and retest as specified herein.

END OF SECTION 22 63 15

SECTION 23 01 30 – HVAC AIR DUCT CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes cleaning of the following existing duct systems:

1. Supply Air Duct, both hot and cold duct risers to 4th level.
2. Entire inside of air handling unit including outside air intake plenums including louvers and screens on louvers.

1.3 DEFINITIONS

A. ASCS: Air system cleaning specialist.

B. NADCA: National Air Duct Cleaners Association.

C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

B. Qualification Data: For ASCS.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. ASCS Qualifications: A certified member of NADCA.

1. Certification: Employ an ASCS certified by NADCA on a full-time basis.
2. Supervisor Qualifications: Certified as an ASCS by NADCA.
3. Experience: Submit records of experience in the field of HVAC systems cleaning.

4. Equipment, Materials, and Labor: Have equipment, materials, and labor required to perform specified services.

B. Comply with current published standards of NADCA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

1. Alpine Air Duct Cleaning
2. Air Quality Duct Cleaning
3. Steamatic
4. Approved equal

2.2 DUCT-MOUNTING ACCESS DOORS

A. As specified in Section 23 33 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine systems to determine appropriate methods, tools, and equipment required for performance of work.

B. Prepare written report listing conditions detrimental to performance of work.

C. Proceed with work only after unsatisfactory conditions have been corrected.

3.2 CLEANING

A. Perform cleaning before air balancing or mark position of dampers and air-directional mechanical devices before cleaning.

B. Use duct-mounted access doors, as required, for physical and mechanical entry and for inspection.

1. Install additional duct-mounting access doors to comply with duct cleaning standards.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection. Replace damaged and deteriorated flexible ducts.
3. Disconnect and reconnect flexible connectors as needed for cleaning and inspection. Replace damaged and deteriorated flexible connectors.
4. Replace damaged fusible links on fire and smoke dampers. Replacement fusible links shall be same rating as those being replaced.
5. Remove and reinstall ceiling components to gain access for duct cleaning. Clean ceiling components after they have been removed and replaced.

C. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

D. Particulate Collection and Odor Control:

1. Where venting vacuuming system inside building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater) particles.
2. When venting vacuuming system outside building, use filtration to contain debris removed from the HVAC system and locate exhaust down wind and away from air intakes and other points of entry into building.

E. Clean the metal-duct system components by removing visible surface contaminants and deposits.

F. Mechanical Cleaning Methodology:

1. Clean metal-duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of ducts so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts or duct liner.
4. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present; use according to manufacturer's written instructions after removal of surface deposits and debris.

G. Cleanliness Verification:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal-duct systems for contaminants.
3. Where contaminants are discovered, re-clean and re-inspect duct systems.

3.3 DUCT ACCESSORIES INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install duct-mounting access doors where access doors do not currently exist to allow for the cleaning of ducts.

D. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body Plus Ladder Access: 25 by 17 inches.

E. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

F. Install the following sizes for duct-mounting, pressure relief access doors:

1. One-Hand or Inspection Access: 7 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 13 inches in diameter.
4. Head and Shoulders Access: 19 inches in diameter.

3.4 FIELD QUALITY CONTROL

A. Gravimetric Analysis: Sections of metal-duct system, chosen randomly by Engineer, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.

1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal-duct system shall be re-cleaned and re-verified.

B. Report results of tests in writing.

END OF SECTION 23 01 30

SECTION 23 05 93 – TESTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Work Specified Elsewhere

1. Control Systems Equipment: Section 23 09 00

1.2 SUMMARY

A. This Section includes testing, adjusting and balancing of HVAC Systems to produce design objectives, including the following:

1. Adjusting blowers, fans and ducts to deliver or exhaust design air flow.
2. Adjusting terminal units, diffusers, registers and grilles to supply, return or exhaust design air flow.
3. Adjusting relief dampers and vents.
4. Adjusting diffusers, registers and grilles to minimize drafts.
5. Adjusting all zones for design supply and return air flow.
6. Adjusting blowers and fans to design rpm.
7. Balancing of heating water and cooling water systems to achieve design flow characteristics.
8. Balancing of domestic hot water return loop.
9. Adjusting VAV terminal box controllers to design cfm. (Heating and Cooling).
10. Sheet metal shop drawing review prior to ductwork installation, review the Sheet Metal Contractor's duct fabrication drawings and mark any additional balancing dampers, etc. that are required for proper balancing of the systems. This Contractor shall receive two copies from the Sheet Metal Contractor and shall return one copy to Sheet Metal Contractor.

1.3 SUBMITTALS

A. Bidding Documents

1. If so requested on the bid form Submit name of the Test and Balance Agency to Architect/Engineer as a subcontractor on the Materials and Subcontractors Listing.

2. If the Contractor fails to submit name of selected Test and Balance Agency, the Architect/Engineer will select the agency of his choice and Contractor must then issue purchase order for this work as directed.

B. Certificate: Selected and approved agency shall submit certificate immediately upon receipt of test and balance contract.

C. Data Sheets

1. Submit type written data sheets on each item of testing equipment to be used.
2. Include name of device, manufacturer's name, model number, latest date of calibration and correction factors.

D. Report Forms

1. Submit specimen copies of the balance report set-up including addendums and alternates before starting work on site.
2. Submit 30, 60, 90 percent site visit reports on installation of HVAC systems.
3. Forms shall be 8-1/2" x 11" paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.
4. Submit preliminary pencil copies of reports as A/E determines.

E. Final Report

1. Upon completion, all information shall be neatly typed and five copies submitted to the Architect/Engineer with accompanying schematic diagrams of systems tested.
2. All test reports shall be assembled, indexed and submitted in vinyl covered loose-leaf notebooks with project name and Balancing Contractor's name permanently printed thereon.

1.4 QUALITY ASSURANCE

A. Test and Balance Agency

1. Obtain the services of an independent Test and Balance Agency that specializes in, and whose business is limited to, the testing and balancing of air conditioning systems.
2. The agency selected shall be fully certified by the NEBB and shall have at least one member of the agency qualified as a certified test and balance Engineer who has been issued this certification by the National Examining Board.
3. All work shall be done under the direct supervision of a full time member of the organization.
4. All final reports shall be signed and sealed by the certified test and balance Engineer.
5. Approved Test and Balance Contractors:

    a. Mechanical Systems Balancing
    b. Total Balance
    c. Fluid Dynamics

d. Gibson Services.
e. Midwest Balance
f. Synergy Test and Balance
g. Bledsoe Test and Balance
h. Technical Systems Group – Terre Haute

6. Agency Contract: Award the contract to the approved Balance Contractor in sufficient time to allow the Test and Balance Contractor to schedule this work in cooperation with other trades involved and comply with the completion date.

B. Instruments

1. The minimum instrumentation for testing, adjusting and balancing shall be the "NEBB Approved Minimum Field Instrumentation."
2. Instruments used for testing and balancing must have been calibrated within a period of six months and checked for accuracy prior to start of work.
3. Instruments must be maintained and carried in such manner to protect them from excessive vibration and moisture conditions.
4. Approval: all products and instrumentation used shall be subject to approval of the Engineer.

C. Procedure - Methodology: testing and balancing shall be performed in complete accordance with NEBB National Standards for Field Measurements and Instrumentation.

D. Conditions: System Operation - heating, ventilating, and air conditioning equipment including filters, shall be completely installed and in continuous operation as required to accomplish the adjusting and balance work specified. Test and Balance Agency shall give a Check List to the Mechanical and/or Sheet Metal Contractors which, when completed, and returned, will assure the systems are ready to be balanced. A/E shall receive a copy of check list from Mechanical and Sheet Metal Contractors when completed.

1.5 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, Commissioning Agent (if applicable) and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide seven (7) days advance notice for each test. Include scheduled test date and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

D. Measurements – Readjustments

1. Should corrective measures caused by faulty installation require retesting, adjusting and balancing, such work shall be at no additional expense.

2. Corrective measures other than the above shall be made only as directed by the Architect/Engineer. Such work shall be at no additional expense.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PREPARATION

A. Air Systems - prior to system testing and balancing:

1. Verify that the appropriate contractor has:

a. Checked all systems and placed them into a fully operational status.
b. Installed clean filters within the equipment. Do not continue testing of unit until clean filters have been provided.
c. Checked temperature and system controls for proper operation.
d. Checked fan rotation for proper operation.

B. Water Systems - prior to system testing and balancing:

1. A complete air balance must be accomplished before beginning the water system test and balance.
2. Open all valves to full open position. Close coil bypass stop valves. Set mixing valves to full coil flow.
3. Set all temperature controls so all coils are calling for full cooling or full heating as required.
4. Verify that the Mechanical Contractor has:

a. Removed and cleaned all strainers.
b. Treated and cleaned water in system.
c. Checked pump rotation.
d. Set automatic fill valves for required system pressure.
e. Bled the system, checked the expansion tanks, etc., so that it is completely full of water and is not air bound.
f. Check air vents at high points of the system for proper operation.
g. Checked automatic bypass valve for proper operation (if required).
h. Set operating temperatures of chillers and boilers to design requirements.

3.2 SYSTEM BALANCE

A. Air Systems - Perform the following minimum tests and balance:

1. Test and adjust supply, return and exhaust fans to design requirements. Change sheaves and belts as required to obtain design air quantities. Sheaves and belts to be furnished by respective equipment manufacturer. Sheaves shall be sized so that maximum CFM will be obtained with VFD at 100% speed. Slowing VFD is not an acceptable method to obtain maximum CFM.
2. Note: Supply fan is original high-pressure fan and will get re-sheaved and new motor. See SF-1, M601 for special requirements to rebalance this fan.
3. Test and record motor electrical characteristics, RPM, service factor, measured voltage, full load amperes and connected load amperage. Check and record starter heaters, sizes and ratings, replacing belts sizes, etc.
4. Make pitot tube traverse (minimum of 16 points) of main supply ducts and obtain design CFM at fans. Seal all test holes with suitable hole plugs.
5. Test and record system static pressure, suction and discharge.
6. Test and adjust system for design CFM recirculated air.
7. Test and adjust system for design CFM outside air.
8. Test and record entering air temperatures (DB heating and cooling).
9. Test and record entering air temperatures (WB cooling).
10. Test and record leaving air temperatures (DB heating and cooling).
11. Test and record leaving air temperatures (WB cooling).
12. Adjust all main supply and return air ducts to proper design CFM.
13. Adjust all zones to proper design CFM, supply and return.
14. Test and adjust each diffuser, grille and register to within ±10% of design requirements.
15. Each grille, diffuser and register shall be identified as to location and area. Size, type, flow factor and manufacturer of diffusers, grilles, registers and all tested equipment shall be identified and listed.
16. Readings and tests of diffusers, grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
17. The Balance Contractor shall list all controls requiring adjustment by Temperature Control Contractor and assist Control Contractor with required settings.
18. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.
19. Read and adjust the minimum and maximum settings on all variable air volume (VAV) boxes. See 23 09 93, Sequence of Operation M700 series drawings, for dual minimum applications. On dual minimum applications, set and confirm both minimums.

B. Water Systems - Perform the following minimum water system test and balance:

1. Set water pumps to proper gallons per minute delivery ±10%.
2. Adjust water flow through equipment.
3. Check leaving water temperatures and return water temperatures. Reset to correct design conditions.
4. Check water temperatures at inlet side of coils. Note rise or drop of temperatures from source.
5. Proceed to balance each water coil.
6. Upon completion of flow readings and adjustments at coils, mark all settings and record data.
7. After adjustments to coils are made, recheck settings at the pumps and readjust if required.

8. Install pressure gauges in gauge fittings provided on coil, read pressure drop through coil at set flow rate for full cooling and on full heating. Set pressure drop across bypass valve to match coil full flow pressure drop.
9. Install zone balance valve and size the control valve to the coil it serves.

C. Record Data

1. Air Systems - record the following minimum data:

   a. CFM delivery and RPM of blowers and fans

      1) Static pressure at inlet and outlet of blowers and fans
      2) All equipment nameplate data
      3) Actual running current and voltage of fan motors and settings for solid state overload relays or heater sizes.

   b. CFM delivered or exhausted at each diffuser, register, or grille.

2. Water Systems - record the following minimum data at each heating and cooling element:

   a. Inlet water temperature
   b. Leaving water temperature
   c. Pressure drop across each coil
   d. Pressure drop across bypass valve
   e. Pump operating suction and discharge pressures and final TDH
   f. Pump nameplate data
   g. List all mechanical specifications of pumps. Check and record starter size, heater sizes, etc.
   h. Rated and actual running amperage of pump motor.
   i. Water balance device readings and/or settings.

D. Equipment Cards

1. Install at each piece of equipment a “check out” card showing all significant operating temperatures, pressures, amperes, voltages, brake horsepower, etc. Check out cards shall be standard 5” x 8” index cards enclosed in vinafilm card folders securely attached to equipment or wall in immediate area.

E. Owner's Instructions: Balancing Contractor shall arrange with the Owner at a time for the instruction of the Owner's personnel as to the proper operation and maintenance of the equipment.

3.3 ADDITIONAL TEST

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods

1. If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions, if so requested by Owner/Engineer.

END OF SECTION 23 05 93

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SECTION 23 09 00 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 20 00 10 Common Work Results for Fire Suppression, Plumbing and HVAC

C. Section 20 00 50 Common Materials and Methods for Fire Suppression, Plumbing and HVAC

D. Sequences of Operation

1.02 SCOPE OF WORK

A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) with electronic actuation for energy management, equipment monitoring and control, and subsystems as herein specified. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer.

B. Main graphics screen shall allow user to set alarms as off/on/auto.

C. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specifically for this project. All systems components shall have been thoroughly tested and proven in actual use for at least two years.

D. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes. Control wiring network throughout building shall be completely independent of all other communication/technology systems.

E. BAS manufacturer shall furnish and/or install all integrated equipment and systems specified herein.

F. The BAS shall be totally integrated with the existing facility infrastructure systems with user access to all system data locally over a secure Intranet within the building and by remote access by a standard Web Browser over the Internet.

G. The Input/Output Summary Table on the Drawings identifies the minimum points that are to be addressed and incorporated into the Direct Digital Control (DDC) System. Any other points required to accomplish the sequences of operation specified or allow for proper operation of the equipment shall be provided at no additional cost to the Owner. The Temperature Control Contractor shall fully coordinate all necessary controls interface requirements with the Mechanical Contractor and applicable equipment prior to submittals.

H. All work performed under this Section of the Specifications shall comply with all codes, laws and governing bodies, and all direct digital controllers and BAS equipment installed shall be U.L. 916 approved.

I. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air conditioning.

J. The unitary controllers, intelligent sensors and intelligent actuators shall be based upon BACnet functional profile configurations.

K. Furnish and install control panels.

L. Furnish and install all control wiring that is a part of this contract.

M. Furnish all motorized temperature control dampers, valves and actuators.

N. Furnish and install all interlocking wiring between mechanical and electrical system components as herein specified including wiring of cooling tower vibration cutout switches.

O. Furnish and install all 120-volt, 24-volt, communication wiring, data wiring, conduit and accessories to all control panels, actuators, control devices that are part of the Temperature Control System. This includes control wiring associated with chillers, and air-cooled condensing units, when applicable.

P. Furnish and install Digital Energy Monitors, gas meters, and water meters where shown on Drawings or specified.

Q. Division 26 Contractor shall provide structures and mount all VFD's. Power wiring to VFD's by Electrical Contractor. Power wiring from VFD's to motors by Electrical Contractor. Control wiring to VFD's by Temperature Control Contractor.

R. Remove all existing pneumatic and electric/electronic controls within the building including air dryer, control panels, piping and wiring.

S. This system shall reside on the Owner's Wide Area Network (WAN) through an Ethernet connection.

T. Provide DDC interface to all central equipment equipped with BACnet interface. Reference equipment specifications. Provide monitoring and control of equipment (including but not limited to alarm management, water temperatures, component status, etc.)

U. This system shall be accessible via the Internet without the purchase of any additional hardware or software by the owner. Final connection to the internet shall be by the owner's IT department.

V. The DDC system shall make only one connection to the owner's LAN in this facility. Any LAN needed between proposed supervisory panels proposed for this system shall run in parallel to the owner's LAN and shall be completely installed and maintained by the TCC. This single connection to the owner's LAN shall be made in the building's IT room.

W. Provide 24V transformers for VAV boxes. Locations as noted on drawings.

1.03 WORK BY OTHERS

A. Sheet Metal Contractor will provide and install all control dampers. Temperature Control Contractor to verify actuators will work with control dampers.

B. Mechanical Contractor will install all taps, control valves and thermo wells in piping for all temperature sensors, flow switches, pressure sensors and any other control device installed in piping.

C. Mechanical Contractor shall fully coordinate controls interface to all mechanical equipment, with Temperature Control Contractor, prior to ordering equipment to meet intent of sequences of operations.

D. Mechanical Contractor will install all differential pressure switches including isolation valves.

E. Mechanical Contractor shall install water meter furnished by Temperature Control Contractor.

F. Electrical Contractor provides:

1. Wiring of all power feeds through all disconnects, starters and VFD's to electrical motors.
2. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by BAS manufacturer.
3. Electrical Contractor will install and connect power wiring to variable frequency drives.
4. Electrical Contractor furnish and install smoke detectors and wire to fan starters.
5. Electrical Control Contractor will install and wire power to 24V VAV transformers.

G. Terminal unit manufacturer shall install DDC controller and actuator provided by BAS manufacturer. Power relay for control of VAV boxes shall be provided by terminal unit manufacturer.

1.04 QUALITY ASSURANCE

A. The BAS system shall be designed, installed, commissioned, and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within

150 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. BAS shall comply with UL 916 PAZX and 864 UDTZ, European Community, and other subsystem listings as applicable, and herein specified, and be so listed at the time of bid.

D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

E. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels and extend new field panels on a previously installed network.

1.05 SUBMITTALS

A. Quantities prepared and submitted as noted in Section 20 00 10 “Shop Drawings”.

B. Submit documentation in the following phased delivery schedule:

1. Valve schedules.
2. Equipment data cut sheets.
3. System schematics, including:

    a. Sequence of operations
    b. Point names
    c. Point addresses
    d. Interface wiring diagrams
    e. Panel layouts
    f. System riser diagrams
    g. AutoCAD compatible as-built drawings

C. Upon project completion, submit operation and maintenance manuals, consisting of the following:

1. Index sheet, listing contents in alphabetical order.

2. Manufacturer's equipment parts list of all functional components of the system, AutoCAD disk of system schematics, including wiring diagrams.
3. Description of sequence of operations.
4. As-Built interconnection wiring diagrams.
5. Operator's Manual.
6. Trunk cable schematic showing remote electronic panel locations, and all trunk data.
7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.).
8. Conduit routing diagrams.
9. One set of software on DVD or USB thumb drive.

1.06 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after substantial completion of entire project.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment, all sensors, and control devices.

PART 2 - PRODUCTS

2.01 Approved BUILDING LEVEL CONTROLLER Manufacturers/Contractors

A. Johnson Controls - Installation by branch office.

2.02 NETWORKING COMMUNICATIONS

A. The design of the BAS shall network operator workstations and stand-alone DDC Controllers with Application Specific Controllers (ASCs). The multiple networks shall be totally transparent to the user when accessing data or developing control programs.

B. The design of BAS shall allow the co-existence of new DDC Controllers with existing DDC Controllers in the same network without the use of gateways or protocol converters.

2.03 DDC CONTROLLER

A. DDC Controllers shall be a 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the point I/O schedule listed in the sequence of operation. Each controller shall support a minimum of three (3) Floor Level LAN Device Networks.

B. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes.
2. Energy management applications.
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified.
5. Maintenance support applications.
6. Custom processes.
7. Operator I/O.
8. Manual override monitoring.

C. Each DDC Controller shall support firmware upgrades without the need to replace hardware.

D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

E. DDC Controllers shall provide a minimum two RS-232C serial data communication ports for operation of operator I/O devices. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

F. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

G. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

H. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

2.04 DDC CONTROLLER RESIDENT SOFTWARE FEATURES

A. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.

B. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:

1. Two-position control.
2. Proportional control.
3. Proportional plus integral control.
4. Proportional, integral, plus derivative control.
5. Automatic tuning of control loops.

C. DDC Controllers shall have the ability to perform any or all the following energy management routines:

1. Time-of-day scheduling.
2. Calendar-based scheduling.
3. Holiday scheduling.
4. Temporary schedule overrides.
5. Start-Stop Time Optimization.
6. Automatic Daylight Savings Time Switchover.
7. Night setback control.
8. Temperature-compensated duty cycling.

D. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network. Database shall support 30-character, English language point names, structured for searching and logs.
2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
3. DDC Controller software shall provide a HELP function key.
4. DDC Controller programming shall be capable of comment lines for sequence of operation explanation.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical

alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hour's destinations) or based on priority.
4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200-character alarm message to more fully describe the alarm condition or direct operator response.
5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of l minute to 7 days shall be provided. Each DDC Controller shall have a dedicated RAM-based buffer for trend data. All trend data shall be available for use in 3rd party personal computer applications (i.e. Microsoft Excel, Lotus 123).

G. DDC Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops. Loop tuning shall be capable of being initiated either locally at the DDC Controller, from an operator workstation, or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

H. DDC Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points.

I. The peer-to-peer network shall allow the DDC Controllers to access any data from or send control commands and alarm reports directly to any other DDC Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer-to-peer network shall also allow any DDC Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

J. The peer-to-peer network shall allow the DDC controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be

accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.

2.05 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through Floor Level local area networks.

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of ASCs as a minimum.

1. Central System Controllers
2. Terminal Equipment Controllers

C. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

1. Central System Controllers
2. Provide for control of central HVAC systems and equipment including, but not limited to, the following:

    a. Air Handling Units
    b. Built-up Air Handling Systems
    c. Chilled and Condenser Water Systems
    d. Heating Water Systems
    e. Steam Systems

3. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide a hand/off/automatic switch for each digital output for manual override capability. Switches shall be mounted either within the controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides. In addition, each switch position shall be supervised in order to inform the system that automatic control has been overridden.
4. Each controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation in the event communication with its DDC Controller is lost and to insure protection during power outages.
5. All programs shall be field-customized to meet the user's exact control strategy requirements. Central System controllers utilizing factory programmed or library programs shall not be acceptable. If field-customized Central System controllers cannot be provided, provide DDC Controllers for all central equipment in order to meet custom control strategy requirements.
6. Programming of central system controllers shall utilize the same language and code as used by DDC Controllers to maximize system flexibility and ease of use. Should the system

controller utilize a different control language, provide an DDC Controller to meet the specified functionality.

7. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs.
8. As required by the sequence of operation, provide a door-mounted interface terminal to allow for direct-user access to the controller. Should the Central System controller be unable to interface to a door-mounted terminal, provide a laptop or similar terminal at the controller, or provide a DDC Controller with a door-mounted or local terminal in order to meet the specified minimum functionality. The terminal shall provide the user with the following functionality as a minimum.

    a. View and set date and time
    b. Modify and override time-of-day schedules
    c. View points and alarms
    d. Monitor points
    e. Command and modify setpoints

D. Terminal Equipment Controllers

1. Provide for control of each piece of equipment, including, but not limited to, the following:

    a. Variable Air Volume (VAV) boxes
    b. Fan Coils

2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard 24V floating control allowing for interface to a variety of modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide DDC Controllers or other ASCs with industry standard outputs for control of all terminal equipment.
3. Setpoint adjustment of terminal equipment controllers via space sensors may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at the central workstation, DDC controller, or POT.
4. Each terminal equipment controller shall perform it’s primary control function independent of other DDC controller LAN communication or if LAN communication is interrupted. The controller shall receive its real-time data from the DDC Controller time clock. Each controller shall include algorithms that incorporate PID control. Gains for PID control shall be adjustable via POT or operator workstation.

2.06 WORKSTATION OPERATOR INTERFACE

A. Basic Interface Description

1. Operator workstation interface software shall minimize operator training through the use of English language prompting, 30-character English language point identification, on-line

help, and industry standard PC application software. Interface software shall simultaneously communicate with up to 4 peer-to-peer Building Level Networks and share data between any of the 4 networks. The software shall provide, as a minimum, the following functionality.

a. Real-time graphical viewing and control of environment.
b. Scheduling and override of building operations.
c. Collection and analysis of historical data.
d. Definition and construction of dynamic color graphic displays.
e. Editing, programming, storage and downloading of controller databases.
f. Alarm reporting, routing, messaging, and acknowledgment.
g. Display of dynamic trend data plot.

2. Provide a graphical user interface which shall minimize the use of the keyboard through the use of a mouse or similar pointing device and a "point and click" approach to menu selection. There shall be a minimum of 8 pre-defined function keys to allow quick access to frequently used applications.
3. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run within a 32-bit operating system such as Windows NT. These Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information.

   a. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via user-sized windows.

      1) Dynamic color graphics and graphic control
      2) Alarm management, routing to designated locations, and customized messages
      3) Week at a Glance Time-of-day scheduling
      4) Trend data definition and presentation
      5) Graphic definition and construction
      6) Program and point database editing on-line

   b. If the software is unable to display several different types of displays at the same time, the BAS contractor shall provide at least two operator workstations.
   c. Report and alarm printing shall be accomplished via Windows program manager, allowing use of network printers.

4. Operator specific password access protection shall be provided to allow the user/manager to limit workstation control, display and database manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall “follow” the operator to any workstation that they log onto. A minimum of 200 passwords shall be supported.

5. Operator Activity Tracking - An audit trail report to track system changes, accounting for operator-initiated actions, changes made by a particular person or changes made to a specific piece of equipment over a designated time frame shall be printable and archived for future use. The operator activity tracking shall be in a tamperproof buffer file.
6. Reports shall be generated on demand or via pre-defined schedule and directed to either LCD monitors, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:

    a. A general listing of all or selected points in the network
    b. List of all points currently in alarm
    c. List of all points currently in override status
    d. List of all disabled points
    e. List of all points currently locked out
    f. List of user accounts and access levels
    g. List all weekly schedules
    h. List of holiday programming
    i. List of limits and deadbands
    j. Excel reports
    k. System diagnostic reports including a list of DDC panels online and communicating and status of all DDC terminal unit device points
    l. List of programs

7. Scheduling and override shall be accomplished via a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Schedules reside in both the PC workstation and DDC Controller to ensure time equipment scheduling when PC is off-line. The PC shall not be required to execute time scheduling. Provide override access through menu selection or function key. Provide the following spreadsheet graphic types as a minimum:

    a. Weekly schedules
    b. Zone schedules, minimum of 200 unique zones
    c. Monthly calendars, up to 365 days in advance

8. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

    a. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. BAS contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or

building environmental conditions. BAS contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

b. Provide additional functionality that allows the user to view real-time trend data on trend graph displays. A minimum of six points may be graphed, regardless of whether they have been predefined for trending. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed.

B. Dynamic Color Graphic Displays

1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, hot water boiler systems, and zone controls shall be provided by the BAS contractor as indicated in the sequence of operation of this specification to optimize system performance analysis and speed alarm recognition.
2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Graphics software shall permit the importing of AutoCAD or Bitmap drawings for use in the system.
3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
4. Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.
5. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
6. Equipment state can be changed by clicking on the point block or graphic symbol and selecting the new state (on/off) or setpoint.
7. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
8. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
9. Off the shelf graphic shall be provided to allow the user to add, modify or delete system graphic displays.
10. A clipart library of HVAC and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and laboratory symbols. The user shall have the ability to add custom symbols to the clipart library.
11. A dynamic display of the site specific architecture showing the status of all controllers, operator workstations, and networks shall be provided.

C. System Configuration & Definition

1. Network wide control strategies shall not be restricted to a single DDC Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
2. Provide automatic backup and restore of all DDC controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller. Changes made at the DDC Controllers shall be automatically uploaded to the workstation, ensuring system continuity.
3. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.

D. Alarm Management

1. Alarm Routing shall allow the user to send alarm notification to selected printers or PC locations based on time of day, alarm severity, or point type.
2. Alarm Notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. These alarm icons shall be displayed when user is working in other Windows programs. The BAS alarm display screen shall be displayed when the user clicks on the alarm icon.
3. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message.
4. Alarm messages shall be customizable for each point to display detailed instructions to the user regarding actions to take in the event of an alarm.
5. Workstation Communications - Provide automatic communications for buildings as specified in the sequence of operation or as requested by Owner.

2.07 FIELD DEVICES

A. Room Thermostats and Sensors

1. Unless otherwise noted and except for DDC Terminal Unit Controllers sensors, thermostats and temperature sensors located in conditioned spaces shall have locking covers which incorporate a thermometer. Room sensors for DDC Terminal Unit Controllers shall have exposed adjustment with locking-type covers. Thermostats shall be Underwriters Laboratories listed under UL934 for use in air plenum applications. Finish shall be manufacturers standard. All thermostat locations shall be submitted for approval before installation. Unless otherwise indicated or specified, provide one thermostat for each zone shown on the drawings. All thermostat temperature ranges to comply with Section 503.8 “Controls” of the Indiana Energy Code.

    a. Protective cover provided on room temperature sensors to prevent accidental damage.

b. Space temperature sensor covers: durable, impact resistant material finished in acceptable color or acceptable metallic finish matching building hardware: utilize locking type cover screws and have thermometers.

2. Room thermostats and sensors shall be capable of being replaced without the need for controller re-calibration. Room thermostats and sensors shall accordingly have manufactured space temperature and setpoint signal precision tolerances of no greater than 1.0°F. DDC/BAS shall be able to limit space sensor integral adjustment through software commands.
3. Each room thermostat or sensor shall have an integral momentary push button, which can be depressed by the occupant during unoccupied mode of operation. This push button shall cause the DDC controller to bring the unitary air handler or building zone to occupied setpoints for a period of up to 2 hours (adjustable through BAS). Override operation shall be reported to appropriate DDC/BAS operator's terminal to allow generation of custom reports.
4. Electric Thermostats: incorporate bimetal sensing elements and snap-acting contacts rated for the intended service to meet the intent of the control sequences as specified in this section.
5. Provide "flat plate" temperature sensors in all "public areas" (i.e. restrooms, gymnasiums, cafeterias, corridors, etc.) and where indicated on drawings.

B. Analog Input Sensors

1. Analog sensing devices shall be available for the measurement of common variables such as temperature, static pressure, differential pressure, humidity, fluid flow, etc. All devices shall be standard manufactured for the purpose intended with an output range as specified. High impedance resistive temperature elements shall not be acceptable to reduce transient noise and voltage coupling and damage at the DDC controller.
2. All temperature measuring sensors shall have the capability of providing local indication at the sensing location and specifically at those locations shown on the point chart.
3. Duct temperature sensors shall incorporate a Thermistor bead embedded at the tip of a staticless steel tube. Probe style sensors shall be used in all air handling and duct applications. No averaging sensors allowed.
4. Duct mounted sensors mount through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A seal shall be used on the sensor assembly to prevent air leaks.
5. Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.

a. Sensor and well shall be supplied as a complete assembly including well head. A thermal conductive compound shall be used in the sensor / well assembly.
b. All thermal wells and sensors shall be mounted to allow easy access to sensor for repair or replacement. All thermal wells are to be installed by the Mechanical Contractor.

6. When thermowells are required, sensor and well shall be supplied as a complete assembly including well head. Thermal conductive compound shall be used in sensor/well assembly.
7. Thermowells constructed as to be compatible with the medium being measured.
8. All thermowells and sensors mounted to all easy access to the sensor for repair or replacement; installed as part of the piping work.
9. Outside air sensors designed to withstand the environmental conditions to which they will be exposed; equipped with solar shields.
10. Accuracies: as follows, including errors associated with sensor, leadwire and A to D converter.

    a. Point Type Accuracy
    b. Outside Air Temperature 1.0°F
    c. Chilled Water Temperature 1.0°F
    d. Space Temperature 1.5°F
    e. Hot Water Temperature 2.0°F
    f. Duct Temperature 1.0°F
    g. Sensors Used in Calibrations 0.5°F

C. Pressure Sensors and Transmitters

1. Pressure sensor construction compatible with the medium being measured.
2. All pressure sensors sized to withstand two times (2x) the average without damage and to hold calibrated accuracy when subject to a momentary forty percent (40%) overrange input.
3. Pressure measurement accuracy within one percent (1%) of the span over an ambient operating temperature of 30°F to 140°F.
4. Differential pressure sensors and transmitters used for flow measurement: sized to the flow sensing device and be supplied with the proper shutoff and bleed valves as required.

D. Humidity Sensors

1. Relative humidity sensors with sensing element rated for the relative humidity range designed into the building environment control system; have an overall accuracy of ±5% over the range of 30% to 80% RH.
2. Humidity sensors shall be Vaisala 60/70 Series.

E. Differential Pressure Switches

1. Pressure differential switches incorporate corrosion resistance, sensing elements of bourdon tube, bellows or diaphragm type, have tamper-proof adjustable range and differential pressure settings; operate automatically and reset automatically when conditions return to normal.
2. Pressure sensor switch contacts: snap action type.
3. Complete Sensor Assembly protected against vibration at all critical movement pivots, etc.

F. Air Flow Measuring

1. Furnish for installation, by Sheet Metal contractor, AFMS as shown on the drawings.
2. All remote panels and wiring shall be installed by Temperature Control Contractor.
3. Sensor shall be thermal, temperature compensated, 316 stainless steel thermistor probe with 304 stainless steel enclosure.

    a. Temperature -20 to 160°F
    b. Humidity 0 to 99% RH

4. Sensor Accuracy

    a. Greater than 500 FPM, +/- 2%
    b. Less than 500 FPM, +/- 10 FPM
    c. Maximum 0.005" w.g. duct probe array pressure drop at 2000FPM
    d. Electronics output to BAS

5. Manufacturers:

    a. Ebtron "STx"
    b. Ruskin Equal
    c. Air Monitor

G. Relays

1. Control relays rated for the application, equipped with Form C contacts, in a dustproof enclosure.
2. Relay contacts: silver cadmium with a minimum life span rating of one (1) million operations. Contacts shall be sized appropriately for intended use and amperage.
3. Relay coils equipped with coil transient suppression.
4. All interface relays must be of two-piece construction consisting of a plug in relay and a base. Single piece relays commonly known as 'relay in a box' (RIBs) are not acceptable. Maintenance personnel shall be able to change out the relay by plugging a new relay in the base. Relays requiring breaking of wiring connections for maintenance purposes are not permitted.

H. Wire and Cable

1. General: provide all wire and cable required for this installation including connection to existing system.
2. Control wiring:

    a. Control wiring for Digital Functions: 18 AWG minimum with 600-volt insulation.
    b. Control wiring for Analog Functions: 18 AWG minimum with 600-volt insulation, shielded 2 or 3 wire to match analog function hardware.
    c. Control wire and cable shall be run in continuous lengths from control point to control point with no splices allowed.
    d. All control wiring and cable shall be plenum rated.

e. All control wiring and cable shall be color coded “purple”.

I. Field Equipment Panels

1. Panels shall be pre-wired and piped and house all controls, transducers, transformers, relays, switches, etc., to coordinate BAS components to achieve specified Direct Digital Control (DDC) sequences.
2. Provide NEMA 1 type enclosures, factory fabricated steel or aluminum totally enclosed and equipped with a hinged front door having locking latch. All cabinet locks shall be keyed alike. BAS contractor shall furnish the required number of field equipment panels, located adjacent to DDC controllers as necessary to accommodate all panel mounted field equipment.

J. Temperature Control Valves

1. Ball Valves

a. Fully proportional with cast bronze or cast-iron bodies rated for 150 psig. Inner valve to be modulating plug or V-port. Seats shall be changeable bronze.
b. Water valves shall be sized by the temperature controls manufacturer to produce the required capacity at or equal to a pressure loss of not more than 5 psi. Nominal body rating shall not be less than 150 psig. However, the valve body and packing selected shall be designed and rated for the maximum system operating pressure and temperature at the point of installation. Each valve shall be equipped with proper packing to assure that there will be no leakage at the valve stem.
c. All 2-way valves shall be single seated valves and have close off ratings greater than the maximum upstream system pressure encountered.
d. Three-way modulating valves shall have close off ratings equal to or greater than the maximum pressure difference, at any load condition, between the outlet and either of the two outlets for diverting valves.
e. All valves shall be provided with characterizing disk to improve valve control stability.
f. All valves shall have blowout proof stem with thrust-bearing double o-ring design. Stem packing gland screw shall be adjustable for wear.
g. Non corroding chromium plated brass ball or where specified, stainless-steel ball and stem, shall be rated at a minimum of 600 PSI WOG (water-oil-gas), cold, non-shock service, and 150 PSI for saturated steam service. All valves shall be provided with reinforced Teflon seats.
h. Standard chromium plated bronze ball or where specified, stainless-steel ball and stem, shall be rated at a minimum of 600 PSI WOG (water-oil-gas), cold, non-shock service, and 150 PSI for saturated steam service. All valves shall be provided with reinforced Teflon seats.
i. All control valves and actuators shall have a three-year full parts and labor warranty.

2. Manufacturers:

a. Belimo B200 Series with characterizing disc.
b. Approved Equal

K. Damper and Valve Actuators

1. Actuators shall be direct coupled, brushless DC motor type, which require no crank arm and linkage. The actuator shall provide 0 - 10VDC, 0-2-V phased cut or 4 - 20 mA proportional control or two position control or pulse width modulation or Tri-State control as dictated by HVAC application and sequences of operation. Actuators shall be designed for either clockwise or counterclockwise fail-safe operation, have a manual positioning mechanism and control direction of rotation switch. Run time shall be constant and independent of torque. A 2 to 10VDC feedback signal shall be provided for position feedback or master-slave applications.
2. Actuators shall be UL listed and CSA certified, protected from overload at all angles of rotation and manufactured under ISO 9001 quality control standards.
3. All actuators on fresh air, return air and face and bypass dampers and valves shall be spring return to their normally open or closed position in the event of power failure.
4. Damper actuators: to be mounted outside the airstream and be able to be removed without taking damper apart. Extension shafts to be installed to mount actuators on outside of CSAC units.
5. All actuators shall be electric or electronic and designed to interface with the Direct Digital Control System.
6. Actuator to be designed to close-off against 200% of system operating pressure.
7. All valve actuators on 6" valves and larger shall have external handwheel.
8. Manufacturers:

a. Belimo
b. Johnson Controls
c. Approved equal

L. Low Temperature Detection Thermostats (Freeze Stat)

1. Low temperature detection thermostats: Automatic reset, line voltage, with flexible sensing elements 20 feet long, responsive to lower temperature along entire length. Furnish two (2) thermostats wired in series, each set at 45°F (adjustable) with sensing elements laced across coil discharge.
2. Install in air handling systems where the possibility of freeze-up or freeze-damage of equipment and property exists.

M. Current Sensing Relays

1. Sensing relay shall be a solid state electronic device with split-core design to eliminate the need to remove power conductor for installation or servicing.
2. Amperage rating of 0-135 Amps.
3. Trip set point shall be adjustable to +/- 1% of range. Provide a trip LED. Provide trip set calibration on all current sensors.

4. Sensor supply current is induced from monitored conductor. Minimum conductor current required is 2 Amps. Provide a power LED to indicate that power is available at the current sensing relay.
5. Sensor shall have 600 VAC ms isolation.
6. Current sensor shall be Veris Hawkeye Model H722.

N. Air Differential Pressure Switches

1. Shall be differential pressure type with adjustable range from .05 to 1.0 inches water gauge. Contacts shall be snap acting SPDT and rated for 10 Amps (non-inductive) 120 VAC.

O. Air Static Pressure Transmitter

1. Transmitter shall have range of 0-1@ or 0.5@ WG and send a 4-20milliamp output signal. Zero set range and span set range +/- 5% of full range output. A combined static error (non-linearity, non-repeatability, and hysteresis) +/- 5% of full range output.

P. Variable Frequency Drives (VFD)

1. Provided by Division 26. Interface and control by Division 23.

Q. Smoke Detectors

1. Furnished and installed by Division 26 Contractor. TCC shall supervise detector installation locations and wire into fan circuits; arranged to stop unit fan(s) upon alarm activation.
2. Manufactures:

    a. General Analysis Corporation
    b. MSA

R. IAQ (CO_2) Sensor

1. Measures CO_2 level only - 0 - 2,000 PPM $\pm$ 5% accuracy.
2. Temperature range of 25 degrees F to 130 degrees F.
3. Duct mounted for large spaces where one AHU serves one zone.
4. Room mounted where one AHU serves multiple zones.
5. CO_2 sensors to be self-calibrating and be provided with portable handheld CO_2 and temperature sensor with data logging capability. Telaire 7000SK.
6. Complete with calibration kit.
7. Manufacturers:

    a. Telaire
    b. Valtronics Model 6289D
    c. MSA

S. Outside Air CO_2 Sensor

1. Confirm outside air levels of CO_2 using Telaire T8000 series unit. Install near roof adjacent to intake air damper. Include weather rated enclosure.

T. Ambient Air Water Vapor Sensor (Master Ambient Sensor)

1. Provide one ambient air water vapor sensor in suitable enclosure mounted on north wall of building to measure outside air wet bulb temperatures.
2. Vapor sensor to have heated diffusion-based sampling enclosure for low temperature (-20°F) operation.
3. Vapor sensor will be used to index all air handling units to economizer mode.
4. Vapor sensor shall be like Telaire or equal.
5. Provide calibration kit like Telaire 2075.

U. Water Meters

1. Water Meters: Displacement type cold water meter with sealed, tamper proof magnetic drive, impulse contact register, single pole, double throw dry contact switch. (Water meters to be connected to building management system by automatic temperature control contractor.) Manufacturer: Neptune Pro Read T-10.

2.08 UTILITY MONITORING

A. Not Required.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Project Management as a Prime Contractor - Provide a designated project manager who, for duration of construction, will be responsible for the following:

1. Construct and maintain project schedule.
2. On-site coordination with all applicable trades and subcontractors.
3. Authorized to accept and execute orders or instructions from Owner/Engineer.
4. Attend project meetings as necessary to avoid conflicts and delays.
5. Make necessary field decisions relating to this scope of work.
6. Coordination/Single point of contact.

B. Electrical Installation

1. Furnish and install sensor, LAN, actuator, and interlock wiring as specified in Division 26 and 27 or shown on the plans. Connect controls in accordance with approved wiring diagrams. Wiring requirements are as follows:

a. 110-volt power and discrete control wiring: #12 AWG THHN.

b. Sensor/low voltage control wiring: #18 AWG twisted/shielded pair.
c. Communication wiring: #20 AWG twisted/shielded pair.

2. Wiring installation minimum requirements, in accordance with Owners' standards, as follows:

a. All wiring installation shall be in accordance with Specifications 26 05 00 and 26 05 33.
b. All control wiring shall be completely independent of all other computer/technology wiring. Control system shall be connected to new/existing network system in only one place.
c. All shield to be grounded at the DDC panel, shields at the sensors or transducers to be folded back and taped.
d. All digital input and output signal wiring between field devices and panel must be "continuous run". No splices will be permitted. Connections (including shield) must be soldered and taped. Signal integrity must be checked with an oscilloscope and appropriate signal generator and lines so tagged. Inform the Engineer of any such work before implementation.
e. Do not route cable diagonally across the building.
f. Control shall not be routed in the same conduit as power.
g. Running wire above bar joist in roof/floor metal deck flutes is not permitted. Wire to be run above bottom chord of truss and supported with J-hooks and wire ties at maximum 4' o.c.
h. Line voltage (48 volts and above) shall be kept separated from low voltage within the control panel. Line voltage terminals shall be covered or protected in such a way that accidental contact with line voltage is prevented.
i. Temperature Control Contractor shall insure that no low voltage wiring is exposed to high voltage wiring within starters, control cabinets, etc. Insulation rating on control wiring must match high voltage wiring rating (above 300 volts) within starters or devices such as start/stop relays and current sensors must be mounted in companion enclosures. Follow guidelines in Div. 26 and/or the NEC, whichever is most strict.

3.02 START-UP AND COMMISSIONING

A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

B. Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

3.03 TRAINING

A. The contractor shall provide factory trained instructor to give full instruction to designated personnel.

END OF SECTION 23 09 00

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SECTION 23 21 13 – HYDRONIC PIPING SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes hydronic piping specialties for the following systems:

1. Chilled Water Systems.
2. Heating Water Systems.

B. Hydronic systems specialties – this section includes the following:

1. Air and Dirt Separators.
2. Air Vents.
3. Strainer – Y-Type.
4. Valve – Automatic Make-Up for Closed Loop.
5. Valve – Balance Valve.
6. Valve – Automatic Flow Control.
7. Valve – Pressure Relief – Water Systems.
8. Expansion Tank (Bladder Type).

C. Pumps: See Section 23 21 23 “Hydronic Pumps and Trim” for pumps and pump accessories for hydronic piping systems.

D. Piping: See Section 20 00 60 “Pipe, Valves, Fittings and Hangers for Fire Suppression, Plumbing and HVAC” for Hydronic Piping, Fittings and Valves.

1.2 SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves. Submit complete valve schedule with indicated specific equipment designation of coil, connection sizes, flows, components, and pressure drops on a single schedule.
2. Air control devices.
3. Hydronic specialties. Include flow and pressure drop curves based on manufacturer's testing.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 AIR AND DIRT SEPARATOR (AS)

A. Full flow coalescing type combination air eliminator and dirt separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet / outlet nozzles.

B. Selection shall be based upon system flow with pipe size as a minimum. In no case shall entering velocity exceed 10 feet per second.

C. Unit shall include internal structured elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must be fabricated by the manufacturer and consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.

D. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.

E. Units shall include a side tap valve to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.

F. Manufacturers:

1. Spirotherm VDT

2.2 AIR VENTS

A. Furnish and install vents where shown and at each high trapped point in closed water systems, each coil, unit heater, piece of radiation and where otherwise required to properly expel air from systems. Pipe air vent outlet to floor drain, drip pan, open-site drain, etc.

B. Main and Riser Vents: vents for venting mains, branches and risers to have heavy-duty cast-iron body, seamless copper float and stainless steel or bronze trim.

C. Branch and Equipment Vents: (Coils, Unit Heaters, Cooling Units, etc.)

1. Vents to have drawn brass body with nickel trim and tapped at top for 1/4" drain connection.

D. Radiation Vents: vents used for venting radiation to be fiber disc type.

E. Manual Vents: pipe air chamber with 1/4" brass pet cock.

F. Manufacturers:

1. Armstrong
2. Bell & Gossett
3. Spirax/Sarco
4. Taco
5. Nexus

2.3 STRAINER – Y-TYPE

A. Furnish and install where indicated on Drawings. Strainers to be full line size.

B. Strainer body working pressure to be suitable for working pressure of system, but not less than pressure listed below. Screen size to be size listed below.

Strainer Size	Screen Size	Pressure Rating
2” and Smaller	10 MESH (1/16”)	250 PSIG
2 ¼ to 4”	10 MESH (1/16”)	125 PSIG
5” and Larger	7 MESH (1/8”)	125 PSIG

C. Strainer connections to be threaded for screwed piping, flanged for welded piping. All sizes 2 ½” and above to be Flanged connection.

D. Strainers to have full tapping size valved blowdown with brass cap. Blowdown tappings above 1" may be 1" size. Valve to be quick opening full port ball valve.

E. Manufacturers:

1. Hoffman

2. Armstrong
3. Crane
4. Mueller
5. Sarco
6. Victaulic
7. Nibco

2.4 VALVE – AUTOMATIC MAKE-UP FOR CLOSED LOOP

A. Furnish and install where shown or required for each closed water circulating system automatic feed or makeup valves.

B. Valves to be spring-loaded pressure-reducing type having bronze body and monel or stainless-steel trim. Valves for use in cold water systems to have rubber diaphragm with composition shutoff disc. Valves for hot water systems to have monel metal diaphragm with stainless steel shutoff disc.

C. Feed valves suitable for entering pressures from 40 to 80 psig and to have a reduced pressure spring range from 8 to 25 psig. Valves to have built-in strainer and check.

D. Valves to be adjusted, after installation, to maintain a minimum of 10 psig at highest and most remote point of system.

E. Manufacturers:

1. Armstrong
2. Taco
3. Bell & Gossett
4. Watts

2.5 VALVE – BALANCE VALVE

A. Furnish and install where shown on drawings and in accordance to manufacturer’s installation instructions.

B. Valves 2” and smaller to be multi-turn hand-wheel or ¼ turn lever with full throttling range and tight shut-off. Valve internals similar to globe or ball valve type construction.

C. Valves 2 1/2” and larger to be multi-turn hand-wheel with full throttling range and tight shut-off. Valve internals similar to globe valve type construction.

D. Positive shut-off with tamper proof memory stop for ease of returning to the balance set point without readjusting.

E. Valves shall maintain flow rates within +/-3% regardless of system pressure fluctuations. Water valves shall be sized by the manufacturer to produce the required flow at or equal to a pressure

loss of not more than 3 psi. Nominal body rating shall not be less than 150 psig. However, the valve body and packing selected shall be designed and rated for the maximum system operating pressure and temperature at the point of installation. Each valve shall be equipped with proper packing to assure that there will be no leakage.

F. Valves 2” and smaller to have bronze or copper alloy body; 2 1/2” and larger to be cast iron.

G. Two 1/4" NPT metering ports with check valves and gasketed caps located on both sides of valve seat for precise flow measurement. Caps shall be of brass construction. Plastic caps are not acceptable.

H. Valve rated for 250 psi working pressure and 250^{o}F working temperature.

I. Valves 2” and smaller to have threaded ends; 2 1/2” and larger to be flanged or grooved ends.

J. Submit complete valve schedule with indicated specific equipment designation of coil, connection sizes, flows, components, and pressure drops on a single schedule.

K. Manufacturers:

1. 1/2” to 2”

   a. Pro Hydronic CBV (lever)
   b. Victaulic 787 Series (multi-turn)
   c. Nexus UltraMB (multi-turn) or UltraXB (1/4 turn)
   d. Nibco 1810 Series (multi-turn)
   e. Griswold Quickset Series (lever)
   f. Bell & Gossett MV (lever)

2. 2 ½” and larger

   a. Nexus UltraMBF (multi-turn)
   b. Nibco F739 (multi-turn)
   c. Bell & Gossett Circuit Setter Plus (multi-turn post)
   d. Victaulic 788/789 (multi-turn)

2.6 VALVE – AUTOMATIC FLOW CONTROL (PREHEAT COIL AND RADIANT CEILING PANELS ONLY)

A. Automatic Flow Limiter

1. Factory calibrated pressure compensating type valve. Valve shall maintain flow rates within +/-5% regardless of system pressure fluctuations.
2. Cartridges easily removable from valve body with disturbing existing piping.
3. Pressure independent design.
4. Cartridges to be made of stainless-steel construction.
5. Flow rate shall be preset and not field adjustable without replacement of cartridge.
6. No brass or plastic components permitted.

B. Valves

1. Valves shall be equipped with nipples and quick disconnect valves for connection of flow measuring instrumentation. Caps shall be of brass construction. Plastic caps are not acceptable.
2. Full port ball valve with blow-out proof stem. Internal diameter of the ball shall be equivalent to the pipe size. Reduced port ball valves are not acceptable.

C. Wye-Strainers

1. Strainers shall have 20 mesh rating. Minimum 8:1 ratio of total area vs internal pipe diameter.
2. Stainless Steel Construction
3. Strainer body shall incorporate a full-port isolation ball valve. Reduced port valves are not acceptable.

D. Submit complete valve schedule with indicated specific equipment designation of coil, connection sizes, flows, components, and pressure drops on a single schedule.

E. Manufacturers:

1. Flow Design
2. Victaulic
3. Nibco
4. Nexus
5. Pro Hydronic
6. Griswold
7. Bell Gossett

2.7 VALVE – PRESSURE RELIEF – WATER SYSTEMS

A. Furnish and install where shown or required for each closed water circulating system automatic relief valve.

B. Valves tested and rated by ASME in btu/hr to relieve full gross heat output of system and to bear ASME stamp.

C. Valves to be spring-loaded type with bronze body, stainless steel trim, brass seat and composition disc. Valves to relieve at 20 psig above setting of its companion system fill valve. Run discharge line from relief valve to nearest floor drain.

D. Manufacturers:

1. Watts
2. McDonnel
3. Kunkle
4. Spirax/Sarco

2.8 EXPANSION TANK – BLADDER TYPE

A. Refer to the plans for the arrangement and capacity of the tank.

B. The expansion tank shall be a bladder type expansion tank. The only air in the system shall be the permanent sealed-in air cushion contained in the removable bladder that fits inside the tank.

C. The expansion tank shall be welded steel, constructed, tested and stamped in accordance with the ASME Code for a working pressure of 125 psig and pre-charged to the minimum operating pressure.

D. The tank to have proper fittings, air charging method and shall have an enameled exterior.

E. Bladder in expansion tank shall be completely expandable to same size as tank and shall be replaceable through flanged opening.

F. Manufacturers:

1. Amtrol
2. Bell & Gossett – Series B
3. Taco
4. Armstrong

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

E. Install balance valves at each piece of equipment as noted on drawings.

3.2 PIPING INSTALLATIONS

A. Install piping of type as indicated in Section 20 00 60.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

N. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

O. Install branch connections to mains using tee fittings in main pipe.

P. Install valves according to Section 20 00 60.

Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each piece of all hydronic equipment (i.e. coils, control valves, chillers, boilers, etc.), pressure-reducing valve, solenoid valves, pumps, and elsewhere, as

indicated or required by manufacturer of equipment. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as shown on drawings.

U. Identify piping as specified in Section 20 00 50.

V. Install air vents at all high points in system and where piping connects to equipment.

3.3 HANGERS AND SUPPORTS

A. See Section 20 00 60 for hanger installation.

B. See Section 20 00 10 for hanging attachment to building construction.

3.4 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

C. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches (1200 mm) above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.

3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections as detailed on drawings.

D. Install all chilled water: control valves, shut off valves, strainers and unions, over drip pan that drains into condensate pan, no exceptions.

E. Install supply to the manufacturers listed connection designed for supply. Do not always assume supply connects to the bottom of the equipment connection.

3.6 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

SECTION 23 21 23 – HYDRONIC PUMPS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Pump – Base-Mounted, End-Suction
2. Pump Trim – Suction Diffuser

1.2 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

C. All pumps shall be in compliance with DOE pump efficiency requirements and include PEI (Pump Energy Index) energy label. Pumps shall be listed for PEI of less than 1.00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PUMP – BASE-MOUNTED, END-SUCTION

A. Furnish and install a single stage pump as hereinafter specified and of a capacity and method of installation as shown on Drawings.

B. The casing shall be constructed of close-grained gray cast iron with smooth passageways and design for working pressure of 125 psi or 1-1/2 times discharge pressure, whichever is greater. Casing to have air vent cock at high point and drain plugs at low points.

C. Casing shall have bronze removable wear ring around impeller inlet.

D. Pump impeller shall be bronze, enclosed type shall be dynamic balanced.

E. Pump shaft shall have removable bronze shaft sleeve at shaft seals.

F. Pump Seals shall have spring loaded mechanical seal.

G. Pump shall be equipped with set of oil lubricated anti-friction roller bearings.

H. Pump and motor shall be mounted on common steel base and connected by means of flexible coupler.

I. Pump motor and bed plate assembly shall be carefully mounted on concrete base and grouted per manufacturer recommendations in field by Mechanical Contractor. Great care shall be taken so that bed plate is level and pump and motor are properly aligned.

J. Motor: to be heavy duty, greaseable ball bearing, open drip-proof. Reference drawings for VFD service. See Section 20 00 50 - Motors for Motor Performance. Motor sized for continuous operation without undue heating or overload.

K. Pump shall not be run until the system is filled with water. Mechanical Contractor shall give particular notice of this to the Electrician who may desire to check the motor rotation.

L. Manufacturers:

1. Taco
2. Bell & Gossett
3. Peerless
4. Armstrong
5. Aurora
6. Grundfos

2.3 PUMP TRIM - SUCTION DIFFUSER

A. Cast iron construction rated at 175 psi at 250^{o} F.

B. 125 ANSI flanges.

C. 90° entrance elbow flow straightening device shall be cast iron and cast as integral part of suction diffuser.

D. Bottom drain/blowdown connection. Pipe same size as connection to floor drain. Provide full port ball valve in pipe.

E. Strainer

1. Fine mesh brass startup strainer.
2. Stainless steel 1/8" hole permanent strainer.

F. Sized for maximum 3 ft head pressure drop. Use increaser to upsize if required to meet pressure drop requirements. Provide pressure drop of suction diffuser at design conditions shall be indicated on submittal.

G. Manufacturers:

1. Taco
2. Bell & Gossett
3. Peerless
4. Armstrong
5. Aurora
6. Grundfos

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with manufacturer's instructions.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Set base-mounted pumps on concrete foundation. See Common Materials and Methods for Fire Suppression, Plumbing and HVAC, Section 20 00 50 for concrete pump base. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3. Gout pump base rails completely full of grout to top of base rails as recommended by manufacturer.

3.2 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves full line size, not pump connection size.

D. Install single gage with multiple input selector valve as detailed on drawings.

E. Ground equipment according to Division 26 Specifications.

F. Connect wiring according to Division 26 Specifications.

END OF SECTION 23 21 23

SECTION 23 22 13 – STEAM AND CONDENSATE PIPING SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes piping, specialties and installation guidelines for the following systems:

1. Low Pressure Steam
2. Steam Condensate Return

B. Steam specialties in this section include the following:

1. Strainers.
2. Steam traps.
3. Thermostatic air vents and vacuum breakers.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be in compliance with section 20 00 60, Pipe, Valves, Fittings and Hangers for Fire Suppression, Plumbing and HVAC.

1.3 SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-reducing and safety valve.
2. Steam trap.
3. Air vent and vacuum breaker.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

B. If requested by Engineer, pipe fitters must provide history of experience with steam piping. If fitter has no experience with steam piping, then a fitter with steam experience must be provided.

PART 2 - PRODUCTS

2.1 DISCHARGE ELBOW AND DRIP PAN ARRANGEMENT

A. Furnish and install where shown on Drawings a discharge elbow and drip pan arrangement and pipe from drain tappings to open-site drain.

2.2 STEAM TRAP - LOW PRESSURE - 0 TO 15 PSIG

A. Float and Thermostatic Traps

1. Furnish and install for each low-pressure main drip, unit heater, etc. and where shown.
2. Traps to have cast iron bodies, thermostatic air bypass, quick opening float valve with renewable seat and plunger and be designed for 15 psig working pressure.
3. Size in accordance with following table:

TRAP SIZE	TRAP CAPACITY
3/4"	100 #/hr condensate
1"	250 #/hr condensate
1-1/4"	600 #/hr condensate
1-1/2"	1200 #/hr condensate
2"	2500 #/hr condensate

B. Manufacturers:

1. Armstrong
2. Modine
3. Sarco
4. Dunham
5. Hoffman
6. Watson-McDaniel

2.3 STRAINER - Y-TYPE

A. Furnish and install where indicated on Drawings. Strainers to be full line size.

B. Strainer body working pressure to be suitable for working pressure of system, but not less than 120 psig.

C. Screen to be:

1. 20 mesh monel for 1/2" thru 2" pipe sizes.
2. Perforated stainless steel for pipe sizes 2-1/2" and above.

D. Strainer connections to be threaded for screwed piping, flanged for welded piping.

E. Strainers to have full tapping size valved blowdown. Blowdown tappings above 1" may be 1" size. Valve to be quick opening full port ball valve.

F. Manufacturers:

1. Hoffman
2. Webster
3. Crane
4. Fisher
5. Mueller
6. Keckley
7. Sarco

2.4 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Body: Cast iron, bronze, or stainless steel.
4. End Connections: Threaded.
5. Float, Valve, and Seat: Stainless steel.
6. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
7. Pressure Rating: 125 psig
8. Maximum Temperature Rating: 350 deg F.
9. Manufacturers:

    a. Armstrong International, Inc.
    b. Barnes & Jones, Inc.
    c. Dunham-Bush, Inc.
    d. Hoffman Specialty; Division of ITT Industries.
    e. Spirax Sarco, Inc.
    f. Sterling

B. Vacuum Breakers

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Body: Cast iron, bronze, or stainless steel.
4. End Connections: Threaded.
5. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
6. O-ring Seal: EPR.
7. Pressure Rating: 125 psig.
8. Maximum Temperature Rating: 350 deg F.
9. Manufacturers:

    a. Armstrong International, Inc.
    b. Dunham-Bush, Inc.
    c. Hoffman Specialty; Division of ITT Industries.
    d. Johnson Corporation (The).
    e. Spirax Sarco, Inc.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.

B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to a point outside building as indicated on Drawings. Install drip pan elbow on discharge of safety valves and pipe drip pan to floor drain. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.2 PIPING INSTALLATION

A. Install piping of type as indicated in Section 20 00 60.

B. Contractor installing steam pipe shall be familiar with steam pipe installation including anchor installation, expansion joint, guides, proper pitch, etc.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

D. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

N. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.

O. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

P. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.

Q. Install valves according to Section 20 00 60. Note: No ball valves or quick opening valves allowed on steam systems unless specifically shown.

R. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

S. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

T. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

U. Install expansion loops, expansion joints, anchors, and pipe alignment guides shown on drawings and as specified.

V. Identify piping as specified in Section 20 00 50.

W. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

X. Install control valves with actuator rotated at 45° from vertical to minimize actuator overheating, i.e. actuator to not be directly above valve.

3.3 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment.

B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, test valve and full-port ball valve downstream from trap unless otherwise indicated.

3.4 HANGERS AND SUPPORTS

A. See Section 20 00 60 for hanger installations.

B. See Section 20 00 10 for hanging attachment to building construction.

3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install vacuum breakers downstream from control valve, close to coil inlet connection.

D. Install a drip leg at coil outlet.

3.6 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping," and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

B. Perform the following tests on steam and condensate piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

C. Prepare written report of testing.

END OF SECTION 23 22 13

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SECTION 23 31 13 – METAL DUCTS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Access doors (high pressure)
4. Sheet metal materials.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing and Balancing" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1. Static-Pressure Classes:

a. Supply Ducts (Upstream to Air Terminal Units): 4-inch wg.
b. Supply Ducts (Downstream from Air Terminal Units): 1-inch wg.
c. Return Ducts (Negative Pressure): 2-inch wg.
d. Exhaust Ducts (Negative Pressure): 1.5-inch wg.

2. Leakage Class:

a. Round Flat Oval Supply-Air Duct: 3 cfm/100 sq. ft. at 1-inch wg.
b. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg.
c. Flexible Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
13. The construction documents are not fabrication drawings and are not intended to show all offsets as required for proper ductwork installation. Contractor to field verify all existing conditions and prepare fabrication drawings based on existing conditions. All additional offsets shall be included in bid price.
14. Submit 2 copies of sheet metal fabrication drawings to Testing and Balancing Contractor for his review prior to submitting to engineer.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.

3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lindab Inc.

b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.
f. United Sheet Metal.
g. LaPine
h. Eastern Sheet Metal
i. JTD Spiral Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 ACCESS DOORS (AD) (HIGH PRESSURE)

A. Construction - steel with 1/2" of fiberglass insulation between door and door pan. Sponge rubber gasketing to be on inside of door frame and between duct and door frame. Door metals to be of sufficient gauge for minimizing leakage at various duct pressures. Hinges not to exceed 12" apart and two handle-type latches to be used for sides exceeding 12".

1. Manufacturers:

a. Ventfrabrics Ventlok Door
b. Buensod Stacey Type F
c. Approved equal

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction

methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Non-corrosive Environments: Cadmium-plated steel rods and nuts. Clean/degrease for painting where applicable.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure Showing 5-1, "Rectangular Duct Hangers Minimum Size," and Figure showing 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. **Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings**.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance that will allow for insulation thickness.

I. Route ducts so that they do not pass through transformer vaults, electrical equipment rooms, stairwell enclosures and elevator equipment rooms.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls, cover the opening between the partition and duct or duct insulation with sheet metal flanges (picture frames) of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with “Intermediate Level” standards as identified in SMACNA's "Duct Cleanliness for New Construction Guidelines." All ducts and air openings on equipment shall be covered and protected throughout construction until ready for use.

3.2 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-1, "Standard Duct Sealing Requirements," unless otherwise indicated.

B. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table showing 1-1, "Standard Duct Sealing Requirements."

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter for, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
2. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
3. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table showing 5-1, "Rectangular Duct Hangers Minimum Size," and Table showing 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports. Clean/degrease where painting is to occur.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Install stiffener’s, turning vanes, and or air straighteners as required to stop objectionable duct oil canning, or fan surge to the satisfaction of the engineer.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 DUCT SCHEDULE

A. Fabricate supply, return, outdoor air, and relief air ducts with galvanized sheet steel unless noted otherwise on drawings or within specifications.

B. All commercial dishwasher ductwork shall be all welded water tight stainless steel below the ceiling or where exposed. Ductwork above ceilings may be all welded watertight stainless steel or aluminum. Ductwork to slope back to dishwater for positive drainage.

C. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "Vanes and Vane Runners," and Figure showing, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "Vanes and Vane Runners," and Figure showing, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure showing, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table showing, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry. No spin-in type fittings allowed.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

F. Escutcheons:

1. For all duct penetrations thru walls into finished areas duct shall have neat shop fabricated picture frame escutcheon on finished side of wall.

a. This applies to both round and square duct work.
b. Externally insulated ducts to have escutcheon oversized by thickness of insulation.
c. Ducts without insulation to have escutcheon tight to exterior of duct.
d. Escutcheon to be fastened to wall and not duct.
e. Escutcheon to be of quality finish and paintable.

END OF SECTION 23 31 13

SECTION 23 31 19 – HVAC HOUSING AND PLENUMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 23 Specification Sections for Fans and Coils.

1.2 SUMMARY

A. This Section includes HVAC casings for field-erected air-handling systems and for housing mechanical equipment. Basically work involves modifying existing housing and replacing rusted pieces adjacent to cooling coil.

1.3 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F at temperature differences specified. Values are expressed as Btu.

1. Example: Apparent Thermal Conductivity (k-Value): 0.26.

1.4 SUBMITTALS

A. Product Data: For factory-fabricated casings, sealant materials, and acoustic liner materials.

B. Shop Drawings: Include plans, elevations, sections, components, and attachments to other work. Show fabrication and installation details of the following:

1. Reinforcement and spacing.
2. Seam and joint construction.
3. Access doors, including frames, hinges, and latches.
4. Filter, coil, humidifier, and other apparatus.
5. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and casing attachment.
6. Interior lighting, including switches.

C. Product Certificates: For factory-fabricated casings, signed by product manufacturer.

1. Show sound-absorption coefficients in each octave band lower than those scheduled when tested according to ASTM C 423.
2. Show airborne sound transmission losses lower than those scheduled when tested according to ASTM E 90.

D. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for HVAC casing joint and seam welding.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 HOUSINGS AND PLENUMS

A. General

1. Housing shall be built with prefabricated 4” (or 2” where shown) insulated panels and be completely designed and detailed for orientation and configuration as shown on drawings.
2. All dimensions shall be field verified prior to fabrication. The housing will be completely field erected.
3. Housing manufacturer shall furnish 1/2” scale fabrication/erection drawings and installation instructions showing all dimensions, panel connection types, connection methods and door locations. Each piece shall be marked to match the location shown on the drawings.
4. Complete housing shall be designed to withstand and remain airtight with 4” positive and 2” negative static pressure. The panels shall not deflect no more than 1/240 of the span. Any air noises shall be fixed to the satisfaction of the Owner/Engineer.
5. All fasteners to be stainless steel.

B. Panels

1. Panels shall be dual wall 4” thick, acoustically insulated with maximum heat transfer of .07 Btu/hr/SF° F. Panels shall be of interlocking tongue and groove type design. Exterior skin to be a minimum 18-gauge solid G-90 galvanized steel. Interior skin for wall panels

to be solid 22-gauge, G-90 galvanized steel. Interior skin for floor panels shall be 18-gauge, G-90 galvanized steel.

2. Panels to be completely framed with 18-gauge galvanized steel channels. Box frames to be welded from side rail to end cap, including corners. Panels to have stiffeners welded to exterior skin and structurally attached to interior skin at 16" o.c.
3. Panel filler/insulation shall meet or exceed the following criteria when tested in accordance with ASTM – E84, NFPA – 255 and UL 723 test methods 25/50 flame/smoke index.

C. Access Doors

1. Access doors to be 4" thick (2" thick in 2" thick walls) with solid 18-gauge galvanized steel on both sides.
2. Access doors shall be provided with a minimum of two hinges and two wedge-lever-type latches operable from both sides of the door. Access doors shall always open against air pressure.
3. Access doors shall have single gasket for air tight fit with positive sealing.
4. Access doors to have 12" x 12" vision panels where noted on the drawings. Vision panels shall be double-glazed, wire-reinforced safety glass with an airspace between panes and sealed with interior and exterior rubber seals.

D. Openings

1. The panel manufacturer shall provide all duct and fan openings. All piping and conduit penetrations shall be field located and cut and sealed.

E. Manufacturers:

1. Rink
2. Tempmaster
3. United Sheet Metal
4. Semco
5. Aerosonics
6. Price Industries

2.2 FILTER HOLDING FRAME

A. Size, capacity and arrangement as shown on the Plans.

B. Holding frames shall be constructed of 16-gauge galvanized steel. All corners shall be mitered, continuously welded and ground to form a smooth surface between the frame sealing surface and the gasket at the corner points of the sealing flange. All sheared edges of the frame shall be de-burred before final assembly.

C. Holding frames shall be designed to hold a 2" thick pre-filter and 4" thick final filter and shall have adequate bearing surface for assembly and mounting. The holding frame shall have 16 pre-punched mounting holes to facilitate proper alignment and assembly. Two rows of dimples

shall be spaced to center a filter and pre-filter when both are used in combination in a single frame. Holding frames shall also be equipped with pre-punched lances to accommodate various types of stainless-steel fasteners. A closed-cell ept/polyethylene/butyl gasket shall be attached to the sealing flange of each holding frame.

D. Include all required stainless-steel spring-loaded fasteners to properly support and hold filter elements within the holding frame.

E. Install and assemble according to manufacturer's written instructions. Provide all miscellaneous hardware (nuts, bolts, washers, etc) as required for a complete installation. Hardware shall be constructed of galvanized steel.

F. Manufacturers:

1. Flanders
2. AAF
3. FARR
4. Approved Equal

2.3 DIFFERENTIAL PRESSURE GAUGE (MAGNAHELIC)

A. A magnahelic air filter gauge for measuring resistance to air flow through the filters shall be installed. Provide one for each bank of pre-filters and each bank of final filters. The gauge shall be diaphragm actuated with pointer zero adjustment and have 3 7/8" diameter white dial with black figures and graduations. Accessories shall include surface mounting bracket with screws and two each, static pressure tips, 5' lengths aluminum tubing and vent valves.

B. Housing constructed of die cast aluminum with a baked enamel finish.

C. Accuracy of plus or minus 2% of full scale at 70^{o} F. Ambient temperature range of 20^{o}F to 140^{o}F. Provide operating range as best suits job conditions and as recommended by filter element supplier.

D. Install according to manufacturer's written instructions. Provide all miscellaneous hardware (screws, tubing, compression fittings) as required for a complete installation.

E. Manufacturers:

1. Dwyer
2. Approved Equal

2.4 PREFILTER ELEMENTS

A. Size as shown on the Plans. Provide 3 complete sets of filters.

B. Each filter element shall be 2" thick with 10 pleats per foot and consist of a cotton and synthetic media, heavy gauge expanded metal support grid and enclosing frame. Filters shall be listed by UL as Class 2.

C. The filter media shall have an average efficiency of 20%, and have an average arrestance of 85-90% (MERV-8) based on ASHRAE Test Standard 52.2. Initial resistance at 500 ft/min shall not exceed 0.30".

D. The media support grid shall be constructed of heavy gauge (.013) expanded electro-galvanized metal with grid members being no less than .025" wide, providing an open area not less than 96%. The grid shall be 100% bonded to the media on the air exiting side to eliminate media vibration and pull-away. The grid shall be formed to provide a uniform V-shaped pleat, with the open area on the air exiting side matching the open area on the air entering side.

E. The enclosing frame shall be constructed of a rigid, high wet-strength beverage board. Diagonal support members shall be bonded to both the air entering and the air exiting sides of each pleat. The enclosing frame shall be chemically bonded to the filter pack on all four sides.

F. Manufacturers:

1. Flanders
2. AAF
3. FARR
4. Approved Equal

2.5 FINAL FILTER ELEMENTS

A. Size as shown on the Plans. Provide 3 complete sets of filters.

B. Each filter element shall be 4" thick and consist of a synthetic or glass media, heavy gauge expanded metal support grid, enclosing frame and mesh face guards. Filters shall be listed by UL as Class 2.

C. Filter Media: The filter media shall be 20 mil thick (minimum) with an average efficiency of 30-35%, and have an average arrestance of 90% (MERV-13) based on ASHRAE Test Standard 52.2.

D. The media support grid shall be constructed of heavy gauge (.013) electro-galvanized expanded metal with grid members being no less than .025" wide, providing an open area of not less than 96%. The grid shall be 100% bonded to the media on the air exiting side to eliminate media vibration and pull-away. The grid shall be formed to provide a uniform V-shaped pleat, with a matching open area on the air exiting and air entering sides.

E. The enclosing frame shall be constructed of die-cut, heavy duty, foil coated beverage board. The filter element shall be a standard size model as noted on the Plans. The enclosing frame shall be chemically bonded to the filter pack on all four sides.

F. Manufacturers:

1. Flanders “Precision Cell”
2. AFF
3. FARR
4. Approved Equal

2.6 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

C. Solvent-Based Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

D. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field measure all existing conditions. This contractor is responsible for fit.

B. Examine concrete bases and roof curbs for compliance with requirements for conditions affecting installation and performance of HVAC casings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install casings according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with recommended spacing of sheet metal screws and with requirements for casing sealing and trim positioning.

B. Apply sealant to joints, connections, and mountings.

C. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

D. Support casings on floor or foundation system. Secure and seal to base.

E. Support components rigidly with ties, braces, brackets, seismic restraints, and anchors of types that will maintain housing shape and prevent buckling.

F. Align casings accurately at connections.

G. Maintain duct seal class integrity throughout casings.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Give seven days' advance notice to Engineer prior to testing.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Determine leakage from entire system or section of system by relating leakage to surface area of test section. Comply with requirements for leakage classification of ducts connected to casings.
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

END OF SECTION 23 31 19

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SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Materials.
2. Counter balanced backdraft dampers (CBBD)
3. Manual volume dampers.
4. Fire dampers.
5. Control dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work on ¼” = 1’-0” scale drawings.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.

2. The construction documents are <u>not</u> fabrication drawings and are not intended to show all offsets as required for proper ductwork installation. Contractor to field verify all existing conditions and prepare fabrication drawings based on existing conditions. All additional offsets shall be included in bid price.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 COUNTER BALANCED BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck EM
2. Ruskin CBD2.
3. United Enertech
4. Pottorff
5. NCA Mfg.

B. Description: Gravity balanced with adjustable weights. Adjustable open from .01” to .15”.

C. Frame: 0.090-inch- thick 6063T5 extruded aluminum, with welded corners and 12 gauge brace at each corner.

D. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with vinyl blade edge seals.

E. Blade Action: Parallel.

F. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

G. Tie Bars and Brackets: Aluminum.

H. Bearings: Synthetic pivot bushings.

I. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

J. Sleeve: Minimum 20-gage thickness.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Ruskin Company.
h. Greenheck.
i. Vent Products Company, Inc.
j. United Enertech
k. Pottorff
l. NCA Mfg.

2. Suitable for horizontal or vertical applications.
3. Frames:

a. Hat-shaped, galvanized-steel channels, 16 ga. minimum thickness.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple (min. 16 ga) or Single blade (min. 20 ga)
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel

5. Blade Axles: Galvanized steel.

a. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

6. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
2. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 1/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include standoff bracket for insulated duct mounting.

D. Remote Operated Balance Dampers

1. Provide cable or electronic operated balance dampers where required to adjust volume dampers above inaccessible ceilings or behind walls.
2. Cable length as required for access via remote adjuster behind an adjustable cover plate for flush finish installation. Refer to A-series drawings for ceiling construction. Cover plate primer coated cover for field painting unless noted otherwise. Like DuroDyne, Young Regulator, or approved equal.
3. Dampers may be electronic balancing damper actuated by hand-held damper positioner that plugs into a connector. Connector plug-in to be inconspicuously mounted and wired to damper. System to have damper position indication. Like Young Regulator EBD with EBDP electronic balance damper positioner tool.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Airstream
3. Arrow United Industries; a division of Mestek, Inc.
4. Cesco Products; a division of Mestek, Inc.
5. Greenheck Fan Corporation.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. American Warming & Ventilating.
9. Prefco; Perfect Air Control, Inc.
10. Ruskin Company.
11. Vent Products Company, Inc.
12. United Enertech
13. Pottorff
14. NCA Mfg.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 14 gauge and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated fusible links.

2.5 CONTROL DAMPERS (NOTE: Most all AHU-1 Control Dampers are existing to be reused.)

A. Dampers – Insulated Air Foil (Required for Outside Air-Relief Air-Exhaust Air Systems)

1. Damper construction: Incorporate blades equipped with steel shafts and operating in bearings in damper frame, arranged so that all linkages are encased in side channels of frame to decrease friction and eliminate noise.
1. Frames: 16 gauge (minimum) extruded aluminum. Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts.
2. Blades: not exceeding 6" in width; air foil shaped, double thickness 22 gauge (minimum) galvanized steel, thermally broken, with 1/2" polystyrene or polyurethane insulation.
3. Bearing: Synthetic.
4. Seals: Installed on all blade edges and frame top and bottom stoops synthetic elastomer: Flexible spring stainless steel compression type for jamb seals.
5. Shafts: All shafts to be a minimum of 1/2" diameter. Actuator shaft shall be welded to the main control damper blade.
6. For multi-section damper assemblies, provide all required linkages and components to operate dampers simultaneously or as specified on Drawings.
7. Insulated dampers shall be utilized for all outside air, relief air, and exhaust air services.
8. Damper Design: Class 1 leakage. 4,000 FPM maximum velocity, provide for tight shutoff, arranged so that leakage does not exceed 8 CFM/FT^2 at a 4" wg pressure differential. Designed for service of 180^o F.
9. All dampers for modulating control: proportioning type with adjacent blades rotating in opposite directions. Note: Some proportional type dampers may require parallel rotation. Reference details on Drawings.
10. All dampers for two position action: have blades arranged for parallel rotation.
11. Manufacturers:

    a. Greenheck ICD-45
    b. Ruskin TED50
    c. Tamco 9000 BF
    d. United Enertech TB-155 & TB-156
    e. Pottorff TICD-51BF & TICD-52BF

B. Dampers – Air Foil (Required for Return Air Systems)

1. Damper construction: Incorporate blades equipped with steel shafts and operating in bearings in damper frame, arranged so that all linkages are encased in side channels of frame to decrease friction and eliminate noise.

    a. Frames: 16 gauge (minimum) extruded aluminum.
    b. Blades: not exceeding 6" in width; air foil shaped, double thickness galvanized steel for 14-gauge equivalent thickness.
    c. Bearing: Synthetic.
    d. Seals: Installed on all blade edges and frame top and bottom stoops synthetic elastomer: Flexible spring stainless steel compression type for jamb seals.

e. Shafts: All shafts to be a minimum of 1/2" diameter. Actuator shaft shall be welded to the main control damper blade.

2. Damper Design: Class 1 leakage. 4,000 FPM maximum velocity, provide for tight shutoff, arranged so that leakage does not exceed 8 CFM/FT^2 at a 4" wg pressure differential. Designed for service of 180^o F.
3. All dampers for modulating control: proportioning type with adjacent blades rotating in opposite directions. Note: Some proportional type dampers may require parallel rotation. Reference details on Drawings.
4. For multi-section damper assemblies, provide all required linkages and components to operate dampers simultaneously or as specified on Drawings.
5. All dampers for two position action: have blades arranged for parallel rotation.
6. Manufacturers:

a. Greenheck VCD
b. Ruskin CD50
c. Tamco 1500
d. United Enertech
e. Pottorff

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Buensod Stacey Type F.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
11. Pottorff

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.

d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 20 to plus 200 deg F.

E. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.10 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiremold Type 86-C.
2. Aircon-Duct.

3. Flexmaster U.S.A., Inc.
4. McGill AirFlow LLC.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 1-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

C. Flexible Duct Connectors:

1. Clamps and Sheetmetal Screws: Nylon strap in sizes 3 through 18 inches with 3 sheetmetal screws to prevent blow-off of duct, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.11 DUCT ACCESSORY HARDWARE (FOR AHU-1)

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts and aluminum accessories in aluminum ducts.

C. Install backdraft and/or control isolation dampers at outlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Install volume dampers at all locations as required for balancing whether shown or not. Dampers specified on backs of grilles shall not be used for balancing unless approved by Engineer.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire, smoke, combination fire and smoke and ceiling radiation dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
3. At changes of direction of kitchen hood exhaust ducts.
4. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 20 00 50.

L. Install flexible canvas connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct rated at 10” static, strapped in place with 3 sheet metal screw stop keep straps from blowing off ducts. Do not use flexible ducts to change directions.

O. Connect diffusers or light troffer boots to low-pressure ducts with maximum 36-inch lengths of flexible duct (rated at 4” static) strapped in place.

P. Connect flexible ducts to metal ducts with draw bands plus sheet metal screws.

Q. Install duct test holes where required for testing and balancing purposes.

R. All dampers that penetrate building envelope shall be insulated dampers. This includes all exhaust, return and relief dampers.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 16 – CENTRIFUGAL HVAC FANS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Backward-inclined centrifugal and plenum fans.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

PART 2 - PRODUCTS

2.1 BACKWARD-INCLINED CENTRIFUGAL AND PLENUM FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme

2. Barry Blower
3. Carrier Corporation
4. Chicago Blower Corporation
5. Greenheck
6. Loren Cook Company
7. Trane
8. Twin City Fan

B. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

C. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Spun inlet cone with flange.
3. Outlet flange.
4. Factory finished with enamel paint

D. Backward-Inclined Wheels: Single-width-single-inlet or double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded to flange and backplate and fastened to shaft with set screws.

E. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Pre-lubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.

1. Ball-Bearing Rating Life: ABMA 9, Ll0 at 200,000 hours.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.5.
2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
3. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
4. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan

or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

6. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. As scheduled on the drawings.
2. Fan guard.
3. 2” Spring Isolators

I. Motors: Comply with requirements in Division 20, Section 20 00 50.

1. Enclosure Type: Totally enclosed, fan cooled.

J. Source Quality Control

1. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating”.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in "Cast-in-Place Concrete."

C. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to fans to allow service and maintenance.

C. Ground equipment according to Division 26 Specifications.

D. Connect wiring according to Division 26 Specifications.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.
11. Install inlet air sheet metal straightener as required if system experiences fan surge.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 34 16

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.
2. In-line centrifugal fans.
3. Motors.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.
3. PennBarry.
4. Carnes Company.
5. Twin City Fans.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top or upblast arrangement with square, one-piece, aluminum base with venturi inlet cone.

1. Hinged Sub-base: Galvanized-steel hinged arrangement permitting service and maintenance when scheduled on the Drawings.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.
5. Belt tensioner.

F. Accessories:

1. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Insulated Motorized Damper.
4. Variable-speed motor controller.
5. Finish: Factory painted with 2-coat Kynar paint, color to be dark bronze.
6. As scheduled on the Drawings.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 20 inches or as scheduled on the Drawings.
3. Pitch Mounting: Manufacture curb for roof slope when required.
4. Metal Liner: Galvanized steel.
5. Provide welded curb adaptors as scheduled on the Drawings.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carnes Company HVAC.
2. Greenheck.
3. Loren Cook Company.
4. Penn Ventilation.
5. Twin City Fans.

B. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Square metal with inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream.

E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

G. Accessories:

1. Companion Flanges: For inlet and outlet duct connections.
2. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
3. Removable panels for access to internal parts.
4. Variable-speed motor controller. (0-10V input.)
5. Factory wired disconnect switch located on outside of fan housing.
6. Neoprene Hanger Isolators.
7. As scheduled on the Drawings.

2.3 MOTORS

A. Comply with requirements in Division 20, Section 20 00 50.

B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 20, Section 20 00 50.

D. Install units with clearances for service and maintenance.

E. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

F. Install ducts adjacent to power ventilators to allow service and maintenance.

G. Ground equipment according to Division 26 Specifications.

H. Connect wiring according to Division 26 Specifications.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 34 23

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SECTION 23 34 24 – DRYER EXHAUST POWER VENTILATORS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Clothes dryer exhaust fan.
2. Secondary dryer lint trap.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Certified to the dryer exhaust duct power ventilator supplement to UL 705.

PART 2 - PRODUCTS

2.1 CLOTHES DRYER EXHAUST FAN (DEF)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Tjernlund LB2.

B. Suitable for up to 150 equivalent feet of duct.

C. Housing: 22-gauge G90 galvanized steel. Features rubber isolated mounting brackets which minimize vibration transfer.

D. Control: Automatically activated fan based on operation of dryer. An LED indicator panel, mounted near the dryer, displays operational status and faults. It communicates via a factory-connected low voltage cable to an on-board booster fan control. The control monitors pressure and temperature within the duct to operate the booster fan in sync with the dryer and to stop booster fan operation if duct temperature is excessive or signal if the duct becomes blocked.

E. Material Handling Impeller: Reverse inclined, particulate handling Impeller repels lint. 18-gauge G90 galvanized steel.

F. Motor: PSC, permanently lubricated ball bearing motor is located outside the dryer exhaust air stream to prevent exposure to heat, lint and moisture.

G. Supply Power: Six-foot 115 VAC power cord factory installed and pre-wired. Requires installation adjacent to a standard electrical outlet.

H. The motor of the DEF shall be located outside of the dryer exhaust air stream.

I. The DEF shall include a notification panel that indicates operational status and alerts user to duct blockage, fan malfunction or elevated exhaust duct temperature.

J. The DEF shall include a redundant one-shot thermal fuse that can stop operation of the DEF independent of the controller’s logic status.

K. Suitable for installation in ambient temperatures between: -20°F and 140°F (-29°C and 60°C). Suitable for dryer duct temperatures up to 167°F (75°C).

L. Warranty: Five (5) year, no-clog guarantee and warranty.

2.2 SECONDARY DRYER LINT TRAP

A. Manufacturer:

1. Tjernlund LT4.

B. Fully recessed into wall.

C. Removable cap to easily get to lint screen. Cap to have window to see lint screen.

D. 4” inlet outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install level and plumb in orientation shown on drawings. Provide ceiling-mounted access panels of suitable size when installed above hard ceiling.

B. Ceiling Units: Suspend units from structure; use all-thread rod or metal straps.

C. Install units with clearances for service and maintenance.

D. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with hard slip-on clamp-type connectors. Slip connectors can be slipped out down adjacent duct allowing removal of fan.

E. Ground equipment according to Division 26 Specifications.

F. Connect wiring according to Division 26 Specifications.

G. Install visual LED indicator panel on wall above dryer.

H. Install secondary dryer lint trap.

I. The lint trap must be installed in an accessible location for the dryer user.

J. Install lint trap recessed in the dryer duct in wall just above the dryer.

K. Install vent box recessed into wall with vertical up connection.

END OF SECTION 23 34 24

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SECTION 23 36 00 – AIR TERMINAL UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Variable Air Volume Box (VAV) with Hydronic Heating Coil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 VARIABLE AIR VOLUME BOXES (VAV)

A. For capacity and size see Equipment Schedule on drawings.

B. Casing: 26-gauge dual wall galvanized steel.

C. Factory installed dual wall access door in the bottom panel of each VAV box furnished with a heating coil.

D. Insulation of terminal units shall be ½" thick, 1-1/2# density fiberglass between dual walls. Insulation must be UL approved and meet NBFU and NFPA 90A requirements.

E. Control valve: shall seal against gasketed stops for minimum leakage. Maximum and minimum mechanical stops shall be provided. Total leakage of casing and valve shall not exceed 1% at 3" inlet static pressure.

F. VAV Control Options:

1. Air Flow Sensor: Integral multiple point air flow sensor to provide primary air flow within ±10% at 400 FPM air flow. Provide integral flow taps and calibration chart with each unit.
2. Damper Actuator and Controller shall be provided by Temperature Control Contractor and installed by the VAV box manufacturer. Actuator shall provide tight close off to 100% open. Coordinate exact requirements with Temperature Control Contractor (TCC).
3. DDC controller by TCC. Factory install controller when requested and as directed by TCC. Installation of TCC's controller shall include, but not be limited to, mounting controller, damper actuator and pneumatic tubing to air flow sensor. Filter for pneumatic tubing will be provided by TCC. Cost to install control components shall be borne by VAV manufacturer.
4. **Provide gauge taps for airflow measurement by test and balance contractor.**
5. Reference Control Section for additional information.

G. Hydronic Heating Coil: provide with hydronic coil with capacity as noted on drawings. Ends of coils shall be insulated.

H. Manufacturers:

1. Trane
2. Envirotec
3. Titus
4. Krueger
5. Price
6. Carnes
7. Nailor Industries
8. Anemostat
9. Warren
10. Metalaire

2.2 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance. Note: VAV air coils may need reoriented based on installation.

C. Connect ductwork to air terminal units with flexible duct connectors on inlet and discharge air connections. Inlet straight duct diameters shall be per manufacturer’s recommendations.

D. Connect wiring according to Division 26 Specifications.

E. Verify supply and return water connections. Supply is not always on the bottom.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
2. Verify that controls and control enclosure are accessible.
3. Verify that control connections are complete.
4. Verify that nameplate and identification tag are visible.
5. Verify that controls respond to inputs as specified.

END OF SECTION 23 36 00

SECTION 23 37 13 – DIFFUSERS, REGISTERS, GRILLES AND LOUVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling-, floor- and wall-mounted diffusers, registers, and grilles.

This Section includes but is not limited to:

1. Ceiling Diffusers
2. Linear Slot Diffusers
3. Linear Bar Grilles
4. Grilles and Registers
5. Filter Return Grilles
6. Louvers

B. Related Sections include the following:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Square Ceiling Diffusers:

1. Manufacturers:

a. Price Industries
b. Titus
c. Nailor Industries
d. MetalAire

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Size: As scheduled on the Drawings.
5. Face Style: Plaque.
6. Mounting: Surface, T-bar, Snap in or Panel mounted. Reference Architectural drawings for ceiling type.
7. Pattern: Adjustable.
8. Dampers: Butterfly type in neck of diffuser adjustable through face of diffuser.
9. Accessories:

a. Plaster ring (when applicable).
b. All back surfaces factory insulated with foil-backed insulation or molded insulation blanket.

10. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

2.2 LINEAR SLOT DIFFUSERS

A. Manufacturers:

1. Price Industries
2. Titus ML Series
3. Nailor Industries
4. MetalAire

B. Material – Frame: Extruded aluminum.
C. Material – Pattern Controller and Tees: Extruded aluminum.
D. Finish – Frame and Tees: Baked enamel, white.
E. Finish – Pattern Controller: Baked enamel, black.
F. Slot Width: As noted on Schedule.

G. Number of Slots: As noted on Schedule.
H. Length: As noted on Schedule or Drawings.
I. Mounting: T-bar or surface-mount. Provide appropriate end configuration and frame for application. Reference Architectural drawings for ceiling type.
J. Accessories:

1. Steel plenum with factory installed external insulation.
2. Alignment strips (when required).

2.3 LINEAR BAR GRILLES

A. Manufacturers:

1. Price Industries
2. Titus CT Series
3. Nailor Industries
4. MetalAire

B. Material: Extruded aluminum
C. Construction: Heavy duty construction for floor-mounted applications.
D. Finish: Anodized aluminum, color selected by Architect.
E. Size: Length and width as noted on Drawings.
F. Core Spacing Arrangement, Mounting and Frame: As noted on Drawings.
G. Damper Type: Adjustable opposed blade (where noted on Drawings).
H. Accessories:

1. Alignment strips (for lengths over 72”).
2. Blank-off strips (where noted on Drawings).

2.4 GRILLES AND REGISTERS

A. Manufacturers:

1. Price Industries
2. Titus
3. Nailor Industries
4. MetalAire

B. Capacity, size, and noise criteria as Scheduled (Return and Exhaust). Additional sizes may be required as indicated and noted on individual Drawings.
C. Material: Heavy gauge steel or heavy gauge aluminum. Provide aluminum construction for installations in shower rooms and corrosive environments.
D. Finish: Baked enamel, white (unless noted otherwise on Drawings).
E. Mounting: Concealed fasteners

F. Frame: 1-1/4” wide.
G. Metal plaster frames: for grilles mounted on plaster, masonry, fiber or metal construction surfaces.
H. Panel mounted where installed in T-bar ceilings unless noted otherwise.
I. Volume Damper: Opposed blade operable through face of grille.
J. Deflecting Blades: 3/4" spacing
K. Supply Grilles: Similar to Titus 272 Series - airfoil blades, double deflection. Horizontal blades always mounted nearest grille face.
L. Return Grilles: Similar to Titus 350 Series - single deflection blades fixed at 35°/45° down (unless noted otherwise on Drawings).
M. Exhaust Grilles: Similar to Titus 350 Series - single deflection blades fixed at 35°/45° down.

2.5 FILTER RETURN GRILLES

A. Manufacturers:

1. Price Industries
2. Titus 355RLF1
3. Nailor Industries
4. MetalAire

B. Material: Heavy Duty Steel
C. Finish: Baked enamel, white.
D. Blades: 35° fixed, 1/2” spacing, blades to run parallel to long dimension.
E. Construction: Designed for 1” filter media complete with holding frame. Grille to drop down to change filter – hinged on one side with 1/4 turn quick release fasteners on opposite side.
F. Filter Media: Provide filter media for filter changes as specified in Section 20 00 10.
G. Installation:

1. Filter grilles used to filter return air on terminal units such as Fan Coils.
2. When grilles are installed in ceiling, install grilles so blades are angled toward wall to minimize visibility of filter.
3. When grilles installed in wall put hinge at bottom. Blades to angle up toward front of grille, so that when looking up at grille from floor, filter is not visible.
4. Reference Drawings for additional information.

2.6 LOUVERS

A. 4” Extruded Aluminum Louvers 50% FA

1. Factory fabricated nominal 4” width frame for recess mounting (no flange overlap).
2. Blades: 6063T5 alloy minimum cross section .080”, two weather stops. All blades longer than 36” to have concealed vertical bracing.

3. Frame: same material and thickness as blades.
4. Screen: ½" mesh, .047" wire. Located screen behind blades, screen permanently attached.
5. Louver and screen constructed of aluminum.
6. Louvers to have minimum of 50% free area.
7. Finish – Anodized Aluminum.
8. Manufacturers:

    a. Greenheck
    b. Airflex Model SL Frame #2
    c. Carnes Model L-30
    d. Vent Products Type VSL-4
    e. Air Guide OL-4
    f. Ruskin
    g. United Enertech FL-D-4
    h. Pottorff

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel if not of panel dimension. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 82 16 – AIR COILS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes air coils.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 COILS

A. General

1. Coil capacities, size and number of rows as shown on Drawings. In no case shall coils be furnished with fewer rows of tubes than shown on Drawings.
2. Coil connections for supply and return shall be clearly marked to ensure that direction of coil water flow is counter to direction of airflow.
3. All coils shall be burst tested to 300 PSIG and proof tested underwater to 200 PSIG unless otherwise noted.
4. All hydronic coils shall have manual air vent and drain valve.
5. Coils shall be extended surface type constructed of copper tubing not less than 5/8" O.D. with .025" wall.

6. Fins fastened to tubes with sufficient pressure to insure permanent metallic bond or rolled into headers. Fins shall be uniformly spaced not closer than 1/8" center to center. Minimum Fin thickness .0095".
7. Each cooling coil section mounted in 16-gauge, 304 stainless steel casing and each heating water coil mounted in 16-gauge galvanized steel casing with drilled mounting flange unless otherwise noted. Coils to have intermediate tube supports to prevent tube sagging.
8. Coils to be set and rigidly supported with angles and fastened to building or CSAC structure. Coils pitched for proper condensate or water drainage.
9. Internal spirals not used unless specifically noted on Drawings.
10. All coil performance shall be certified in accordance with AHRI Standard 410.
11. Coil connection nipples to coil headers to be red brass.

B. Hot Water and Chilled Water Coils

1. Standard serpentine type and pipe so entering water is connected to leaving air side of coil. Coils shall be ARI Certified.

C. Manufacturers – Same as manufacturer of equipment they are installed in or:

1. Carrier
2. Trane
3. McQuay
4. York
5. Temtrol
6. Haakon
7. Engineered Air
8. HeatCraft
9. Aerofin
10. Coilmaster Corp
11. Greenheck
12. Capitol Coil & Air
13. RAE Coils

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Straighten bent fins on air coils.

D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

E. Pipe coils as detailed on drawings.

F. Install piping adjacent to coils to allow service and maintenance.

G. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section “Instrumentation and Control for HVAC”.

H. Install ball valve with hose bib connection and cap to drain coils.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 82 16

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SECTION 23 82 33 – CONVECTORS - HYDRONIC

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hydronic convectors.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Samples: For each exposed product and for each color and texture specified.

D. Field quality-control test reports.

E. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 CONVECTOR – FINNED TUBE

A. Convector capacity, size and cabinet type as shown on Drawings.

B. Elements suitable for hot water or steam service, constructed of copper tubing with non-ferrous fins securely bonded to tubing. Element headers securely fastened to tubing and tapped for required piping arrangement so as not to trap air or condensate. Elements reinforced with steel side plates, factory tested to 150 psi, mounted on adjustable legs or clips and pitched in field to insure proper circulation and drainage.

C. Cabinet enclosure constructed of 16-gauge steel and exposed fronts constructed of 14-gauge steel with all exposed corners rounded. Cabinet braced and reinforced to provide suitable stiffness with front fastened in place with quick opening fasteners. Cabinet bonderized and painted inside and outside in color selected by the Architect/Engineer.

D. Grilles to be directional vaned type stamped as an integral part of cabinet front.

E. Cabinet types noted on Drawings as hereinafter described.

1. Wall-Hung: suspended approximately 5” to 6” above the floor and have front outlet grille and open at bottom.
2. Semi-Recessed: to extend 2-1/2” into finished room, front inlet and outlet grilles, four side overlap (approximately 1-1/2” flanged type front cover) and mounted above baseboard or base cover.
3. Fully Recessed: front inlet and outlet grilles, four side overlap, recessed into construction with no extension into finished room and mounted above baseboard or base cove.

F. Manufacturer:

1. Sterling
2. Zhender Rittling
3. Trane
4. Modine
5. Vulcan
6. Sigma Products
7. Approved equal

PART 3 - EXECUTION

3.1 CONVECTOR INSTALLATION

A. Install units level and plumb.

B. Install valves within reach of access door provided in enclosure.

C. Install air-seal gasketing between wall and recessing flanges or front cover of fully recessed unit.

D. Install piping within pedestals for freestanding units.

3.2 CONNECTIONS

A. Connect hot-water units and components to piping as detailed on drawings.

1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.

B. Install control valves as required as indicated on drawings.

C. Install piping adjacent to convection heating units to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper convection heating unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace convection heating units that do not pass tests and inspections and retest as specified above.

END OF SECTION 23 82 33

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SECTION 23 82 39 – UNIT HEATER

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cabinet unit heaters with centrifugal fans and hot-water coils.
2. Propeller unit heaters with hot water coils.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Equipment schedules to include rated capacities, furnished specialties, and accessories.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sterling

2. Engineered Air Ltd.
3. International Environmental Corporation.
4. Modine
5. Zhender Rittling
6. Trane.
7. Airtherm
8. Vulcan
9. Sigma Products

B. Description: A factory-assembled and -tested unit complying with ARI 440.

1. Comply with UL 2021.

C. Coil Section Insulation: Flexible elastomeric insulation.

1. Thickness: 1/2 inch.
2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.

D. Cabinet: Steel with baked enamel finish with manufacturer's standard paint, in color selected by Architect.

1. Vertical Unit, Exposed Front Panels: Minimum 14-gauge sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
2. Horizontal Unit, Exposed Bottom Panels: Minimum 14-gauge sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
3. Recessing Flanges: Steel, finished to match cabinet.

E. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Glass Fiber Treated with Adhesive: Minimum MERV 4.

F. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

G. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 20, Section 20 00 50.
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

H. Electrical Connection: Factory wire motors, controls and unit mounted fused disconnect switch for a single field connection. Voltage as scheduled on the Drawings.

I. Capacities, Characteristics and Arrangement:

1. As scheduled on the Drawings.

2.2 PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sterling
2. Engineered Air Ltd.
3. Modine.
4. Zhender Rittling.
5. Trane.
6. Sigma Products

B. Description: An assembly including casing, coil, fan, and motor in discharge configuration scheduled on the Drawings.

C. Comply with UL 2021.

D. Cabinet: Removable Panels for maintenance access to controls.

E. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.

F. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

G. Hot Water Coil: Test and rate hot water propeller unit heater coils according to ASHRAE 33. Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.

H. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

I. Fan Motors: Comply with requirements in Division 20, Section 20 00 50.

1. Motor Type: Permanently lubricated. Voltage as scheduled on the Drawings.
2. Factory installed and wired fused disconnect switch.

J. Electrical Connection: Factory wire motors, controls and unit mounted fused disconnect switch for a single field connection. Voltage as scheduled on the Drawings.

K. Capacities, Characteristics and Arrangement:

1. As scheduled on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Suspend cabinet unit heaters from structure with elastomeric hangers and vibrations isolators. Vibration isolators are specified in Division 20, Section 20 00 50.

C. Suspend propeller unit heaters from structure with all-thread hanger rods.

D. Install new filters in each unit before starting supply fans.

E. Piping installation requirements are specified in other Division 20 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

F. Install piping adjacent to machine to allow service and maintenance.

G. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors.

H. Comply with safety requirements in UL 1995.

I. Ground equipment according to Division 26 Specifications.

J. Connect wiring according to Division 26 Specifications.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 82 39

SECTION 23 82 43 – RADIANT CEILING PANELS - HYDRONIC

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Radiant Ceiling Panels - Hydronic.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include a schedule showing unique model designation, room location, model number, size and accessories furnished.

C. Samples: For each exposed product and for each color and texture specified.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicating size, profiles and dimensional requirements of radiant panels are based on the specific system indicated.

1.4 COORDINATION

A. Coordinate layout and installation of radiant panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system and partition assemblies.

PART 2 - PRODUCTS

2.1 RADIANT CEILING PANELS - HYDRONIC

A. Linear radiant panels shall use extruded aluminum with integrated heat sinks on the back to transfer heat between copper tubes and the panel face. The linear radiant panel is to radiate or absorb heat from or to the zone below.

B. Water Tubes: Tubes shall consist of seamless ½" nominal (5/8" OD) copper tubing. ½" nominal (5/8" OD) return bends and interconnectors shall be flared ends and be shipped loose. Water connections shall be suitable for solder, compression fittings or threaded connection.

C. Heat Sinks: Heat sinks shall be extruded aluminum and copper piping will be mechanically fastened to the heat sink. A non-hardening heat transfer paste is required between the tubing and the heat sink.

D. Extruded Aluminum Planks: The panel shall be constructed of 0.0725" thick minimum extruded aluminum. The extruded aluminum panels shall interlock using tongue and groove connections and be mechanically held together.

E. Insulation: All active panels shall be insulated with 1" thick, ¾ lb. density fiberglass insulation.

F. Dimensions: Panel lengths and widths as indicated on the drawings. Total width and number of tubes should meet the required design specifications.

G. Capacity: As scheduled. Linear radiant panel capacity shall be tested and certified by the manufacturer to meet performance listed on the schedule.

H. Finish: All visible components shall be powder-coated with polyester paint. Color to be manufacturer's standard white unless noted otherwise. Contractor to provide all T-bar trim framing for installations in hard ceilings or bulkheads. Division 23 contractor shall be responsible for the coordination of the installation.

I. Mounting: Radiant panels shall be mounted in lay-in or drywall ceiling. Manufacturer shall provide all required hardware for suspension support system.

J. Manufacturers

1. Sterling
2. Price
3. Airtex
4. Vulcan
5. Zhender Rittling
6. Sigma Products

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install radiant panels level and plumb. Maintain sufficient clearance for normal services, maintenance or in accordance with construction drawings.

B. Install radiant panels according to manufacturer's instructions.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that controls and control enclosure are accessible.
2. Verify that control connections are complete to control valves as needed.
3. Verify that any identification tags are visible.
4. Verify that controls respond to inputs as specified.

3.2 CONNECTIONS

A. Connect radiant panels and components to piping as detailed on drawings.

1. Install shutoff valves and unions on inlet and outlet, strainer on inlet and balancing valve on outlet.

B. Install control valves as indicated on drawings.

C. Install piping adjacent to radiant panels to allow for service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, fill water tubes and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace convection heating units that do not pass tests and inspections and retest as specified above.

3.4 CLEANING AND PROTECTION

A. Clean all visible surfaces of equipment; touch up as required.

B. Protect all units before, during and after installation. Damaged materials due to improper protection shall be cause for rejection.

END OF SECTION 23 82 43

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions apply to all electrical work.

1.02 DESCRIPTION OF WORK

A. Section 26 05 00 applies to all electrical materials, equipment, installations and services supplied under any portion of the work.

B. All work must meet or exceed all Local, State and Federal Codes and ADA Guidelines.

C. All Electrical Contractor or Electrical Sub-contractor work shall be performed by a licensed and bonded Electrical Contractor with at least five (5) years of successful installation experience on projects with electrical work similar to this project.

D. The Electrical Contractor or Electrical Sub-contractor shall coordinate the Basic Requirements as applicable to any equipment, installations and services of an electrical nature.

E. It is the intention of this Division of the Specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system.

F. The Contract drawings indicate the extent and the general location and arrangement of equipment, conduit and wiring. The General Contractor and their Electrical Sub-contractor shall study the plans and details and shall coordinate with all other trades to prevent conflict and interference with other installations.

G. The Electrical Contractor or the Electrical Sub-contractor is responsible for installation of a complete and operating electrical system in accordance with the intent of the Drawings and Specifications.

H. Any minor changes in location of equipment and conduits from those shown on the plans shall be made without extra charge if so directed by the Owner prior to installation.

I. All equipment shall be installed such that maintenance and service may be properly accomplished. If necessary, the Owner may at their option require the contractor to demonstrate the service on any piece of equipment to determine sufficient service space exists. If service space is not adequate, the equipment shall be relocated at no additional cost to the Owner so that sufficient service space is achieved.

1.03 PERMITS AND FEES

A. This work shall include the procurement of and payment for all permits and fees for the performance of the electrical work.

1.04 SUBMITTALS

A. The following items that shall be submitted for approval prior to ordering. Submit individually by the appropriate Specification Section number.
   1. Raceway (unless special raceway is specified a letter on Company letterhead stating the products to be used are in conformance with the Specifications is acceptable as a Submittal. Check with Engineer/Owner)
   2. Wire (unless special wire is specified a letter on Company letterhead stating the products to be used are in conformance with the Specifications is acceptable as a Submittal. Check with Engineer/Owner)
   3. Wiring Devices and Covers
   4. Lighting Fixtures
   5. Disconnect Switches
   6. Motor Starters
   7. Panelboards and Switchboards
   8. Fire Alarm
   9. Others as required by the related Division 26 Section.

B. Submission of the above information shall be electronically in ISU approved PDF Format.

1.05 PROJECT CLOSEOUT

A. On Electrical Prime Projects one set of all Project documents shall be submitted electronically in PDF Format on a USB Flash Drive. The following is a list, but not limited to, of required documentation to be included on the USB flash drive:
   1. Bid Form
   2. Award Letter and Contract for Construction
   3. Meeting minutes and supporting documentation.
   4. Reviewed submittals and reviewed shop drawings
   5. All Change documentation, e.g. ASI, RFI, CCD, RFP, CP, CO, etc.
   6. Pay Applications
   7. Installation instructions and schematic drawings
      a. Complete parts list with manufacturer's model numbers.
      b. Complete wiring diagrams showing all connections and internal wiring. Factory typical wiring diagrams are not acceptable.
   8. Operating and maintenance instructions.
   9. Warranty and guarantee information
   10. Substantial Completion documents to determine start of Warranty Period

B. When individual Specification Sections call for close-out submission they may be combined on a master Project close-out USB flash drive with itemized files and sub-files for each Section.

C. Additionally, submit one hard copy of the O&M's in a 3-ring binder and unfolded Record Drawings.

D. Prior to release of final payment, Indiana State University must receive a complete set of record drawings in AutoCAD 2010 on a CD or DVD. The Design Engineer and the Indiana State University Department of Facilities Management engineering staff must approve these drawings.

1.06 COPPER REQUIREMENTS FOR ELECTRICAL EQUIPMENT

A. All current-carrying components (phase, neutral and ground) of all electrical equipment shall be copper. No CUAL allowed without prior approval of Owner.

B. Exceptions: molded case circuit breakers with in-built lugs and safety switches.

1.07 UNDERGROUND UTILITIES

A. All underground utility lines shall be buried a minimum of 36" below finished grade.

B. Place 3" of compacted red sand below all buried utility lines and cover with 12" of red sand.

C. Remainder of the trench shall be back filled with new topsoil free of debris, compacted in 6" lifts to 98% standard proctor using the water jet method.

D. Install the appropriate 6" wide marker tape a minimum of 12" above any buried utility line.

1.08 NEUTRAL RULES

A. Neutral rules and requirements for multi-circuit branch raceway installations.

1. A separate dedicated neutral shall be installed for every phase conductor in a multi-circuit 120-volt or 277-volt raceway.
2. Neutrals shall be marked in such a way as to prevent the accidental crossing of neutrals at device locations.
3. Neutrals in 120-volt applications shall be white, gray in 277-volt applications.
4. This includes pre-wired raceway systems such as ISODUCT and systems furniture.
5. No sharing of neutrals is allowed.

B. Oversizing of neutral conductors shall not be allowed in lieu of the preceding rules and requirements.

C. <u>THESE RULES SUPERCEDE ANY OTHER NEUTRAL INSTRUCTIONS EITHER WRITTEN OR IMPLIED IN ANY OTHER SPECIFICATION SECTION OR SHOWN ON DRAWINGS.</u>

1.09 RACEWAY SYSTEMS INSTALLATION SUMMARY

A. Provide conduits, cable trays, surface raceways, boxes, fittings and supports to form a complete, coordinated, and continuously grounded raceway system.

B. No more than three (3) single phase (120volt and 277volt) circuits shall be installed in a conduit raceway system.

1.10 RACEWAY REQUIREMENTS

A. Conduits indoors in general areas shall be electrical metallic tubing (EMT) with steel set screw or compression fittings.

B. Conduits indoors in hazardous areas, encased in concrete floorslabs or subjected to water, physical damage or abuse shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC) with cast or malleable iron threaded fittings and bushings.

C. Conduits indoors for medium voltage distribution circuits or for fire pump feeders shall be galvanized rigid steel conduit with cast or malleable iron threaded fittings and bushings.

D. Conduits outdoors shall be galvanized rigid steel or intermediate metal conduit with cast or malleable iron threaded fittings and bushings.

E. Conduits encased in concrete underground shall be Type DB PVC for IT applications and Schedule 80 for MV applications both with matching fittings.

F. Conduits direct buried underground shall be Schedule 40 PVC with matching fittings.

G. Conduits in steam tunnels shall be galvanized rigid steel or intermediate metal conduit with cast or malleable iron threaded fittings and bushings. Exceptions to this requirement are tunnel segments inside building (i.e., mechanical rooms) where EMT may be used.

H. Final connections to recessed lighting fixtures and under counter lights shall be 1/2" minimum flexible metallic conduit, manufactured wiring systems, or galvanized steel Type MC Cable all with steel fittings.

   1. Manufactured wiring systems shall
      a. Only be used above accessible ceilings.
      b. Shall not be used in walls or above permanent ceilings.
      c. Shall contain a dedicated, separate, grounding conductor.

   2. Type MC cable conductors shall be color coded to match the building color-coding scheme. Type MC Cable shall be terminated with steel setscrew connectors that have integral insulating bushings. Self-locking, twist-in type fittings are not acceptable.

I. Final connections to motors, transformers and equipment subject to vibration or removal for maintenance shall be 1/2" minimum liquid tight flexible metallic conduit with steel liquid tight fittings. Transformer connections may be non-liquid tight flexible metallic conduit in electrical rooms only.

J. Connections to recessed power receptacles and light switches in areas with accessible ceilings:

   1. In new 'metal stud and gypsum board partitions (walls)' and in existing 'metal stud and gypsum board partitions (walls)', where the wall is not being otherwise opened up, the final connections may be made with type MC Cable. This MC Cable, shall:

      a. Be run to a box immediately above the accessible ceiling, and the box size shall not exceed 4-11/16" square.
      b. Conduit shall be used for the entire run, from this junction box, to the power source, load (lights), etc.
      c. No more than three circuits may be run through any given junction box.

d. Individual conductors making up the MC cable shall be stranded copper, with separate grounding conductor, and steel corrugated armor. Individual conductors shall be color coded as required in section 16120.
e. The MC Cable is terminated using UL listed hardware intended for the cable and boxes being used, (and rated for commercial and industrial environments).
f. The MC Cable shall be secured in the wall cavity as required by NEC.
g. The MC Cable shall be as short as it is necessary to serve the need and meet the Code.

K. In areas with non-accessible ceilings devices shall be installed with standard conduit; run back in a continuous installation to a junction box located at an access point in the ceiling.

L. Connections to other recessed devices, (including communication outlet boxes, junction or pull boxes, etc) shall be with standard conduit of the type appropriate for the wall construction.

1.11 CABLE TRAY REQUIREMENTS

A. Power and telecommunications cable trays shall be aluminum, ladder type, of the sizes shown on the drawings.

B. Center spline telecommunications cable tray may only be used where shown.

C. Changes in cable tray direction or elevation shall be made using standard fittings from the same manufacturer as the cable tray.

D. Barriers shall be installed in cable trays where shown to separate circuits of different voltage levels.

1.12 SURFACE RACEWAY REQUIREMENTS

A. When conduits in finished areas cannot be concealed in walls or above ceilings, surface raceways may be used where permitted. Boxes and fittings shall match and be from the same manufacturer as the raceways.

B. Raceway shall be metal and white in color unless otherwise noted on the drawings.

C. Contractor shall verify with the Owner if the use of metal surface raceway is acceptable.

1.13 BOX REQUIREMENTS

A. Provide sheet steel outlet boxes, extensions, and plaster rings for EMT, flexible metal conduit, and MC cable.

B. Provide cast or malleable iron outlet boxes and covers for galvanized rigid steel conduits, intermediate metal conduits, and liquid tight flexible metal conduits.

C. Boxes shall be sized for all conductors and devices to be contained within. Box extensions shall not be used to correct for undersized boxes. A single extension may be used as follows only if all free conductors extend at least 3 inches outside of the extension opening.

1. On boxes being flush mounted in masonry walls.
2. On existing boxes in walls that are being furred out.
3. On existing boxes for connecting to an existing circuit.

4. On fire alarm, security and clock system boxes where required by the system manufacturer's instructions.

D. Plaster rings shall not be considered box extensions, but their capacities may be included in box fill calculations.

1.14 SUPPORT REQUIREMENTS

A. Mechanical Areas and Tunnels

1. Surface mounted equipment shall be secured to steel channels.
2. Surface mounted raceway 1½" and smaller and boxes maybe attached directly to surfaces.
3. Multiple raceway runs maybe attached to
   a. A trapeze system with approved straps
   b. Trapeze shall be attached to the structure by steel channels and threaded rod.
4. Vertical surface race way 1½" maybe attached by:
   a. Below 8' by one- or two-hole straps
   b. 8" and above with pipe hangers ("Minerallac style hangers")
5. The channels and raceway shall be attached with toggle bolts to hollow tile, block or similar surfaces, and attached with screws or bolts and expansion shields to solid masonry or concrete.

B. Finished Areas Above Suspended Ceilings

1. Raceway and boxes maybe attached directly to surfaces with appropriate straps or hangers.
2. Multiple raceway runs maybe attached to
   a. A trapeze system with approved straps
   b. Trapeze shall be attached to the structure by steel channels and threaded rod.
3. The channels and raceway shall be attached with toggle bolts to hollow tile, block or similar surfaces, and attached with screws or bolts and expansion shields to solid masonry or concrete.
4. Attachment of raceway to ceiling grid support wires or rods is not permitted.

C. Finished Areas Inside Walls

1. Raceway and boxes shall be attached to structural members with devices specifically designed for raceway/box attachment to the type of structural member used.

D. Finished Areas Exposed

1. Surface raceway shall be attached to finished surfaces utilizing the factory approved method of attachment.
2. Tape is not acceptable for attachment of non-metallic surface raceway.

PART 2 - PRODUCTS

2.01 CONDUITS

A. Electrical metallic tubing shall be thin wall steel tubing, electro-galvanized or hot dipped galvanized inside and outside. Fittings and bushings shall be galvanized steel set screw type with two screws per connection for sizes over 2".

B. Galvanized rigid steel conduit and intermediate metal conduit shall be hot dipped galvanized inside and outside, in 10' lengths and threaded on both ends. Fittings and bushings shall be cast or malleable iron, and hot dipped galvanized inside and outside.

C. PVC conduit and fittings shall be Type DB for encasement in concrete for IT applications, Schedule 40 for direct burial, concealed and exposed work, and Schedule 80 in MV Duct Banks. Fittings shall be of the same type and from the same manufacturer as the conduit. PVC conduit shall be UL Labeled for 90 degrees C cables. Approved Manufacturers:
   1. Cantex
   2. Carlon
   3. National Pipe & Plastic.

D. Flexible metallic conduit shall be galvanized steel or aluminum. Fittings shall be of steel with cadmium or galvanized finish. Fittings shall be machine screw clamp type, single or two-piece. Self-locking, twist-in type fittings are not acceptable.

E. Liquid tight flexible metallic conduit shall consist of a flexible, galvanized steel core, a continuous copper ground strip and a polyvinyl chloride jacket. Fittings shall be steel liquid tight grounding type from the same manufacturer as the conduit.

2.02 CABLE TRAYS

A. Ladder type cable tray shall be aluminum, of the width shown, with 4" rail height, 13/16" minimum rung width, and 9" maximum rung spacing. The tray with a 10' span shall be capable of sustaining a working load of 145 pounds per lineal foot with a load deflection of 1.0" when tested in accordance with NEMA VE1-3.01. Approved Manufactures:
   1. B-Line
   2. Chalfant
   3. Cope
   4. Globetray
   5. Husky
   6. Mono-Systems
   7. Square D
   8. Wiremold.

B. Center spline cable tray shall be aluminum, of the width shown, with top mounted rungs, 3” load depth, 13/16” minimum rung width, and 9” maximum rung spacing. The tray with a 10' span shall be capable of sustaining a working load of 145 pounds per lineal foot with a load deflection of 1.0" when tested in accordance with NEMA VE1-3.01.

C. Tray fittings including horizontal and vertical bends, tees, crosses, reducers, splice plates and expansion joints shall be from the same manufacturer and of the same product line as the tray. Bends, tees, crosses and reducers shall have a 13/16” minimum rung width, a 9" maximum rung spacing, and a 12" minimum bend radius.

D. Tray fasteners shall be galvanized or zinc plated steel.

2.03 SURFACE RACEWAYS

A. Where surface raceways are called for on the drawings, or when conduits in finished areas cannot be concealed in walls or above ceilings, surface raceways shall be used. Boxes and fittings shall match and be from the same manufacturer as the surface raceway.

B. Surface raceways shall consist of a base and cover, sized for the number of conductors contained within, complete with all connectors, fittings, bushings, boxes, covers and mounting hardware.

C. Raceways shall be 600 volt rated, and be in compliance with the applicable paragraphs of NEC Article 352.

D. They shall be non-flammable, and UL labeled, under UL 5, or UL 5A (as applicable).

E. The completed raceway system shall be vandal resistant.

F. Shall accept receptacles, cover plates, telephone/data outlets and other standard wiring devices as specified elsewhere in these specifications.

G. The cover plates used for wiring devices and telecommunication outlets shall be of the 'overlapping' type, and shall therefore cover the 'cut-end' of the raceway cover.

H. The raceways shall have "scuff" resistant finish, and the raceways shall be paintable.

I. All components of the raceway system exposed to view shall be of the same color and shade.

J. Barriers shall be provided when necessary to separate conductors of different voltages, or services.

K. Surface raceways shall be steel or plastic as noted below, and as noted on the drawings:

L. Type Standards Manufacturers

1. Metallic
    a. Metallic raceways shall be of .040" thick (minimum) zinc plated or galvanized steel.
    b. The acceptable levels of quality are, generically,
        1) Like "Wiremold V500 and V700" for smaller single channel raceway applications,
        2) Like "Wiremold V3000" for larger single channel raceway applications, and
        3) Like "Wiremold V4000" for larger multi-channel raceway applications.
    c. Manufacturers include Wiremold, Hubbell, Thomas and Betts, or Mono-System.
2. Plastic
    a. Plastic raceways shall be of a material meeting all of the requirements of UL 5A, (including flammability, resistively structural strength, etc.).
    b. The acceptable levels of quality are, generically,
        1) Panduit LD series, or Carlon Series 30 for smaller single channel raceway applications;
        2) Panduit Type T-70, or Carlon "Premiere", for larger single channel raceways, and smaller multi-channel raceways; and
        3) Panduit Twin 70 or Carlon "Prestige", for larger multi-channel raceway applications.
    c. Manufacturers include Panduit, Carlon, Hubbell, Mono Systems, and Wiremold.

M. Use vertical surface raceways from junction boxes above the ceiling, to the horizontal portion of the surface raceway. Locate vertical section as close to room corners (or 'vertical breaks' in mid wall) as is possible. Use of exposed vertical conduits is not acceptable.

2.04 BOXES

A. Boxes for fixtures, outlets, switches, equipment connections and wire pulling shall be

1. Cast or formed from carbon steel sheets of commercial grade steel not less than 14-gauge,
2. One-piece construction, zinc, or cadmium plated,
3. Tapped for mounting plates and covers as required.

B. Pull and junction boxes shall be:

1. Fabricated from galvanized or painted code gauge cold rolled carbon steel sheets.
2. Welded construction with flat removable covers fastened to the box with machine screws.
3. Seams and joints shall be closed and reinforced with flanges formed of the same material from which the box is constructed or by continuous welding which will provide equivalent strength to flange construction.
4. Preferably not provided with 'knockouts'.

C. Box covers shall be fastened in place by machine screws or hinges and latches. Self-tapping or sheet metal fasteners are not acceptable.

2.05 SUPPORTS

A. Hangers and brackets shall be made of steel pipe, channel iron, angle iron or prefabricated steel channel. Prefabricated steel channel shall be by B-Line, Hilti, Powerstrut or Unistrut.

B. Anchors shall be lead shield anchors or plastic expansion anchors for small loads, and expansion or epoxy anchors for large loads. Powder-driven anchors shall not be used.

2.06 LABELS AND DIRECTORIES

A. Equipment nameplates shall be engraved .125-inch (1/8") thick 'Lanaloid' (Lanacoid) plastic. White, with black letters. The engraved letters shall be at least one quarter inch (¼") high.

B. Receptacles and lighting switch covers shall be labeled using clear adhesive backed nylon or Mylar tape with black text permanently laminated to the tape.

C. Panel directories shall be typed on supplied card stock with panel, or card stock similar in thickness and material as those supplied with the panels. Install supplied clear plastic cover, or one of like material.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall conform to all applicable Codes and Construction Standards.

B. All installations shall be warranted for a period of one (1) year against defects in material and workmanship.

C. The Owner reserves the right to relocate any device fifteen (15) feet prior to installation at no additional cost.

D. Material Storage

1. All materials shall be new and in original factory packaging.
2. All material shall be kept dry and clean.
3. The Owner reserves the right to reject any material not properly stored.

E. Contractor shall swab clean the interior of all raceway prior to pulling wire.

F. Device plate screw slots shall be oriented vertically.

3.02 RACEWAYS

A. Size conduits in accordance with the NEC, but not less than the sizes shown on the drawings. Minimum power, fire alarm and control conduit size shall be ¾". Minimum telecommunications conduit size shall be 1".

B. Install concealed and exposed conduits and cable trays parallel to or at right angles to building lines. Conduits shall not be embedded in concrete slabs except where specifically shown. Install surface raceways as close to room corners or trim features as possible to make the surface raceways less obvious.

C. Make directional changes in primary power distribution conduits above ground with sweeps and long radius elbows, and underground with 20' minimum radius bends.

D. Conceal conduits wherever possible and practical. When conduits cannot be concealed in finished areas, use surface raceways with matching boxes from the same manufacturer as the raceways.

E. Metal conduits, fittings, enclosures and raceways shall be mechanically joined together in a firm assembly to form a continuous electrical conductor providing effective electrical grounding continuity.

F. Provide expansion fittings at the intervals specified in the manufacturer's instructions.

G. Conduits entering panels located outdoors, in parking structures, in steam tunnels and on cooling towers shall enter from the sides, back, or bottom. Conduits shall not enter from the top.

H. Separate raceways from uninsulated steam pipes, hot water pipes, and other hot surfaces by a minimum of 4" horizontally or 12" vertically. Separate raceways from ventilation ducts and insulated pipes so that they do not come into contact with each other.

I. Low voltage signal circuits shall be separated or shielded from power circuits to prevent the induction of noise into the signal circuits.

J. EMT entering sheet metal enclosures and outlet boxes shall be secured in place by a connector with a locknut. Rigid conduit shall be secured with locknut inside and outside and a bushing. Sufficient thread on the connector or conduit shall extend into the enclosure so that the bushing will butt tight into the connector or conduit. Bushings shall not be used as jamb nuts or in lieu of locknuts.

K. Flexible metallic conduit to motors and similar equipment shall not exceed 3'-0" in length, and shall have adequate slack to absorb the maximum vibration. Flexible conduit connections to lighting fixtures shall not exceed 6'-0" in length.

3.03 MOUNTING HEIGHTS

A. Except where shown otherwise, install equipment and devices at the following heights:

1. Receptacles (Wall): 18" A.F.F. to center
2. Receptacles (Above Counter): 48" A.F.F. to center or 4” minimum above countertop or backsplash.
3. Receptacles (Unfinished Area): 48" A.F.F. to center
4. Surface Raceway Receptacle Strips: 42" A.F.F. to bottom
5. Light Switches: 48" A.F.F. to center
6. Telephone Outlets (Wall Phone): 48" A.F.F. to center
7. Telephone/Data Outlets: 18" A.F.F. to center
8. Clock Outlets: 88" A.F.F. to center
9. Fire Alarm Pull Stations: 45" A.F.F. to center
10. Fire Alarm Horn/Strobes: 80" A.F.F. to bottom or 1’ below finished ceiling whichever is lower.
11. Card Readers: 48" A.F.F. to card slot
12. Security System Controls: 48” A.F.F. to center
13. Thermostats/HVAC Controls: 48” A.F.F. to center
14. Panelboards: 72" A.F.F. to top
15. Safety Switches/Motor Starters: 72" A.F.F. to top (except top of handle shall not exceed 78" A.F.F.)
16. Motor Control Pushbuttons: 60" A.F.F. to center
17. Verify with the Owner for heights not otherwise listed.

3.04 SUPPORTS

A. Provide 4" thick concrete housekeeping pads for floor-mounted equipment.

B. Support all electrical items independently of supports provided by the other trades.

C. Support conduits and boxes using steel conduit straps or 1/4-inch minimum diameter threaded rod hangers. Suspended ceiling hangers or hanger wire shall not be used (except to support flexible metallic conduit and manufactured wiring systems).

D. Support cable trays with support brackets or 3/8" diameter minimum threaded rod hangers at intervals not exceeding 8'-0" for straight runs. Additional supports shall be provided at tray fittings.

E. Hangers shall be of sufficient strength that their deflection at mid span does not exceed 1/240 of the hanger span length after the cables are installed.

F. Route flexible metallic conduit, manufactured wiring systems and Type MC cable parallel to or perpendicular to building lines, and in a neat and workmanlike manner. Coil the excess

manufactured wiring systems and Type MC cable, and support independently of the ceiling grid system at intervals not exceeding 3 feet.

3.05 PENETRATIONS, SLEEVES AND FIRE SEALS

A. Cut floor and wall penetrations neatly and to the minimum size required for installation of the equipment and raceways.

B. Provide galvanized steel pipe sleeves for all conduits penetrating floors, exterior walls and roofs.

1. Extend floor sleeves above the floor a minimum of 2 inches.
2. Embed sleeves in new concrete or step-core concrete and grout sleeves into existing concrete with epoxy grout.
3. Seal floor sleeves using fire-sealing systems approved by a Nationally Recognized Testing Laboratory.
4. Seal exterior wall and roof penetrations watertight.

C. Patch both sides of wall penetrations cut for electrical equipment and raceways to seal against the passage of air, sound and fire.

1. Seal cable tray penetrations in fire rated walls using fire sealant bags approved by a Nationally Recognized Testing Laboratory.
2. Seal conduit penetrations in fire rated walls using fire sealing caulk approved by a Nationally Recognized Testing Laboratory.
3. Seal conduit penetrations in non-rated walls using masonry materials that match the wall construction.
4. Fire seal between recessed outlet boxes located on opposite sides of a fire rated wall if the box openings are over 16 square inches and the boxes are less than 24 inches apart.

3.06 EXPANSION FITTINGS

A. Provide expansion fittings at all building expansion joints.

B. Provide expansion fittings, in accordance with manufacture recommendations, in all areas subject to swings in temperature of more than 15 degrees C.

C. Install expansion fittings in all locations were expected expansion difference is ¼", or more, between boxes.

3.07 IDENTIFICATION

A. Provide nameplates and labels in accordance with Article 2.6.

1. Lanaloid labels shall be mechanically secured in place with sheet metal screws and/or bolts and nuts.
2. Labels shall be neatly centered. Place labels in like positions on similar equipment.

B. Color code wiring as noted in Section 26 05 19 3.01 B

C. Color code junction boxes and box covers of

1. Emergency power circuits with red paint
2. Fire alarm circuits with red paint.

3. Temperature control circuits with blue paint.
4. Phone and Data circuits with orange paint.

END OF SECTION 26 05 00

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SECTION 26 05 02 – SELECTIVE ELECTRICAL DEMOLITION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Demolition of electrical items and associated materials as indicated herein or as indicated on the drawings.

1.02 SECTION INCLUDES

A. Removal of designated equipment and devices.

B. Removal of designated construction.

C. Disposal or storage of removed materials.

D. Identification of utilities.

E. Refer to items as indicated.

1.03 SUBMITTALS FOR CLOSEOUT

A. Project Record Documents: Accurately record actual locations of terminated utilities and subsurface obstructions.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, safety of structure, dust control, products requiring electrical disconnection and re-connection.

B. Obtain required permits from authorities.

C. Do not close or obstruct egress width to any building or site exit.

D. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

E. Conform to procedures applicable when hazardous or contaminated materials are discovered.

1.05 SCHEDULING

A. Perform work between the hours of 7 a.m. and 7 p.m.

1.06 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied areas.

B. Maintain protected egress and access to the Work.

PART 2 – NOT USED

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect existing materials which are not to be demolished.

B. Notify affected utility companies before starting work and comply with their requirements.

C. Utilize OSHA lockout/tag-out procedures for disconnecting means.

D. Label all wiring to remain (phase and device fed) to assure proper re-connection.

E. Mark location and termination of utilities.

3.02 DEMOLITION

A. Disconnect, remove, cap, identify designated utilities to remain and demolish in an orderly and careful manner.

B. Remove demolished materials from site except where specifically noted otherwise.

C. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

3.03 PROTECTION OF SALVAGED ITEMS

A. Remove, store and protect the materials and equipment scheduled to be re-used.

B. Protect wiring to be re-used by means of a Junction Box

1. Junction Box shall be of sufficient size to permit reconnection of existing wiring to new wiring per NEC Requirements.

2. In outdoor locations the junction box shall be NEMA 3R or a custom junction box with welded seams and gasketed cover.

END OF SECTION 26 05 02

SECTION 26 05 19 – LOW VOLTAGE WIRE AND CABLE

PART 1- GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of electrical wire and cable work is indicated by the Project drawings.

B. Types of wire, cable and connectors in this section include the following:

1. 600 volt insulated copper conductors.
2. Twist on insulated metal spring connectors.
3. Compression connectors
4. Split Bolt connectors

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable of types sizes and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installers: Firm with at least five (5) years of successful installation experience with projects utilizing electrical wiring and cabling work similar to those required for this Project.

C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cable.

D. U.L. Compliance: Comply with applicable requirements of UL Standard 83, “Thermoplastic-Insulated Wires and Cables”, and UL Standard 486A, “Wire Connectors and Soldering Lugs For Use With Copper Conductors”.

E. UL Labels: Provide wire, cable and connectors which are UL listed and labeled.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver wire and cable properly packaged in factory–fabricated type containers or wound on NEMA Specified type non-returnable wire and cable reels.

B. Store wire and cable in a clean dry space. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing, or tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wire and cable is maintained.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufactures offering products which may be used on this Project include, but not limited to, the following:

1. Low Voltage Wire:
    a. American Insulated Wire and Cable
    b. Southwire Company
    c. Others as Approved
2. Electronic Cable
    a. Belden
    b. Alpha
    c. Anixter
3. Twist on insulated metal spring connectors
    a. Ideal
    b. Thomas and Betts Corp
    c. 3M Company
4. Compression
    a. Square D / Anderson
    b. Thomas and Betts

2.02 DESCRIPTION THHN / THWN

A. Conductor:
    1. Bare, soft annealed copper per ASTM B-3.
    2. Sizes 14 - 10 AWG: Solid, bunched, unilay concentric combination unilay or compressed stranded (class C) alternate ASTM B-787, ASTM B-3 or ASTM B-8 and UL-83.
    3. Sizes 8 - 2 AWG: Concentric, compressed stranded (class C) alternate ASTM B-787, ASTM B-8, UL-83 and UL-1063.
    4. Sizes 1 AWG - 750 KCMIL: Concentric, compressed stranded (class B) ASTM B-8, UL-83 and UL-1063.

B. Insulation:
    1. High dielectric polyvinyl chloride (PVC) per UL-83 and UL-1063.
    2. Overall Jacket: Nylon per UL-83 and UL-1063.

C. Cable Identification:
    1. Ink print on jacket for Sizes 14 - 10 AWG (solid conductors): “(size) AWG Type THHN or THWN GAS AND OIL RES II 600V(UL) or AWM VW-1---(Company Name).---C-UL Type T90 NYLON or TWN 75”
    2. Ink print on jacket for Sizes 14 AWG - 750 KCMIL (stranded): “(size) AWG (or KCMIL) Type MTW or THHN or THWN or GAS AND OIL RES II 600V (UL) or AWM---(Company Name).---C-UL Type T90 NYLON or TWN 75.”

3. Also “VW-1” and “FT1” on sizes 14 through 6 AWG and “for CT USE SUN RES” on sizes 1/0 AWG and larger in black.

D. Cables conform to the following standards:

1. UL-83 for THHN-THWN, UL-1063 for MTW (stranded conductors only)

2. Federal Specification J-C-30B, NEMA WC-5, UL-758 for AWM Styles 1316 through 1321, 1408 through 1414, 1452 and 1453.

2.03 ELECTRONIC CABLE - COMMUNICATION AND SIGNAL

A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.

B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.

C. Multi-conductor cables shall have the conductors color coded.

2.04 CABLES AND CONNECTORS

A. General: Provide electrical cables and connectors of Manufacturer’s standard materials, as indicated by published product information.

B. Provide copper conductors with conductivity of not less than 98% at 68^0 F (20^0 C).

C. Electronic cable shall be Plenum rated and as recommended by the Equipment Supplier

D. Connectors shall be for copper-to-copper connections.

E. Insulation: All connectors shall be fully insulated to match insulation type and rating of conductors being spliced.

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL and NECA’s “Standard of Installations”, and in accordance with recognized industry practices.

B. Feeder phase identification from left to right or front to back facing front of equipment shall be one of the following:

Phase A	Phase B	Phase C	Neutral	System
X	Y	Z	N	Any voltage
BLACK	RED	BLUE	WHITE	120/208 volt feeders
BROWN	ORANGE	YELLOW	GRAY	277/480 volt feeders

C. Install all wiring in conduit except as indicated on the drawings or directed by Owner.

D. Pull conductors together where more than one is being installed in a raceway.

E. Use pulling compound or lubricant where necessary. Compound must not deteriorate conductor or insulation. Use of soap is not permitted as a pulling lubricant.

F. Pulling means must not damage cable or raceway.

3.02 COMPRESSION CONNECTORS

A. Use only compression indenter tools designed for the type of connector used.

B. For multiple indentations start at center and indent outward.

3.03 FIELD QUALITY CONTROL

A. Prior to energizing, test all cables and wires with “Megger” to determine insulation resistance levels to ensure insulation integrity.

B. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide grounding for all systems and equipment.

1.02 GROUNDING SYSTEM REQUIREMENTS

A. Each ground rod shall have a maximum resistance to ground of 10 ohms before connection to the other ground rods. If reading is above 10-ohms, drive one extension. Further testing of that individual rod is not needed.

B. The total grounding system with all connections completed shall have a maximum resistance to ground of 2 ohms for primary services or 5 ohms for secondary services.

1.03 CONNECTION REQUIREMENTS

A. Provide exothermic weld type, or Burndy Hyground, ground connections for concealed, underground, and concrete encased ground connections, for ground connections to structural steel, connections between sections of the main ground bus and all connections to the substation room ground bus bars.

B. Exposed ground connections (except connections to structural steel and substation room ground bus bars) may be made with copper or bronze compression ground fittings or bolted compression ring lugs.

C. Provide exothermic weld type, or Burndy Hyground ground connections for splices and taps of grounding conductors No. 8 AWG and larger. Exposed splices and taps shall be taped.

PART 2 - PRODUCTS

2.01 GROUND RODS

A. Unless shown otherwise, ground rods shall be 3/4" diameter by 10' long, copper clad steel. Ground rods shall be capable of being extended when additional length is required.

2.02 GROUNDING CONDUCTORS

A. Grounding conductors for direct burial underground, for encasement in concrete, and for grounding of unit substations shall be No. 4/0 AWG minimum, bare, stranded copper.

B. Grounding conductors for general use shall be stranded, copper conductor, sized in accordance with the NEC unless shown otherwise on the drawings, and insulated with green NEC Type THHN insulation rated 90 degrees C, 600 volts.

2.03 GROUND CONNECTIONS

A. Ground connections shall be Burndy Hyground, Cadweld, Thermo-weld or Thomas & Betts Blackburn only.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Ground duct banks and manholes in accordance with Specification Section 26 05 13

B. Provide bare copper grounding conductors from duct banks, manholes, unit substations, primary switches, transformers, switchgear, panelboards, motor control centers and control panels to the building grounding system. Equipment rated above 480 volts or 600 amps shall be grounded by a minimum of two independent grounding conductors.

C. Bond transformer, UPS system, central battery/inverter system, emergency generator, and separately derived electrical system neutrals to the building grounding system.

D. Ground motors rated 460 volts and below by motor feeder equipment grounding conductors. Stranded copper grounding conductors connected to building steel shall also bond motors rated over 460 volts.

E. Provide green insulated equipment grounding conductors in all service, feeder, and branch circuits for connection of load devices to the power source ground. Raceways shall not be used as equipment grounding conductors.

F. Equipment grounding conductors shall not be daisy-chained.

G. Bond equipment-grounding conductors in boxes and enclosures where the grounding conductors are terminated or spliced.

H. Bond conduits, cable trays, wireways, surface raceways, boxes, and enclosures together, and to the building grounding system. Provide bonding bushings and bonding jumpers to bond conduits where they enter a box or enclosure.

I. Ground the lightning protection system with separate ground rods. The building grounding system ground rods shall not be used. After completion of both systems, the lightning protection system shall be bonded to the building grounding system.

J. Protect separately routed grounding conductors subject to damage or physical abuse by Schedule 40 PVC nonmetallic conduits. Grounding conductors shall not be routed in metallic conduits except when routed with phase conductors.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAY AND BOXES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies raceways and boxes for building and structure electrical systems under 600 volts.

B. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.

C. Related Sections:

1. Division 01 - General Requirements
2. Applicable sections of Division 26 - Electrical

PART 2 – PRODUCTS

2.01 GENERAL INFORMATION

A. All boxes, brackets, bolts, clamps, etc., shall be galvanized or electro-galvanized.

B. All hardware used outdoors shall be hot dipped galvanized.

2.02 CONDUIT

A. Rigid galvanized conduit shall be installed in poured concrete slabs, walls and partitions. Rigid or I.M.C. shall be installed in damp locations and inaccessible places.

B. All rigid conduit, I.M.C. and E.M.T. shall be hot dipped galvanized or electro-galvanized.

C. E.M.T. may only be installed exposed, above suspended ceilings, or in partitions.

D. Flexible steel conduit may be used for short runs to individual pieces of equipment.

E. Flexible sheathed metallic conduit shall be used for runs less than 6’ in length to individual pieces of equipment in mechanical rooms, penthouses, etc.

F. MC Cable is permitted in existing walls where installation of EMT is not possible to devices.

G. No E.M.T. or aluminum conduit shall be used in concrete, direct burial or in corrosive locations.

H. Aluminum conduit may only be used in sizes 1-1/2 inch and larger. No aluminum conduit will be permitted in concrete. When aluminum conduit is used, all bends shall be galvanized steel.

I. Size and type of conduit shall comply with the National Electric Code. Where conduits are indicated on the drawing to be larger than required by Code, the larger conduit shall be used.

J. Minimum conduit size shall be 3/4 inch in all runs.

2.03 PULL AND JUNCTION BOXES

G. All pull boxes shall be galvanized sheet steel, sized as required, with thickness not less than no. 14 gauge.

2.04 OUTLET BOXES

A. All outlets, except as otherwise specified, shall consist of approved galvanized steel boxes of pattern adapted to the special requirements of each outlet, securely fastened in place in an approved manner.

PART 3 – EXECUTION

3.01 CONDUIT

A. Conduit shall be concealed in all new walls and run above suspended ceilings.

B. Use Wiremold type metal raceway where necessary to run exposed on existing walls and/or ceilings in finished areas as shown on the drawings.

C. All conduit shall be fastened or suspended from structural members, slabs, or walls only. It shall not be run on or fastened to tee bars of suspended lay-in ceilings.

D. All conduit shall be supported by approved hangers at spaced per NEC.

E. All exposed conduit shall be run parallel to the structural members of the building in a neat manner, securely fastened in place.

F. When metal conduit extends below the bottom of a slab on the ground, the slab shall be thickened in the area of the conduit so as to encase the conduit in concrete by at least 2 inches on all sides. The responsibility for and expense of this work shall be borne by the Contractor.

3.02 OUTLET BOXES

A. Recessed outlet boxes for single gang or 2-gang installations shall be 4” square with appropriate device ring or plaster ring for the required number of devices.

1. All device rings and plaster rings shall be installed vertically unless instructed otherwise by the A/E or Owner.

2. All plaster rings shall not extend past flush with wall surface or be recessed more than ¼” from wall surface.

3. For installations of more than two devices use the appropriate wall box for the number of devices required. If approved by the Owner the use of gangable wall boxes is allowed.

4. For surface installations in Mechanical Area or similar locations 4” square boxes shall be used with ¼” raised cover.

3.03 PULL AND JUNCTION BOXES

A. Pull boxes shall not be installed in inaccessible locations.

END OF SECTION 26 05 33

SECTION 26 09 23 – LIGHTING CONTROLS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install a lighting control as specified and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 26 05 00 Common Work Results for Electrical

B. Section 26 05 19 Low Voltage Wire and Cable

C. Section 26 05 33 Raceway and Boxes

D. Section 26 51 00 Interior Lighting

1.03 SUBMITTALS -- FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Architect/Engineer and Owner

1. Manufacturer’s product cut-sheet

B. Submit electronically in PDF format.

1.04 SUBMITTALS -- FOR INFORMATION

A. When requested by the Engineer the following product information shall be submitted:

1. Descriptive bulletins

2. Product sheets.

B. Submit electronically in PDF format.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.06 OPERATION AND MAINTENANCE MANUALS

A. One (1) paper copy and one (1) USB flash Drive of the equipment operation and maintenance manuals shall be provided.

B. Operation and maintenance manuals shall include the following information:

1. Instruction books and/or leaflets

2. Recommended renewal parts list

3. Drawings and information required by section 1.06.

PART 2 – PRODUCTS

2.01 TIME CLOCK

A. Manufacturers

1. Paragon
2. Tork

B. Ratings

1. Like Paragon Model EC71st /120V Electronic Sun Tracker
2. 120-volt ac control voltage
3. Single Channel control
4. Contact Rating, 15 amp
5. NEMA 1 enclosure

2.02 PHOTOCONTROL

A. Manufacturers

1. Tork
2. Precision

B. Ratings

1. Weatherproof Lexan® housing
2. Photocell: 1 inch cadmium sulfide light sensitive element.
3. Turn on: 1 to 3 foot-candles. External light level slide allows field adjustment between 3 to 10 foot-candles.
4. Turn on / turn off ratio 1:3.
5. Minimum 15 second time delay.
6. Single-pole, single-throw switch. Contact position at night normally closed.
7. Temperature Range -40-to-158-degree F
8. ½'-14 threaded stem.

2.03 LIGHTING CONTACTOR

A. Manufacturers

1. ASCO
2. Cutler Hammer
3. Square D

B. Ratings

1. 30 amp minimum
2. Number of poles as required
3. Control/coil voltage 120 volt
4. Electrical held
5. Installed in NEMA 1 enclosure or as required for location.

2.04 OCCUPANCY SENSORS

A. Wall Mounted

1. Wall Mounted occupancy sensors shall be a multi-technology (Ultrasonic & PIR) wall switch that turns lights on and off based upon occupancy and ambient light levels. Type 2 sensors shall contain two separate relays and manual override controls for dual level switching of light fixture. Sensors shall have built-in light level sensor, adjustable time delays, zero crossing switching, and smart technology. Provide necessary device box. Type 1 sensors shall be Hubbell Building Automation #LHMTS1 or pre-approved equal. Type 2 sensors shall be Hubbell Building Automation #LHMTD2 or pre-approved equal. Color of devices shall be as selected by owner but generally shall match color of wiring devices.

B. Ceiling Mounted

1. Ceiling Mounted occupancy sensors, indicated by OS on plans, shall be a multi-technology (ultrasonic & PIR) sensor that turns lights on and off based upon occupancy. Sensor shall have adjustable time delays, zero crossing switching, and smart technology. Provide the necessary back-box. Sensor shall be Hubbell Building Automation #OMNIDT2000 or pre-approved equal.

C. Power Packs and Relays

1. The power packs shall provide both the 24VDC power supply to operate sensors as well as the 20-amp line voltage relay to control the load. Power pack shall be mounted to a junction box located above accessible ceiling. Housing shall be plenum rated. Power packs shall be Hubbell Building Automation #UVPP Universal Voltage Power Pack, or pre-approved equal. For every Power Pack, also provide an adjacent model MPSA auxiliary power pack, whose contact will be used by others to monitor occupancy.

2.05 WALL BOX DIMMERS

A. Wall box dimmers shall be Leviton Renoir II series or approved equal.

B. Shall be compatible with light fixture/driver and shall be capable of multi-location applications.

2.06 COMBINATION WALL BOX DIMMER AND OCCUPANCY SENSOR

A. Wall box device providing both digital PIR occupancy sensor and 0-10V dimming shall be Hubbell LHDMIRS-3 series or approved equal.

B. 3 buttons provide on/off, raise and lower light levels.

2.07 ELECTRONIC WALL BOX TIMERS

A. Timer shall be like Hubbell DT300 or Legrand TS-400

1. Multiple timer intervals
2. Energy code presets for Title 24, IECC, and ASHRAE 90.1
3. Visual and audio turnoff warning
4. 3 Way and Multiple Way Switching
5. No Neutral Required
6. No Load Requirement

B. Do not use in unconditioned spaces where temperature may fall below 30 degrees F.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. Protect the equipment from damage and keep clean and dry during construction.

C. **Installation of in wall switch replacement occupancy sensors must be approved by the Owner**.

D. Install power packs above accessible ceilings and locate near door to room. If space has no ceiling, install power pack within a minimum 4” square junction box and locate near the door to the room, as neatly as possible. Coordinate with manufacturer.

END OF SECTION 26 09 23

SECTION 26 22 13 – DRY-TYPE DISTRIBUTION TRANSFORMERS – GENERAL PURPOSE

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 26 05 00

1.03 REFERENCES

A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI and NEMA.

1.04 SUBMITTALS -- FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Dimension drawing and weight.
2. Technical certification sheet
3. Conduit entry/exit locations
4. Transformer ratings including:
   a. Primary and secondary kVA
   b. Voltage
   c. Taps
   d. Primary and secondary continuous current
   e. Basic Impulse level for equipment over 600-volts
   f. Impedance
   g. Insulation class and temperature rise
   h. Sound level.

B. Submit electronically ln PDF format.

1.05 SUBMITTALS -- FOR INFORMATION

A. When requested by the Engineer the following product information shall be submitted:
   1. Descriptive bulletins
   2. Product sheets.

B. Submit electronically ln PDF format.

1.06 SUBMITTALS -- FOR CLOSEOUT

A. The following information shall be submitted for record purposes.
   a. Final as-built drawings and information for items listed section 1.04.
   b. Connection diagrams

c. Certified production test reports
d. Installation information
e. Seismic certification and equipment anchorage details.

B. Submit one paper copy and one (1) electronic copy in PDF format on a USB Flash Drive of the above information.

1.07 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

C. The transformers shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC]. Guidelines for the installation consistent with these requirements shall be provided by the transformer manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, UBC: a peak of 0.75g, and a ZPA of 0.38g. The tests shall fully envelope this response spectrum for all equipment natural frequencies up to at least 35 Hz.

1.08 REGULATORY REQUIREMENTS

A. All transformers shall be UL listed and bear the UL label.

1.09 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.10 FIELD MEASUREMENTS

A. Measure primary and secondary voltages and make appropriate tap adjustments.

1.11 OPERATION AND MAINTENANCE MANUALS

A. One (1) paper copy and one electronic copy on USB Flash drive of the equipment operation and maintenance manuals shall be provided.

B. Operation and maintenance manuals shall include the following information:

1. Instruction books and/or leaflets

2. Recommended renewal parts list

3. Drawings and information required by section 1.06.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Cutler-Hammer

B. Square D

C. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. kVA and voltage ratings shall be as shown on the drawings.

B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

C. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

1. Up to 9 kVA 40 db
2. 10 to 50 kVA 45 db
3. 51 to 150 kVA 50 db
4. 151 to 300 kVA 55 db
5. 301 to 500 kVA 60 db
6. 501 to 700 kVA 62 db
7. 701 to 1000 kVA 64 db.

2.03 CONSTRUCTION

A. Insulation Systems

1. Transformers shall be insulated as follows:

a. 15 kVA and above: 220 degrees C insulation system based upon 150 degree C rise

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient.

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, nonaging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade **copper** with continuous wound construction.

2. On units rated 30 kVA and the core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out

moisture. The assembly shall be installed on vibration-absorbing pads. Taps shall be two (2) steps above and four (4) steps below nominal voltage in 2.5% increments.

2.04 WIRING/TERMINATIONS

A. Recommended external cable shall be rated 90 degrees C (sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.

2.05 ENCLOSURE

A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.

B. On units rated 30 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt.

C. On outdoor units rated 30 kVA or above, provide suitable weather shields over ventilation openings.

2.06 FINISH

A. Enclosures shall be finished with ANSI 61 color weather-resistant enamel.

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Ratio tests at the rated voltage connection and at all tap connections
2. Polarity and phase relation tests on the rated voltage connection
3. Applied potential tests
4. Induced potential test
5. No-load and excitation current at rated voltage on the rated voltage connection.

B. The following special factory tests shall be performed on ratings above 500 kVA provided under this section. All tests shall be in accordance with the latest revision of ANSI and NEMA standards.

1. Resistance measurements on all windings at the rated voltage connection of each unit and at the tap extremes of the first unit made of a new design.

3.02 INSTALLATION

A. Contractor shall install per the manufacturer's recommendations and the contract drawings.

B. Transformers shall be installed on a minimum 3” high housekeeping pad.

3.03 FIELD QUALITY CONTROL

A. During storage, transformers shall be protected from damage and kept clean, warm and dry.

B. Prior to energizing the Contractor shall test transformer for shorts and grounds with a VOM

3.04 FIELD TESTING

A. Megger primary and secondary windings for shorts and grounds.

B. Measure primary and secondary voltages for proper tap settings.

3.05 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage with no load.

B. Retest voltage with full connected load energized and adjust taps to within 5% of rated voltage.

C. The Owner shall witness the connected load test.

END OF SECTION 26 22 13

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SECTION 26 24 16 - PANELBOARDS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 26 09 23 – Lighting Control System

B. Section 26 43 13 – Transient Voltage Surge Suppression

1.03 REFERENCES

A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:

1. UL 67 – Panelboards
2. UL 50 – Cabinets and boxes
3. NEMA PB1
4. Fed. Spec. W-P-115C
5. Circuit breaker – Type I class I
6. Fusible switch – Type II class I.

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Breaker layout drawing with dimensions indicated and nameplate designation.
2. Component list
3. Conduit entry/exit locations
4. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
5. Cable terminal sizes
6. Product data sheets.

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in paragraph 1.04
2. Installation information

3. Seismic certification and equipment anchorage details.

B. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.06 QUALIFICATIONS

A. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers and fusible switches.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, UBC: a peak of 2.15g's (3.2–11 Hz), and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

E. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.07 REGULATORY REQUIREMENTS

A. The panelboards shall be UL labeled.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

B. Submit electronically in PDF format.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Cutler-Hammer

B. Square D

C. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. Panelboards rated 240V AC or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 22,000 amperes RMS symmetrical.

B. Panelboards rated 480V AC shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 65,000 amperes RMS symmetrical.

C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:

1. Size and type of upstream device

2. Branch devices that can be used

3. UL series short-circuit rating.

2.03 CONSTRUCTION

A. Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.

C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

D. Surface trims shall be the same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

F. All locks shall be keyed alike.

2.04 BUS

A. Main bus bars shall be copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

B. A system ground bus shall be included in all panels.

C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.05 BRANCH CIRCUIT PANELBOARDS

A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be like Cutler-Hammer type Pow-R-Line 1a, Pow-R-Line 2a or Pow-R-Line 3a.

B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

C. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.

1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

D. Circuit breakers shall have a minimum interrupting rating of 22,000 amperes symmetrical at 240 volts, and 42,000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

2.06 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

A. Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be fully rated Panelboards and shall be like Cutler-Hammer type Pow-R Line 3a or Pow-R-Line 4B. Panelboards shall have molded case circuit breakers as indicated below.

B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

C. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.07 ENCLOSURE

A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

B. Enclosures shall be provided with blank ends.

C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.08 NAMEPLATES

A. Provide an engraved nameplate for each panel section.

B. Owner shall provide label information.

2.09 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.02 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.03 QUALITY CONTROL

A. Prior to energizing the Contractor shall:

1. Torque all connections per the Manufacturer's recommendations.

2. With a 1000-volt Megger test all phase and neutral bus for shorts and grounds.

END OF SECTION 26 24 16

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SECTION 26 27 26 – WIRING DEVICES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Types and locations of wiring devices are indicated by the Project drawings.

B. Types of wiring devices in this section include the following:

1. Receptacles
2. Switches
3. Cover plates

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of wiring devices, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installers: Firm with at least five (5) years of successful installation experience with projects utilizing wiring device work similar to those required for this Project.

C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and coding of wiring devices.

D. UL Labels: Provide wiring devices that are UL listed and labeled.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver wiring devices properly packaged in factory–fabricated type containers.

B. Store wiring devices in a clean dry space. Protect products from weather, damaging fumes, construction debris and traffic.

PART 2 – PRODUCTS

2.01 GENERAL

A. General use receptacles shall be heavy-duty 20-amp duplex 2 pole 3 wire grounding type.

B. All switches shall be specification grade quiet switches, 120–277-volt 15 amp.

C. Device colors shall be a selected by the Owner but generally all devices shall be white on painted walls and brown on wood walls unless for special application.

D. Devices on emergency circuits shall be red.

E. All exterior receptacles and any receptacle within six (6) feet of any water shall be GFCI.

2.02 MANUFACTURERS AND CATALOG NUMBERS

A. Hubbell, LeGrand, Leviton and Pass & Seymour are the only acceptable manufacturers.

B. The following is an approved list of receptacles by type (based on Hubbell).

1. 20-amp duplex- # HBL5362 or approved equal
2. 20-amp duplex tamper-resistant- # HBL5362TR or approved equal
3. 20-amp single- # HBL5461 or approved equal
4. 20-amp duplex with two USB charging ports- # USB20AC or approved equal
5. 20-amp GFCI - # GFR5362SG or approved equal

C. The following is the approved list of switches by type 15 amp (based on Hubbell).

1. Single pole toggle switch-# HBL1201 or approved equal.
2. 2 pole toggle switch - # HBL1202 or approved equal.
3. 3-way toggle switch-# HBL1203 or approved equal
4. 4-way toggle switch- # HBL1204 or approved equal
5. Single pole key switch with key- # HBL1201L
6. 2 pole key switch with key- # HBL1202L
7. 3-way key switch with key- # HBL1203L
8. 4-way key switch with key- # HBL1204L
9. Maintained contact 3 position, 2 circuit, center off, single pole, double throw 20 amp- # HBL1385.
10. Momentary contact 3 position, 2 circuit, center off, 20 amp- # HBL1557.

D. All interior device cover plates are to be polycarbonate type (thermoset plastic not allowed), color to match device color unless otherwise noted.

E. All exterior device cover plates shall be weatherproof type unless otherwise noted.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. General: Install wiring devices as indicated, in compliance with applicable requirements of NEC, NEMA, UL and NECA's "Standard of Installations", and in accordance with recognized industry practices.

B. Install all wiring in approved boxes or enclosures.

C. For vertically install receptacles with ground up and on horizontal receptacles the ground on the left.

D. Verify proper orientation of all switches.

E. Cover plates must cover all openings around devices and boxes.

F. All devices must be installed plumb with the surroundings.

G. All device cover plate screws slots shall be vertical.

END OF SECTION 26 27 26

SECTION 26 28 13 – LOW VOLTAGE FUSES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less and spare fuse cabinets.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Submit in PDF format

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Submit in PDF format per Section 017700

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Littelfuse, Inc.
4. Mersen.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.03 SPARE FUSE CABINETS

A. Cabinet: Wall-mounted, 0.05-inch-thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

B. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

C. Finish: Gray, baked enamel.

D. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.

E. Fuse Pullers: For each size of fuse.

PART 3 – EXECUTION

3.01 FUSE APPLICATIONS

A. Service Entrance: Class L, time delay.

B. Feeders, 600 A or Less: Class J, time delay.

C. Feeders, 601 A or Greater: Class L, time delay.

D. Motor Branch Circuits: Class RK1, time delay.

E. Other Branch Circuits: Class J, time delay.

F. Control Circuits: Class CC, fast acting.

3.02 INSTALLATION

A. Install fuses in fusible devices.

B. Arrange fuses so rating information is readable without removing fuse.

C. Install spare-fuse cabinet.

3.03 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 28 13

SECTION 26 28 16 – SAFETY SWITCHES

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the low-voltage fused and non-fused switches as specified herein and as shown on the contract drawings.

1.02 REFERENCES

A. The switches and all components shall be designed, manufactured and tested in accordance with the latest applicable standards:

1. NEMA KS-1
2. UL 98

1.03 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Dimensioned outline drawing
2. Conduit entry/exit locations
3. Switch ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
4. Fuse ratings and type
5. Cable terminal sizes
6. Product data sheets

1.04 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in paragraph 1.04.
2. Submit electronically in PDF format.

1.05 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

1.06 REGULATORY REQUIREMENTS

A. The safety switches shall bear a UL label.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Cutler-Hammer

B. Square D

C. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 GENERAL DUTY SAFETY SWITCHES

A. Provide switches as shown on drawings with the following ratings:

1. 30 to 600 amperes
2. 240 volts AC maximum
3. 2 and 3-pole plus S/N
4. Fusible and non-fusible
5. Mechanical lugs suitable for aluminum or copper conductors.

B. Construction

1. Switch blades and jaws shall be visible and plated copper.
2. Switches shall have a black handle through 100A (except on plug-fuse type) that is easily padlockable with two 3/8-inch shank locks in the OFF position. Higher rating shall have a red handle that is easily padlockable with three 3/8-inch shank locks in the OFF position.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the handle is in the ON position.
4. Switch assembly and operating handle shall be an integral part of the enclosure.
5. Switches rated 100A to 600A shall have reinforced fuse clips.
6. Switch blades shall be readily visible in the ON and OFF position.
7. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type (except 30A plug-fuse type).
8. Fusible switches shall be suitable for service entrance equipment and be equipped with factory installed neutrals.
9. All switches (except 30A plug-fuse type) shall have side opening doors. Door padlocking capability shall be provided.
10. Suitable for systems capable of 100kA with Class R Fuses (except 30A plug-fuse type).
11. Double-make, double-break switch blade feature shall be provided (except 30A plug-fuse type).
12. 30A to 100A shall have R fuse rejection capability (not applicable to plug-fuse type).
13. All switches shall be manufactured in the USA.

C. Enclosures

1. All enclosures shall be NEMA 1 general purpose unless otherwise noted.
2. Other types, where noted, shall be:

a. NEMA 3R rainproof
b. NEMA 1 plug fuse indoor

3. Paint color shall be ANSI 61 gray.
4. 30A to 60A NEMA 1 enclosures shall have tangential knockouts on the top, bottom, and sides of the enclosure. NEMA 3R enclosures shall have tangential knockouts on the bottom and sides. (Not applicable to NEMA 1 plug-fuse type).

2.03 HEAVY-DUTY SAFETY SWITCHES

A. Provide switches as shown on drawings, with the following ratings:

1. 30 to 1200 amperes
2. 250 volts AC, DC; 600 volts AC (30A to 200A 600 volts DC)
3. 2, 3, 4, and 6 poles
4. Fusible and non-fusible
5. Mechanical lugs suitable for aluminum or copper conductors.

B. Construction

1. Switch blades and jaws shall be visible and plated copper.
2. Switches shall have a red handle that is easily padlockable with three 3/8-inch shank locks in the OFF position.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the handle is in the ON position. Defeater mechanism shall be front accessible.
4. Switch assembly and operating handle shall be an integral part of the enclosure base.
5. Switches rated 30A to 600A shall have reinforced fuse clips.
6. Switch blades shall be readily visible in the ON and OFF position.
7. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable.
8. Fusible switches shall be suitable for service entrance equipment.
9. Switches shall have line terminal shields.
10. Suitable for systems capable of 200 kA at 480V with Class J, L, R, or T fusing as applicable.
11. Embossed or engraved ON-OFF indication shall be provided.
12. Double-make, double-break switch blade feature shall be provided.
13. Fuse pullers shall be provided on all NEMA 4X and 12 switches through 200A.
14. Renewal parts data shall be shown on the inside of the door.
15. All switches shall be manufactured in the USA.

C. Enclosures

1. All enclosures shall be NEMA 1 general purpose unless otherwise noted.
2. Other types, where noted, shall be:
   a. NEMA 3R rainproof
   b. NEMA 4 watertight (800A max.)
   c. 30A to 200A – 304 stainless steel

d. 400A to 800A – 304 stainless steel
e. NEMA 12 dust-tight and oil-tight special industry (800A max.).

3. Paint color shall be ANSI 61 gray.
4. 30A to 100A NEMA 4, 4X, and 12 enclosures shall be provided with draw-pull latches.

D. The following factory modifications are to be included:

1. Phenolic nameplates
2. Class R fuse clips factory installed.

2.04 NAMEPLATES

A. Nameplate shall be front cover mounted, containing a permanent record of switch type, ampere rating, and maximum voltage rating.

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

3.02 INSTALLATION

A. The equipment shall be installed per the manufacturer’s recommendations.

END OF SECTION 26 28 16

SECTION 26 29 13 – ENCLOSED MOTOR STARTERS – LOW VOLTAGE

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the low voltage motor starters as specified herein and as shown on the contract drawings.

1.02 REFERENCES

A. The motor starters shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA, ANSI and UL.

1.03 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Master drawing index
   2. Dimensioned outline drawings
   3. Conduit entry/exit locations
   4. Cable terminal sizes
   5. Wiring diagrams
   6. Nameplate schedule
   7. Ratings including:
      a. Voltage
      b. Horsepower and/or continuous current
   8. Product data sheets.

1.04 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in paragraph 1.04.
   2. Wiring diagrams
   3. Seismic certification.

B. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

C. Submit electronically in PDF format.

1.05 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

C. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) for Zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, UBC: a peak of 2.15g's (3.2–11 Hz), and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

D. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Cutler-Hammer

B. Square D

C. Allen Bradley

D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 MANUAL MOTOR CONTROL

A. Single-Phase Manual Starters

1. Manual single-phase starters 1 hp or smaller shall be Cutler-Hammer type MS starters or approved equal. The starter shall have a quick-make/quick-break toggle mechanism. The overload shall have a field adjustment allowing up to +/- 10% variance in ratings of the nominal heater value.

2. Manual single-phase starters above 1 hp shall be Cutler-Hammer type B100 or approved equal. The starter shall have quick-make/quick-break mechanism. The closure of the

contacts shall be blocked while the line terminals are exposed. The operating handle or button shall clearly indicate whether the unit is ON, OFF or TRIPPED.

3. The enclosure shall be as indicated on the contact drawings.

B. Three-Phase Manual Starters

1. The starter shall have quick-make/quick-break operating mechanism.
2. The operating handle or button shall clearly indicate whether the unit is ON, OFF or TRIPPED.
3. The closure of the contacts shall be blocked while the line terminals are exposed.
4. The enclosure shall be as indicated on the contract drawings.
5. Manual three-phase motor starters shall be Cutler-Hammer type B100 or equal.

C. Three-Phase Manual Motor Starter and Protector

1. The starter shall have an adjustable Class 10 ambient compensated integral overload relay and a fixed magnetic short-circuit trip mechanism designed to trip at twelve (12) times the maximum current rating of the starter.
2. The starter shall be UL listed and CSA certified for group motor installations with 1200 ampere maximum fuse and circuit breaker ratings at 480V AC.
3. The starter shall have provisions for padlocking in the OFF position.
4. The starter shall have accessories such as auxiliary contacts, trip alarm, undervoltage release, and shunt trip available for field installation.
5. The enclosure shall be general purpose NEMA 1.
6. Motor starter and protector shall be Cutler-Hammer type A302 or equal.

2.03 ELECTROMECHANICAL MOTOR CONTROL

A. Non-Reversing Starters

1. Magnetic starters through NEMA Size 9 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring. Each starter shall have one (1) NO auxiliary contact.
2. Coils shall be of molded construction through NEMA Size 9. All coils to be color-coded through Size 5 and permanently marked with voltage, frequency and part number.
3. Solid-State Overload Relay
   a. Provide a solid-state overload relay for protection of the motors. The relay shall be Cutler Hammer type CEP7 or approved equal.
   b. The overload relay shall provide high accuracy through the use of state-of-the-art microelectronic packaging technology. The relay shall be suitable for application with NEMA Size 1 through Size 7 motor starters.
   c. The overload relay shall be modular in design, be an integral part of a family of relays to provide a choice of levels of protection, be designed to directly replace existing electromechanical overload relays, and be listed under UL Standard 508.
   d. The overload relay shall have the following features:

1) Be self-powered
2) Class 10 or 20 fixed tripping characteristics
3) Manual or automatic reset
4) Phase loss protection. The relay shall trip in 2 seconds or less under phase loss condition when applied to a fully loaded motor
5) Visible trip indication
6) One NO and one NC isolated auxiliary contact
7) Test button that operates the normally closed contact
8) Test trip function that trips both the NO and NC contacts
9) A current adjustment range of 3.2:1 or greater
10) Ambient temperature compensated
11) Ground fault protection. Relay shall trip at 50% of full load ampere setting
12) Jam/Stall protection. Relay shall trip at 400% of full load ampere setting, after inrush.

4. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Size 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed.
5. Motor starters shall be Cutler-Hammer Freedom Series or approved equal.

B. Reversing Starters

1. Reversing starters shall consist of two (2) contactors and a single overload relay assembled together. The contactors shall be mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously.
2. Magnetic starters through NEMA Size 8 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring.
3. Coils shall be of molded construction through NEMA Size 8. All coils to be color-coded through Size 5 and permanently marked with voltage, frequency and part number.
4. Solid-State Overload Relay
   a. Provide a solid-state overload relay for protection of the motors. The relay shall be Cutler Hammer type CEP7 or approved equal.
   b. The overload relay shall provide high accuracy through the use of state-of-the-art microelectronic packaging technology. The relay shall be suitable for application with NEMA Size 1 through Size 7 motor starters.
   c. The overload relay shall be modular in design, be an integral part of a family of relays to provide a choice of levels of protection, be designed to directly replace existing electromechanical overload relays, and be listed under UL Standard 508.
   d. The overload relay shall have the following features:
      1) Be self-powered
      2) Class 10 or 20 fixed tripping characteristics
      3) Manual or automatic reset

4) Phase loss protection. The relay shall trip in 2 seconds or less under phase loss condition when applied to a fully loaded motor.
5) Visible trip indication
6) One NO and one NC isolated auxiliary contact
7) Test button that operates the normally closed contact
8) Test trip function that trips both the NO and NC contacts
9) A current adjustment range of 3.2:1 or greater
10) Ambient temperature compensated
11) Ground fault protection. Relay shall trip at 50% of full load ampere setting.
12) Jam/Stall protection. Relay shall trip at 400% of full load ampere setting, after inrush.

5. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Sizes 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed.
6. Motor starters shall be Cutler-Hammer Freedom Series or approved equal.

C. Two-Speed Starters

1. Magnetic starters through NEMA Size 6 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring.
2. Coils shall be of molded construction through NEMA Size 6. All coils to be color-coded through Size 5 and permanently marked with voltage, frequency and part number.
3. Solid State Overload Relay
   a. Provide a solid-state overload relay for protection of the motors. The relay shall be Cutler Hammer type CEP7 or approved equal.
   b. The overload relay shall provide high accuracy through the use of state-of-the-art microelectronic packaging technology. The relay shall be suitable for application with NEMA Size 1 through Size 7 motor starters.
   c. The overload relay shall be modular in design, be an integral part of a family of relays to provide a choice of levels of protection, be designed to directly replace existing electromechanical overload relays, and be listed under UL Standard 508.
   d. The overload relay shall have the following features:
      1) Be self-powered
      2) Class 10 or 20 fixed tripping characteristics
      3) Manual or automatic reset
      4) Phase loss protection. The relay shall trip in 2 seconds or less under phase loss condition when applied to a fully loaded motor
      5) Visible trip indication
      6) One NO and one NC isolated auxiliary contact
      7) Test button that operates the normally closed contact
      8) Test trip function that trips both the NO and NC contacts

9) A current adjustment range of 3.2:1 or greater
10) Ambient temperature compensated
11) Ground fault protection. Relay shall trip at 50% of full load ampere setting
12) Jam/Stall protection. Relay shall trip at 400% of full load ampere setting, after inrush.

4. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any combination of normally open or normally closed contacts. Sizes 3 through 6 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any combination of normally open or normally closed contacts.
5. Two-speed magnetic starters for motors up to 400 hp, 600 volts shall be Cutler-Hammer Freedom Series type AN700 or approved equal.

2.04 ELECTROMECHANICAL REDUCED VOLTAGE MOTOR CONTROL

A. Autotransformer Type

1. The starter shall utilize an autotransformer for a reduced voltage start. The autotransformer shall have adjustable voltage taps at 50%, 65% and 80%.
2. The starter shall be an open transition type.
3. The autotransformer shall use electromechanical type starters.

B. Part-Winding Type

1. The starter shall utilize a part winding connection for a reduced voltage start.
2. The starter shall be an open transition type.
3. The part-winding starter shall use electromechanical type starters.

C. Wye-Delta Type

1. The starter shall utilize a wye-delta connection for a reduced voltage start.
2. The starter shall be an open transition type.
3. The wye-delta starter shall use electromechanical type starters.

2.05 ENCLOSURES

A. The enclosure shall be as indicated on the contract drawings.

B. Starters shall have an adjustable instantaneous motor circuit protector (HMCP) type disconnect device.

2.06 OPTIONS

A. Each starter shall be equipped with a fused control power transformer (100 VA minimum)

B. HOA selector switch

C. Red LED “run” pilot light

D. 2 NO/2 NC auxiliary contacts

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

B. The manufacturer shall provide certified copies of factory test reports in PDF Format.

END OF SECTION 26 29 13

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SECTION 26 29 33 – ADJUSTABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Adjustable Frequency Drives (AFDs)

1.02 RELATED WORK

1.03 REFERENCES

A. UL 508

B. NEC

1.04 QUALITY ASSURANCE

A. To ensure quality and minimize infantile failures at the jobsite, the complete AFD shall be tested by the manufacturer. The AFD shall operate a dynamometer at full load and speed and shall be cycled during the test.

B. All optional features shall be functionally tested at the factory for proper operation.

1.05 SUBMITTALS

A. Submit manufacturer’s performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, AFD's FLA rating, certification agency file numbers and catalog information.

B. The specification lists the minimum AFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

C. Harmonic filtering. The seller shall, with the aid of the buyer’s electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will met the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Danfoss Graham VLT HVAC Series

B. No substitutions, campus standard

2.02 GENERAL

A. Furnish complete variable frequency AFDs as specified herein for the fans and pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the AFD enclosure, unless otherwise specified. AFD shall be housed in a metal NEMA 1 enclosure, or other NEMA type according to the installation and operating conditions at the job site. The AFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated AFD.

B. The AFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

C. With the motor's rated voltage applied to the AFD input, the AFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. AFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

D. The AFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

E. The AFD and options shall be tested to ANSI/UL Standard 508. The complete AFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the AFD and option panel, in the case where these are not contained in one panel. When these AFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.

F. The AFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. AFDs without DC link reactors shall provide a minimum 3% impedance line reactor.

G. The AFD's full load amp rating shall meet or exceed NEC Table 430-150. The AFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

H. The AFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

I. An automatic energy optimization selection feature shall be provided standard in the AFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

J. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the AFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

K. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

L. Galvanic and/or optical isolation shall be provided between the AFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. AFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

M. AFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and AFD efficiencies while reducing motor noise.

2.03 PROTECTIVE FEATURES

A. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.

B. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, AFD overtemperature and motor overtemperature. The AFD shall display all faults in plain English. Codes are not acceptable.

C. Protect AFD from sustained power or phase loss. The AFD shall provide full rated output with an input voltage as low as 90% of the nominal. The AFD will continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230-volt units, and 313 V AC for 460-volt units.

D. The AFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.

E. AFD package shall include semi-conductor rated input fuses to protect power components.

F. To prevent breakdown of the motor winding insulation, the AFD shall be designed to comply with IEC Part 34-17. Otherwise, the AFD manufacturer must ensure that inverter rated motors are supplied.

G. AFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

H. AFD shall function normally when the keypad is removed while the AFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

I. AFD shall catch a rotating motor operating forward or reverse up to full speed.

J. AFD shall be rated for 100,000 amp interrupting capacity (AIC).

K. AFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The AFD will identify which of the output phases is low or lost.

L. AFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230-volt VFDs, and 539 V AC on 460-volt AFDs.

2.04 INTERFACE FEATURES

A. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the AFD and determine the speed reference.

B. The AFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the AFD is in Auto/Remote mode.

C. The AFD shall provide digital manual speed control. Potentiometers are not acceptable.

D. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.

E. The keypads for all sizes of AFDs shall be identical and interchangeable.

F. To set up multiple AFDs, it shall be possible to upload all setup parameters to the AFD's keypad, place that keypad on all other AFDs in turn and download the setup parameters to each AFD. To facilitate setting up AFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.

G. Display shall be programmable to display in 9 languages including English, Spanish and French.

H. The display shall have four lines, with 20 characters on three lines and eight large characters on one line.

I. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the AFD when the keypad is removed.

J. A quick setup menu with factory preset typical HVAC parameters shall be provided on the AFD eliminating the need for macros.

K. The AFD shall include a standard RS-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.

L. The AFD, when furnished with a Bypass shall include a common Start/Stop relay to allow the unit operation to be controlled by the Temperature Control Contractor or time clock when operating in either the Drive or Bypass modes.

M. As a minimum, the following points shall be controlled and/or accessible:

1. AFD Start/Stop
2. Speed reference
3. Fault diagnostics
4. Meter points
    a. Motor power in HP
    b. Motor power in kW
    c. Motor kW-hr
    d. Motor current
    e. Motor voltage
    f. Hours run

g. Feedback signal #1
h. Feedback signal #2
i. DC link voltage
j. Thermal load on motor
k. Thermal load on AFD
l. Heatsink temperature

N. Four additional Form C 230-volt programmable relays shall be available for factory or field installation within the AFD.

O. LonWorks communication shall be available for factory or field installation within the AFD.

P. Two set-point control interface (PID control) shall be standard in the unit. AFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.

Q. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

R. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. AFDs unable to show these four displays simultaneously shall provide panel meters.

S. Sleep mode shall be provided to automatically stop the AFD when its speed drops below set "sleep" level for a specified time. The AFD shall automatically restart when the speed command exceeds the set "wake" level.

T. The sleep mode shall be functional in both follower mode and PID mode.

U. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the AFD does not start until dampers or other auxiliary equipment are in the proper state for AFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the AFD to start.

V. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, AFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). AFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

W. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (^{o}F) for a cooling tower application.

X. AFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.

Y. If the temperature of the AFD's heat sink rises to 80°C, the AFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the AFD shall automatically reduce its output frequency to the motor. As the AFD's heat sink temperature returns to normal, the AFD shall automatically increase

the output frequency to the motor and return the carrier frequency to its normal switching speed.

Z. The AFD shall have temperature-controlled cooling fans for quiet operation and minimized losses.

AA. The AFD shall store in memory the last 10 faults and related operational data.

BB. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

CC. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of AFD status.

DD. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.

EE. Two programmable 0 to 20 mA analog outputs shall be provided for indication of AFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

FF. Under fire mode conditions, the AFD shall be able to be programmed to automatically default to a preset speed.

2.05 ADJUSTMENTS

A. AFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.

B. Sixteen preset speeds shall be provided.

C. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.

D. Four current limit settings shall be provided.

E. If the AFD trips on one of the following conditions, the AFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.

F. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

G. An automatic “on delay” may be selected from 0 to 120 seconds.

2.06 BYPASS

A. Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the AFD. In the OFF position, the motor and AFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the AFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the AFD. This allows the AFD to be given an operational test while

continuing to run the motor at full speed in bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in DRIVE or BYPASS mode. Bypass shall be furnished with an Undervoltage relay.

B. Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specially designed tool and mechanism while meeting all local and national code requirements for safety.

2.07 SERVICE CONDITIONS

A. Ambient temperature, -10 to 40°C (14 to 104°F).

B. 0 to 95% relative humidity, non-condensing.

C. Elevation to 3,300 feet without derating.

D. AC line voltage variation, -10 to +10% of nominal with full output.

E. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

PART 3 – EXECUTION

3.01 START-UP SERVICE

A. The manufacturer shall provide start-up commissioning of the AFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the AFD, its options and its interface wiring to the building automation system.

3.02 WARRANTY

A. The AFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service.

3.03 EXAMINATION

A. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for AFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

B. The AFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The AFD shall not be operated while the unit is covered.

END OF SECTION 26 29 33

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SECTION 26 32 13 – ENGINE GENERATOR SYSTEM (NATURAL GAS)

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies engine generator systems for buildings and structures emergency electrical systems.

B. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.

C. Products supplied but not installed under this section shall be turned over to the Owner.

D. Engine generator system equipment as follows:

1. Complete set of all special tools required to operate and service the equipment as recommended by the manufacturer for periodic field maintenance.
2. Two oil filter replaceable elements.
3. Two air filter replaceable element.

E. Related Sections:

1. Division 01 - General Requirements
2. Applicable sections of Division 26 – Electrical
3. Section 26 36 23 - Transfer Switches
4. Applicable portions of Sections of Division 22: Fuel gas piping, exhaust gas piping, flexible pipe connections, cooling air duct work, assembling generator accessories.

1.02 REFERENCES

A. Emergency generators shall be in accordance with the latest applicable standards as recommended by, SAE, IEEE, and ANSI/NEMA MG-1 Motors and Generators.

1.03 SUBMITTALS

A. Shop Drawings

1. Emergency generator systems including:
    a. Engine-generator set.
    b. Auxiliary and remote equipment.
    c. Make of engine, number of cylinders, compression ratio, bore and stroke, cylinder displacement, and speed.
    d. Make of generator, electrical rating, number and type of bearings, and exciter type.
    e. Plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.

f. Product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer and vibration isolators.

g. Installation instructions.

h. Name, location and phone number of nearest authorized distributor/service facility.

B. Manuals and Test Data

1. Operation and Maintenance Manuals for all major components including instructions for normal operation, routine maintenance requirements, service manuals for generator, engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.

2. Test data required in 1.04 Quality Assurance.

1.04 QUALITY ASSURANCE

A. Submit certified performance test data for this or a duplicate unit. Test shall include a full load test conducted at the specified ambient temperature for at least four (4) hours. The test shall be conducted with all components intended for this project including engine, generator fan and radiator. Test shall include actual surge and steady state performance data for "0-to-50%", and "0"-to-100%" instantaneous load applications. Test results shall include oil temperature, coolant temperature, fuel pressure, ambient temperature, load in kW, kVA, amperes and voltage. Load characteristic shall be sinusoidal, 80% power factor and steady state performance testing shall also include at least four (4) hours at 100% rating, with a load of 80% power factor and total harmonic distortion of 50%.

1.05 WARRANTY

A. Furnish full parts and labor warranty to cover the entire engine generator package including all accessories for one year from date of installation.

1.06 MAINTENANCE

A. Furnish one set of any special tools required for routine maintenance of each engine generator system. Package tools in adequately sized metal toolbox.

B. Provide two spare sets of each oil, and air filter element required for each engine generator system.

PART 2 – PRODUCTS

2.01 GENERAL INFORMATION

A. Furnish and install a new natural gas engine driven electric generating unit, factory assembled single unit generator set, with continuous output ratings as shown on the drawings at 0.8 power factor, 60 hertz, grounded neutral service, fully rated for operation at 600 feet above sea level in an ambient temperature range of 120 degree F. maximum to -20 degree F. minimum, consisting of a natural gas engine, direct-connected generator, exciter, radiator and fan cooling system, exhaust system with silencer and weathercap, automatic battery starting equipment, battery rack with heater, batteries and charger, instrument panel, control panel, instruments and controls, all mounted on a common steel base complete suitable for mounting on a concrete foundation pad, complete with a remote mounted automatic transfer switch, remote mounted panel and all accessories as specified and required for normal operation in standby service.

B. Generator set shall be manufactured by

1. Caterpillar
2. Cummins/Onan
3. Kohler
4. Generac
5. Other pre-approved manufacturer.

C. Manual and Automatic Start - Unattended Operation

1. Manual starting shall be accomplished by operating the “start” button on the generator or selecting “manual” on the manual-off-automatic selector switch on the automatic transfer switch.
2. Automatic starting shall be accomplished selecting the “automatic” position on the manual-off-automatic selector switch on the automatic transfer switch.

D. Voltage and frequency regulation.

1. Engine/generator shall be delivering rated output (kVA) at rated frequency and power factor, at not more than 2% above or below rated voltage.
2. Voltage regulation shall be plus or minus 2% for any constant load between no load and rated load. Random voltage variation shall not exceed .5% for any constant load. Voltage recovery to 100% normal output shall take no longer than two seconds after single step application of 100% rated load.
3. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
4. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

E. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

F. Furnish all necessary electrical connections, transfer switch, control panel, relays, etc., for installation of new generator set.

G. Generator and engine shall be mounted on vibration isolating supports capable of 95% isolation to minimize vibration of the remainder of the skid-mounted equipment and transmission of vibration to the supporting pad.

H. Generator shall be fully enclosed or suitably guarded to prevent exposure to all parts that operate at extremely high temperatures, be electrically energized, or rotating. All non-current carrying parts shall be grounded.

I. Thoroughly clean all equipment, and prime and finish paint with manufacturer's standard paint finish.

J. The engine/generator set shall be suitable for indoor installation.

2.02 ENGINE

A. Engine shall be standby power rated, multi-cylinder, spark ignited four stroke cycle, liquid cooled, internal combustion engine for use with natural gas fuel, industrial type, designed for full rated power output at 1800 rpm, 60 hertz. Aspiration may include turbocharger with after-cooler system. Block and head shall be cast-iron with replaceable cylinder liners.

B. Governor shall be electronic isochronous type no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Random frequency variation shall not exceed ±0.25% of its mean value for constant loads from no load to full load. Governor shall be provided with means for manual operation and adjustment.

C. Lubrication system.

1. Full pressure type with engine driven positive displacement sump pump,
2. Full flow strainer,
3. Full flow filter,
4. Pressure relief and automatic bypass valves,
5. Crankcase ventilator with filter and connection for outside venting,
6. Bayonet type oil level indicating pressure gauges on the upstream and downstream side of the strainer and filter,
7. Drain connection,
8. Oil cooler,
9. Low oil pressure safety shutoff device

D. Cooling system.

1. Pressure type, with radiator, blower type fan,
2. Engine driven circulating pump,
3. Thermostat in conjunction with a radiator bypass,
4. Drain connection,
5. High coolant temperature safety device,
6. Fan shall be sized to maintain safe engine temperature in ambient temperature of 120 degrees F.,
7. Provide a –40 F glycol antifreeze solution for the coolant.

E. Air intake system shall be complete with a dry type filter, and high frequency filter-type silencer for reducing the sound level at the intake to a point acceptable for residential use.

F. Engine exhaust system shall be complete with residential type silencer capable of reducing ambient exhaust noise level to 60 db when measured 50 feet from the engine under full engine load and clear weather. Silencer shall be adequately supported. Unit shall be provided with adequate means to prevent incursion of water at the exhaust stack outlet.

G. Standard NPT or SAE tubing and fittings.

2.03 GENERATOR

A. Generator shall be alternating current, three phase, four pole, reconnectible brushless revolving field synchronous type with brushless exciter directly connected to the generator field windings without slip rings or commutators.

B. Generator shall have a single pre-lubricated sealed bearing, direct connected to the engine, and air cooled by a direct drive centrifugal blower fan.

C. Insulation shall be Class H in a self-ventilated enclosure. Temperature rise shall be 125 deg C. max over ANSI 40 deg C. ambient for standby service.

D. Bring out all leads from each winding to a generator main lead terminal box adequate in size for making up all connections and grounding the neutral to the generator set supporting frame.

E. Voltage regulation shall include 3 phase sensing, generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics. Include manual controls to adjust voltage output plus or minus 5% of nominal voltage level.

F. The generator shall have the necessary excitation control circuitry to prevent the loss of excitation on fault conditions allowing quick return to full voltage and power to normal and faulted circuits.

G. Furnish NEMA 1 output terminal and outgoing cable termination compartment integral with the engine-generator frame.

2.04 VOLTAGE REGULATION

A. Static type, three phase, mounted either on the generator control panel or combined with the exciter. Voltage shall have "manual-automatic" switch and be adjustable +/- 10% under all operating conditions.

2.05 ELECTRIC STARTING SYSTEM

A. Engine starting system shall be a DC battery system sized for the engine/generator specifically, consisting of a heavy-duty electric cranking motor(s) with drive mechanism, heavy duty batteries with metal frame or box, engine driven alternator, battery charger, and transistorized voltage regulator.

B. Cranking motor shall be capable of starting the engine five times in rapid succession without overheating the motor and at sufficient speed for starting in ambient temperatures as low as -10-degree F.

C. Storage batteries shall be lead acid type of voltage and capacity as determined by the engine manufacturer, with sufficient capacity to crank the generator set five 45 second attempts in rapid succession.

D. Battery charger shall be an automatic, self-protected, self-regulated, dual rate rectifier type of a capacity determined by the engine manufacturer and sufficient to automatically recharge the batteries quickly according to the requirements governed by battery discharge duty, and suitable for 120-volt, single phase, 60 hertz input service from a remote receptacle panel.

E. Engine governor shall be a hydraulic, adjustable, isochronous type designed to maintain a constant engine speed from no load to full load. The frequency at any constant load, including

no load, shall remain within a steady state band width of plus or minus 0.5% of rated frequency. The governor shall not permit frequency modulation to exceed one cycle per second.

F. Fuel system shall be natural gas type. Unit shall be complete with all code required operating and safety controls and valves.

2.06 ACCESSORIES

A. Exhaust silencer: critical grade silencer, with muffler companion flanges and flexible stainless-steel exhaust fitting as necessary for orientation, sized in accordance with engine manufacturer's instructions.

B. Batteries: Heavy duty, engine starting type lead-acid storage batteries, 225 ampere - hours minimum capacity, thermostatically controlled battery heater, powered by the battery charger. Match battery voltage to starting system. Include necessary cables and clamps.

C. Battery Tray: Plastic coated metal for electrolyte resistance, constructed to contain spillage of electrolyte.

D. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, voltmeter and ammeter, and 120-volt AC fused input. Charger shall include NEMA 1 enclosure. Package shall include provisions for connection of 120/208V power for charger, for engine jacket water heater, and any other devices requiring energization while in storage. External charger shall automatically disconnect from the engine battery charging system immediately on transfer switch operation.

E. Output circuit breakers: Provide output breakers as indicated on the drawings.

F. CT’s with shorting blocks and potential connections with fuse blocks for metering.

G. Provide a remote annunciator to monitor the majority of generator functions and an emergency stop button for remote mounting.

2.07 ENGINE-GENERATOR CONTROL PANEL

A. Control panel shall be engine generator frame mounted in NEMA 1 enclosure, totally front accessible. Control panel shall be completely factory pre-wired. All external connections shall be wired out to terminal blocks for field wiring. Control panel shall be complete with all engine and generator controls and indicators. Include front hinged double doors with latches and provision for locking.

B. Control panel shall include the following fully identified by means of permanent nameplates:

1. Control

   a. Cranking limiter relay.
   b. Overspeed shutdown.
   c. Low oil pressure shutdown.
   d. High coolant temperature shutdown.
   e. Battery operated service light to illuminate panel during power outage conditions.
   f. Manual-off-auto engine start switch.

2. Visual monitoring

   a. Frequency Meter: 45-65 Hz range, 3½ inch (89 mm) dial.

b. AC Output Voltmeter: 3½ inch dial, 2 percent accuracy, with phase selector switch (phase-to-phase and phase-to-ground).
c. AC Output Ammeter: 3½ inch dial, 2 percent accuracy, with phase selector switch and 3 current transformers.
d. Push-to-test indicator lamps, one for each:
    1. Engine run
    2. Low oil pressure
    3. High water temperature
    4. Overspeed and overcrank
    5. Overspeed shutdown
    6. Failure to crank
    7. Failure to establish voltage or frequency
e. Engine hour meter.
f. Oil pressure gauge.
g. Water temperature gauge.
h. Fuel pressure gauge.

3. Audible monitoring
    a. Low oil pressure alarm condition.
    b. High coolant temperature alarm.
    c. Failure to crank.
    d. Failure to establish voltage or frequency.

C. Battery charging system including alternator and solid-state regulator.

PART 3 – EXECUTION

3.01 FIELD QUALITY CONTROL

A. Furnish, as part of the base scope of work, a factory authorized field service engineer to inspect the equipment for proper installation and proper functioning, to direct all electrical and mechanical adjustments which may be required, to supervise all testing and to certify that the installation and equipment is in accordance with Manufacturer's requirements, ready to be placed in operation.

B. The equipment shall be operated through all design functions. This shall include all remote-control operation, actuation of all alarm and indication devices, mechanical and electrical operation from protective devices. In addition, perform all specific inspections and tests as recommended by the manufacturer.

C. The engineering field service shall include, but not be limited to, the following:

1. Examine for evidence of shipping, storage, and handling damage. Identify parts damaged and reorder as required. Expedite equipment as appropriate.
2. Determine that shipping devices and tags have been removed. Direct the removal of such straps, blocks, braces that remain.
3. Examine all interior wiring, breakers, fuses, etc., for any damage.

4. Examine insulation and assembly of phase bus, ground bus, control, sensors, relaying and metering connections. Identify and direct all necessary changes.
5. Check all accessible connections to manufacturer's tightening torque specifications.
6. Verify phasing.
7. Check circuitry for electrical continuity.
8. Test for circuit integrity with a megohm meter.
9. Check electrically operable devices by operating several times.
10. Check that primary and control connections are made. Determine that control voltages are consistent with equipment furnished.
11. Visually inspect main bus between the generator terminals and the outgoing feeder. Direct the disconnecting of the generator and check the bus with a megohm meter if conditions dictate. Values shall be in accordance with the manufacturer's recommendations.
12. Megger insulation resistance levels phase-to-phase and phase-to-ground. Values shall be in accordance with the manufacturer's recommendations.
13. Verify that the equipment is clean and free of debris.
14. Assure that the equipment is level, properly secured to the floor, physically connected to the grounding system, and that doors swing properly and can be readily secured closed. Direct any adjustments or additional work required.
15. Review the field assembly work and, to the extent possible, determine that the work was completed in accordance with the manufacturer's instructions and drawings.
16. Test temperature relays, gages, switches, alarms, safety shut-down systems, and local and remote-control meters and indicating lights for proper installation and operation.
17. Check operation of auxiliaries, interlocks, etc. Check contact wipe, gaps and clearances as described in the Manufacturer's instruction book.
18. Verify proper operation of starting battery and charger system.
19. Set governor, voltage regulator, etc. and verify proper operation under all load conditions.
20. Assist in commissioning.

D. Load Bank Test

1. Furnish a continuous on site four (4) hour full load "Load Bank" test. Test shall be conducted when ambient temperatures are at least 75 degrees F.

E. Adjusting and Cleaning

1. Adjust operating mechanisms for free mechanical movement.
2. Touch-up scratched or marred surfaces to match original finishes.
3. Remove debris, tools, and foreign material from the area.

F. Inspection

1. Manufacturer must examine areas and conditions under which the engine-generator and components are to be installed, and notify the Engineer and Owner's Representatives in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Engineer and Owner's Representative.

G. Generator Start-up, Transfer and Run

1. Verify the proper functioning of all indicating devices.
2. Verify the proper operation of the engine starting and power transfer equipment.
3. Verify proper phasing, proper frequency and isochronous operation no-load to full-load.

H. A checklist with this information shall be prepared by the manufacturer and three copies signed and dated by the manufacturer's engineer verifying proper installation, commissioning, and operation of the equipment shall be submitted to the Owner's Representative.

3.02 INSTALLATION

A. Maintain Code and manufacturer defined working clearance around generator.

B. Install engine-generator on concrete pad with sound isolation pads or springs between mounting surface and generator.

C. Provide a maintenance disconnect switch, rated for the DC service, between battery and engine starter.

D. Set all timers, overcurrent devices, and all other such items needing to be set, in accordance with Owners direction or direction of manufacturer.

3.03 EXHAUST SYSTEM

A. Pressure drop in the complete exhaust system shall be small enough for satisfactory operation of the engine-generator set while it is delivering 110 percent of its specified rating.

B. Exhaust pipe size, from the engine to the muffler, shall be as recommended by the engine manufacturer. Pipe size from muffler to air discharge shall be two-pipe sizes larger than engine exhaust pipe.

C. Connections at the engine exhaust outlet shall be made with a flexible exhaust pipe. Provide bolted type pipe flanges welded to each end of the flexible section.

D. Condensate drain at muffler shall be made with schedule 40 black steel pipe through a petcock.

E. Exhaust Piping and Supports: Black steel pipe, ASTM A-53 standard weight with welded fittings. Spring type hangers, shall support the pipe.

F. Insulation for Exhaust Pipe and Muffler

1. Calcium silicate minimum 3 inches thick.
2. The installed insulation shall be covered with aluminum jacket 0.016 inch thick. The jacket is to be held in place by bands of 0.015 inch thick by 0.5-inch-wide aluminum.
3. Insulation and jacket are not required on flexible exhaust sections.

3.04 CONNECTIONS TO EQUIPMENT

A. Provide connections to equipment as indicated on the Contract Drawings.

B. Update panel directories and label source panel at equipment.

END OF SECTION 26 32 13

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SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCH

PART 1 – GENERAL

1.01 SCOPE

A. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

B. ATS shall be open transition.

1.02 CODES AND STANDARDS

A. The automatic transfer switches and accessories shall conform to the requirements of:

1. UL 1008 - Standard for Automatic Transfer Switches
2. NFPA 70 - National Electrical Code
3. NFPA 110 - Emergency and Standby Power Systems
4. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
5. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
6. NEC Articles 700, 701, 702
7. International Standards Organization ISO 9001: 2000

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers

1. ASCO
2. Onan-Cummins Power
3. Others must submit for approval ten (10) days prior to Bid opening.

2.02 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Neutral conductors are to be switched.

2.03 MICROPROCESSOR CONTROLLER WITH MEMBRANE INTERFACE PANEL

A. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. ANSI C37.90A/IEEE 472 Voltage Surge Test
2. NEMA ICS – 109.21 Impulse Withstand Test
3. IEC801-2 Electrostatic discharge (ESD) immunity
4. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity
5. IEC 801 – 4 Electrical fast transient (EFT) immunity
6. ENV50142 Surge transient immunity.
7. ENV50141: Conducted radio-frequency field immunity.
8. EN55011: Group 1, Class A conducted and radiated emissions.
9. EN61000 –4 – 11 Voltage dips and interruptions immunity

2.04 ADDITIONAL REQUIREMENTS

A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

ATS Size	Withstand & Closing Rating MCCB	W/CLF
30	22,000A	100,000
70 - 200	22,000A	200,000

230	22,000A	100,000
260 – 400	42,000A	200,000
600 – 1200	65,000A	200,000
1600 – 2000	85,000A	200,000
2600 – 3000	100,000A	200,000

2.05 ENCLOSURE

A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

B. Controller shall be flush-mounted display with LED indicators for switch position and source acceptability. It shall also include test and time delay bypass switches.

2.06 VOLTAGE AND FREQUENCY SENSING

A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.

B. Single-phase voltage and frequency sensing of the emergency source shall be provided.

2.07 TIME DELAYS

A. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.

B. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

C. A generator stabilization time delay shall be provided after transfer to emergency.

D. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

E. A 5-minute cooldown time delay shall be provided on shutdown of engine generator.

F. All adjustable time delays shall be field adjustable without the use of special tools.

2.08 ADDITIONAL FEATURES

A. A set of contacts rated 5 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

B. A push-button type test switch shall be provided to simulate a normal source failure.

C. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.

D. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.

E. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.

F. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.

G. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

H. Engine Exerciser - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.

I. Inphase Monitor - An Inphase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.

J. Selective Load Disconnect - A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.

K. Provide an elevator pre-signal module, to be wired to the building's elevator to signal an eminent transfer between active power sources to allow the elevator to lower to a designated floor and open its doors prior to transfer. Coordinate with the elevator installer.

PART 3 – OPERATION

3.01 TESTS AND CERTIFICATION

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001: 2000 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2000.

3.02 SERVICE REPRESENTATION

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

C. For ease of maintenance, the transfer switch nameplate shall include drawing numbers and serviceable part numbers.

3.03 INSTALLATION ASSISTANCE

A. The manufacturer of the Soft Load Transfer Switch shall provide the services of satisfactory trained technician to provide installation assistance.

3.04 CONTRACTOR'S RESPONSIBILTY

A. It shall be the responsibility of the installing contractor to verify that the following items have been completed and are ready to perform as specified before the arrival of the factory technician.

1. Inspect for obvious shipping damage.
2. The Soft Load Transfer Switch is securely installed and grounded.
3. All power cables have been terminated.
4. Install customer control wiring to external equipment including engines, batteries, associated motor control, etc.
5. The engine generator set is installed and ready to run.
6. Associated motor controls, plumbing, building utilities are complete and operational.

Note: Sufficient building load must be available at start-up procedures to properly test and qualify soft loading control operations. Available building loads must equal 100% of engine-generator set tested. Should building loads be less than 100% of the engine-generator set tested, load banks shall be required on-site at additional cost to installing contractor.

3.05 START-UP TECHNICIAN'S RESPONSIBILTY

A. The Factory Technician shall perform the following service onsite.

1. Verify contractor connections, control power availability, and visually inspect relay settings.
2. With the engine generator supplier's technical representative controlling the engine, verify that the switchgear and control equipment are fully operational and perform per the sequence of operation specified. Equipment or services shall be provided by the engine generator set supplier.
3. With the engine generator supplier's technical representative controlling the engine, demonstrate all functions of the control system, both automatic and manual, to the satisfaction of the approving engineer.
4. Provide documentation in the form of function checklists and recorded data for each section to the approving engineer.
5. Provide plant operators with instruction on the plant operating procedures and major component maintenance after acceptance by the approving engineer.

END OF SECTION 26 36 23

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SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions apply to all lighting installations.

B. Section 26 05 00 Common Work Results Electrical

C. Section 26 05 33 Raceway and Boxes

D. Section 26 05 19 Low Voltage Wiring

E. Section 26 09 23 Lighting Controls

1.02 REQUIREMENTS OF WORK

A. The Basic Electrical Requirements apply to all electrical materials, equipment, installations and services supplied under Dimmer package.

B. The Electrical Contractor shall obtain a Bill of Materials from the Lighting Supplier(s) listed herein or proposed for substitution. The Bill of Materials shall be submitted with the Contractor's bid and shall include, but not limited to, the following.

1. All lighting fixtures
2. All fixture accessories
3. Number, fixture type and luminaire type to be provided.

C. The Electrical Contractor (Sub-Contractor) and the Lighting Supplier(s) are responsible for the installation of a complete and operating lighting system in accordance with the intent of the Contract Documents.

1.03 SUBMITTALS

A. The following items shall be submitted for approval prior to ordering.

1. Lighting Fixtures

B. All submittals shall be submitted electronically in PDF format.

1.04 INSTALLER QUALIFICATIONS

A. A firm with at least five (5) years of successful installation experience on projects with electrical works similar to this project.

PART 2 – PRODUCTS

2.01 FIXTURE SCHEDULE

A. See fixture schedule on Electrical Drawings.

PART 3 – EXECUTION

3.01 GENERAL

A. All equipment shall be installed in a workmanlike manner and shall conform to industry Standards for this type on installation.

B. All fixtures shall be plumb and square with ceilings and walls.

C. Support for fixtures in or on a grid type ceiling. Use grid for support.

1. Install grid support wires on all four corners of each fixture.

2. Install support wires or support chains, minimum of two, independent of the ceiling grid to each fixture not more than 6 inches from the corner on diagonally opposite corners of each fixture.

D. Flange mounted fixture installation shall be per Manufacturer's instruction.

3.02 TESTING

A. "Megger" all wiring prior to energizing.

B. Test all switches and sensors for proper operation

C. Verify proper operation of each fixture.

D. Test each emergency fixture by interrupting the power to the fixture.

3.03 CLOSEOUT

A. Prior to final acceptance and Project closeout the Contractor shall:

1. Clean all fixtures and lenses inside and outside

2. Replace any burned out lamps or LED arrays.

3.04 WARRANTY

A. As Specified on each individual fixture listed herein.

B. In lieu of a specific fixture warranty, all parts and labor on this Project shall be warranted for a period of one (1) year after start-up and Owner acceptance.

END OF SECTION 26 51 00

SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions apply to all lighting installations.

B. Section 03 21 11 Concrete Reinforcing

C. Section 03 31 13 Cast in Place Concrete

D. Section 26 05 00 Common Work Results Electrical

E. Section 26 05 33 Raceway and Boxes

F. Section 26 05 19 Low Voltage Wiring

G. Section 26 09 23 Lighting Controls

1.02 REQUIREMENTS OF WORK

A. The Basic Electrical Requirements apply to all electrical materials, equipment, installations and services supplied under Dimmer package.

B. The Electrical Contractor shall obtain a Bill of Materials from the Lighting Supplier(s) listed herein or proposed for substitution. The Bill of Materials shall be submitted with the Contractor's bid and shall include, but not limited to, the following.

1. All lighting fixtures
2. All fixture accessories
3. Number, fixture type and light source type to be provided

C. The Electrical Sub-Contractor and the Lighting Supplier(s) are responsible for the installation of a complete and operating lighting system in accordance with the intent of the Contract Documents.

1.03 SUBMITTALS

A. The following items shall be submitted for approval prior to ordering.

1. Poles and arms (crossarms)
2. Light fixtures

B. All submittals shall be submitted electronically in PDF format

1.04 INSTALLER QUALIFICATIONS

A. A firm with at least five (5) years of successful installation experience on projects with electrical works similar to this project.

PART 2 – PRODUCTS

2.01 LIGHTING FIXTURE MANUFACTURERS

A. Acceptable Manufacturers Holophane

B. No substitutions campus standard.

2.02 FIXTURE SCHEDULE

A. All lighting unless otherwise noted shall be LED 3000K.

B. Refer to Electrical Drawings for fixture schedule.

PART 3 – EXECUTION

3.01 GENERAL

A. All equipment shall be installed in a workmanlike manner and shall conform to industry Standards for this type on installation.

B. All fixtures shall be plumb and square on the base and surroundings

3.02 POLE BASES

A. Pole bases shall be formed with appropriate sized sonatube, Earth formed bases are not permitted.

B. Raceway shall extend a minimum of 2” above finished top of base.

C. Provide ½” by 8’ copper ground rod at each base location a minimum of 1’ outside the diameter of the concrete base. Top of ground rod shall be buried a minimum of 6” below finished grade. Provide raceway out of the base to ground rod location and install a #10 solid bare copper conductor. Connection to ground rod shall be by means of a mechanical connector.

D. Provide concrete bases per details shown on the Electrical Drawings.

3.03 EMERGENCY POWER

A. When a building has an emergency generator and available emergency load is available:

1. Exterior lighting on walkways shall be on emergency power

2. Exterior lighting at entrances shall be on emergency power

3.04 TESTING

A. “Megger” all wiring prior to energizing.

B. Test all switches and sensors for proper operation

C. Verify proper operation of each fixture.

3.05 CLOSEOUT

A. Prior to final acceptance and Project closeout the Contractor shall:

1. Repair or replace any non-functional fixtures.

2. Verify all poles are level and plumb.

3.06 WARRANTY

A. As Specified on each individual fixture listed herein.

B. In lieu of a specific fixture warranty, all parts and labor on this Project shall be warranted for a period of one (1) year after start-up and Owner acceptance.

END OF SECTION 26 56 00

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SECTION 27 00 00 – GENERAL REQUIREMENTS BY OWNER

Telecommunications Equipment Rooms - General:

1. All ER's and TR's shall have access doors from public spaces.
2. All telecommunications room floors are to be clean and sealed before data racks, patch panels, or other equipment is installed.
3. Room layout and equipment layout within racks shall be approved by Owner before any equipment is installed.
4. All ER's and TR's shall have **24/7/365 temperature and humidity control**. Typically this shall be a separate unit from building HVAC systems. Main data wiring center will typically have a 7,000 watt heat load from the data switch gear. This heat load needs to be considered in unit sizing. ER and TR HVAC units shall be capable of operation below zero degrees Fahrenheit external temperature.
5. No lines that do or may carry any liquid shall be installed in or pass through ER's and TR's.
6. No electrical switch gear shall be installed with any ER or TR.
7. ER's and TR's shall not be shared spaced used for any other purpose.
8. There shall be no less than 60 inches clearance between the back of any row of racks and the nearest wall or row of racks. There shall be no less than 42 inches clearance between the front of any row of racks and the nearest wall. There shall be no less than 42 inches clearance at the end of any row of racks on the end opposite the starting wall of the row. There shall be no less than 6 inches clearance between the start of any row of racks and the nearest wall. (this includes wire management)

Telecommunications and Networking Requirements -General:

1. There shall be a Cat6A outlet anywhere a wall mounted TV or video display is shown.
2. There shall be a Cat6A wall mounted telephone outlet at ADA height in each classroom, conference room, and lab specifically for an ENS (Emergency Notification System) phone. This is stand alone and separate from any general use telephone(s) in the room. Where appropriate these shall be installed near the teaching station or at the front of the room.
3. There shall be a wireless access point connection in the ceiling per 25 students in a given area such as classrooms, labs, etc. All wireless access point locations shall have one CAT6A connection. **In areas with high ceilings wireless access points shall be installed no higher than twelve feet above finished floor**.Wireless access point layout must be approved by Owner before installation.
4. There shall be a Cat6A wall mounted telephone jack installed at ADA height near the doorway in all mechanical rooms, electrical rooms, storage rooms, etc.
5. All jacks called out for Data and Voice shall be Electrical Ivory. Face plates shall also be Electrical Ivory unless contract specifies face plate color to be the same as electrical face plate color.

6. **Every space including hallways, restrooms, closets, stairwells, etc shall have a unique room number identifier**. Final room numbers shall be confirmed with the Owner before construction documents are issued. **Once construction begins room numbers shall not change**.
7. Please clarify any questions with Owner prior to bidding, construction, or installation.
8. Contractor shall maintain and provide to ISU a Microsoft Excel spreadsheet in electronic format of all connections installed with the following fields filled out. **NO DATA PORTS WILL BE ACTIVATED UNTIL THIS SHEET IS PROVIDED FULLY FILLED OUT TO OWNER:**
    a. Room Number
    b. Jack Label
    c. Wire label
    d. IDF Room Number
    e. Rack Label for patch panel
    f. Patch Panel label
    g. Patch panel port
    h. Cable Length

Telecommunications and Networking Room -Architectural:

1. The (ER) minimum room size shall be 10' deep and 12' wide for the main equipment room.
2. The minimum size for a Telecommunications Room(s) (TR) shall be 10' deep and 8' wide.
3. The minimum ceiling height shall be 9 feet above finished floor (AFF).
4. To permit maximum flexibility and accessibility of cabling pathways, false ceilings are not permitted.
5. Walls SHALL extend to structural ceiling.
6. Ceiling, floor, and wall finish that minimizes dust shall be used.
7. Design ER/TRs to have fully opening (to 180 degrees recommended), lockable doors that are minimally 42 inch wide and 80 inches tall.
8. Door sills are not allowed because they impede the movement of equipment.
9. Removable center posts are permitted, if required.
10. Install doors to be removable.
11. Dust and Static Electricity; Avoid dust and static electricity by:
    a. Installing tile instead of carpet.
    b. Treating floors, walls, and ceiling to minimize dust.
12. Doors SHALL open outward.
13. Doors SHALL have locks with campus master “FM5" installed.

Telecommunications and Networking Rooms - Environmental Control:

Provide HVAC that will:

1. Maintain continuous and dedicated environmental control (**24 hours per day, 365 days per year**.)
2. If emergency power is available, consider connecting it to the HVAC system that serves the ER/TR.
3. Maintain positive pressure have have a minimum of one air change per hour in the ER/TR.
4. Dissipate the heat generated by active devices.
5. Provide 300ft cubed of 54 degrees conditioned air per 20 ampere (A) dedicated electrical outlet.
6. The temperature range should be 64 degrees to 75 degrees.
7. The humidity range should be 30% to 55% relative humidity.
8. Keep changes in temperature and humidity to a minimum.
9. ERs/TRs should be calculated using 7500 BTU/HR from communications equipment.

Fire Protection

1. If sprinkler heads are provided, install wire cages to prevent accidental operation.
2. For wet pipe systems, drainage troughs are required to protect equipment from any leakage that may occur.
3. To prevent water damage, consider using “dry pipe” sprinkler systems.

Lighting

1. Provide a minimum equivalent of 500 lux (50 footcandles) measured 3 feet AFF.
2. Coordinate closely with the rack/cabinet placements.
3. Locate light fixtures a minimum of 9 feet AFF.
4. Light fixtures SHALL be positioned to provide adequate light to front and rear of racks as well as backboards.
5. Emergency lighting is required. Place emergency lighting to ensure that the loss of power to normal lights will not hamper an emergency exit from the TR.
6. ER/TR shall not have motion and/or timer based lighting.ER/

Other Uses

1. ER/TRs should be dedicated to the telecommunications function and related support facilities. Equipment not related to the support of the ER/TRs (e.g. piping, duct work, and distribution of building power) should not be located in, or pass through, the ER/TR.
2. The ER/TR shall not be shared with building users or custodial services.

Power

1. On the wall at the end of each row of relay racks install two (2) 5-20 110vac outlets.
2. On the wall at the end of each row of relay racks install two (2) L6-30 208vac outlets per 224 data/voice outlets terminated in the relay racks. L6-30 208vac outlets are to be installed in pairs. One of each pair is to be on building commercial power. And one of each pair is to be on the building emergency generator power.
3. Make sure there are a minimum of two (2) quad 5-20 110vac outlets evenly spaced on each of the four walls.
4. All outlets in telecommunications rooms are to be on building emergency generator power except as noted in item #2 above.
5. All outlets must have labels indicating the circuit / breaker panel and if they are commercial or generator feed.
6. Consider providing emergency power to the ER/TR with automatic switchover capability.
7. Distribution panels that serve telecommunications equipment should be separate from those that serve lighting fixtures.
8. At least one electrical outlet shall be on normal power, and one electrical outlet shall be on emergency power.
9. Outlets requirements on backboards as well as racks/cabinets as shown on the enlarged floorplans.

Data Communications Equipment

1. Owner shall provide network electronics – Network Switches and Access Points.
2. Ceiling mount Access Point identification and installation.
    a. All locations shall have labeling consistant with wall plate labeling specified in 27.11.16.0.
    b. Optimal mounting height is 8 to 12 feet in height from the floor. Exceptions need to be approved by the owner.
    c. Access points that mount to ceiling grid / drop ceilings shall have the label placed on the grid at the location of the terminated cable. 10’ service loops only apply to these types.
    d. Access points that mount to hard ceilings will have a duplex box mounted flush with the ceiling and the network cable terminated and through the box. No wall plate is required. No extra service loop required.
    e. Access points that mount in open concept ceilings will have an appropriate conduit and box to mount the Access point to. Should the ceiling exceed 12’ in height a conduit with a quad box shall be mounted and extended down from the structure to the desired height. The Box and Conduit can be painted as desired to match the decore. The final height of the should be even or slightly below any other hanging objects such as lights, ventilation etc. to offer optimal wireless coverage.
    f. All ceiling access points and necessary brackets will be provided by the owner and the contractor will hang the access points. Installation shall be in accordance with the designated location and methods required by the specific mounting type. Installation

shall not occur until after the cable is tested / certified and while lifts and ladders are still available to mount the equipment.

g. The contractor will add the cable labels to the face of each access point after mounting so that they are easily identifiable in addition to the labeling already provided by the owner.

3. Office Wall mount Access points identification and installation.
   a. All locations shall have labeling consistant with wall plate labeling specified in 27 11 16 0.
   b. All locations shall have a duplex wall box and have 2 network drops provided to the location. No wall plate is required.
   c. All wall mount access points and necessary brackets will be provided by the owner and the contractor will mount the access points in accordance to the designated location and methods required by the specific mounting type, after the cable is tested / certified.
   d. The acces point will have the first network drop connected to the Pass-Thru port and the second to the access point port.
   e. The contractor will add the cable labels to top of the Access points after mounting so that they are easily identifiable in addition to the labeling already provided by the owner.
4. General area mount Access Point identification and installation.
   a. All locations shall have labeling consistant with wall plate labeling specified in 27 11 16.0.
   b. Optimal mounting height is 8 to 12 feet in height from the floor. Exceptions need to be approved by the owner.
   c. All locations shall have a duplex wall box and have 1 network drop provided to the location. No wall plate is required.
   d. All wall mount access points and necessary brackets will be provided by the owner and the contractor will mount the access points in accordance to the designated location and methods required by the specific mounting type, after the cable is tested / certified.
   e. In some locations protective guards (plexiglass shields) may be required and will be provided by the owner to be installed by the contractor.

Voice Communications Equipment

1. Viking E-1600-65A phones shall be installed in all areas of refuge as designated by ISU Public Safety. These areas may include those such as elevator lobbies, stairwell access areas, etc. Owner shall confirm these locations prior to installation.

Requirements for ER/TR data commucation equipment Installation

1. The owner will not install the final set of equipment in an ER/TR until the following conditions are completed per the specifications. It will take 3 to 5 days to install and test equipment in each ER/TR once turned over.
    a. HVAC is operational
    b. All plywood and significant construction in the room is completed.
    c. All copper terminations are completed, tested and labeled per the specifications.
    d. Fiber uplinks to either the appropriated ER or Core networking location is terminated and tested.
    e. All Power and lighting is installed, labeled and completed. Additionally the power will not be or minimally interrupted.
    f. ER/TR is cleaned and floor is mopped and sealed.
    g. ER/TR is lockable with final specified key.
2. Interim temporary switches can be installed for critical infrastructure like HVAC and similar systems. Equipment will be a small 8 port switch that will be mounted to the plywood covered wall. However the following must be meet and 1 to 3 days are required to install and test equipment in each ER/TR as required.
    a. Fiber or copper uplinks to either the appropriate ER or Core networking location is terminated and tested.
    b. Plywood is mounted on the wall nearest the end of the rack row.
    c. Power and lighting is installed and active.
    d. ER/TR is lockable / secured during non-working hours.
3. Construction related infrastructure network activation requests must be directed to the owner project liason for proper request processing. Typically HVAC, cameras and similar systems. They can only be completed when either option 1 or 2 above for “Requirements for ER/TR data communication equipment Installation” are completed.

Occupant / General Network Access

1. Once the final set of equipment is installed in the ER/TR and the access points are installed / mounted. The wireless should become active in 1 to 3 business days.
2. Network wired ports are activated on request of the occupant. The owner (user support consultant) will work to coordinate identifying and activating the necessary ports through the owner Help Desk system.
3. By default only one (1) network port will be actived per single person office as identified. Second port can be active on request with reasonable justification.
4. All activation requests, if not coordinated by the owner (user support consultant), must be directed through the owner Help Desk by the occupants.
5. Each building is assigned unique sets of IP addresses. Therefore all occupants moving between buildings will be required to re-register their wired devices for a new IP address before it will function.

6. Port activation SLA is typically 1 working day unless there are multiple activities occurring (i.e. start of the semester etc.) that may extend this delivery time. It will be on a first come first serve best effort process.
7. Occupants should plan to bring any existing network cables currently connected to their devices from their previous location. Should the occupant need a different length cable they can request one through the owners help desk. All office patch cables must be CAT5e or higher.
8. Network jack locations are designated in the construction plan. Should occupants disagree with the location and want to add an new jack they must:
    a. If the building has not been turned over and while the project is still under way, then they must work with the owner Facilities Management team and request a change order to the project with justification to have the additional network drop added or relocated.
    b. If the building has been turned over and the project is officially completed, then they must request any additional network jacks through the owner defined processes and are subject to installation fees per the owner specifications.

END OF SECTION 27 00 00

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SECTION 27 00 10 - GENERAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. The following items are additional requirements for Division 27 “Communications” Work.
B. If after reviewing all documents and drawing there is any questions or doubt, or if a conflict or discrepancy is found between the documents and the drawings, contact the Owner in writing for clarification before proceeding. Clarification will be issued by Addendum.
C. Each Item below has the Division 01 00 00 specification section number (in parenthesis) of the article where the base requirements are found. The additional requirements are to be considered additive to the Division 01 00 00 section and apply only to Division 27 work.
D. Each Division 27 Specification Section may add additional requirements specific to that Section.

1.3 REQUIREMENTS

A. (01 25 00 Substitution Procedures)
   1. Substitutions
      a) All products provided as Work of this Project shall be in compliance with, and meet the physical, functional, and operational requirements of the products as outlined in Part II of each Division 27 specification Section.
      b) Product Substitutions
         1) Substitution requests must be received by the Owner as required by Division 1.
         2) No substitutions will be accepted without prior approval. Only changes issued in an Addendum will be allowed.
         3) See Substitution Submission below.
      c) Standard of Quality
         1) A Standard of Quality will be set by applying a Manufacturer and Catalog number to each item in Part II of each applicable specification section.
         2) A standard of quality item has the physical, functional, and operational attributes to provide the designed functionality.
         3) Additional approved manufacturer(s)
            i) Listing as an additional approved manufacturer for an item is not an assurance that the manufacturer has products that meet the requirements; at minimum, the written description must be met along with any key attributes used in the Project design.

ii) When a listed “additional manufacturer” has a product that meets the written description and has the physical, functional, and operational attributes, that product may be used in place of the product that was listed as the standard of quality without submission for prior approval.
(A) If such a substitution is made, the requirements for items by the “same manufacturer” shall be adhered to.
(1) Requirements for “system” type warranties requiring the same manufacturer or manufacturing “partnership” items for warranty application shall be adhered to.
(B) It will be the sole responsibility of the Contractor to provide adequate design compensation for fulfillment of the intent of the Specification for any change in Scope due to an “approved manufacturer’s” product change from this Section (i.e., required rack space, box size, support requirements, etc.).
(1) Adequate compensation shall be determined by the Owner.

4) Where 2 or more Manufacturers and Catalog numbers are listed, one of the two products must be utilized. Item listed first is Owner’s preferred product.

B. (01 25 13 Product Substitution Procedures)
1. Substitution Submission
a) Each item submitted must meet the physical, functional, and operational attributes of the Standard of Quality item.
b) All requests for substitutions shall be accompanied by a complete system brochure and/or individual product data sheets.
1) Contractor shall state a reason for the substitution request (i.e. familiarity, availability, functionality, Brand specific training, Manufacturer’s warranty issue, etc.)
2) Contractor shall provide comparison list of features, functions and specifications where proposed substitute product differs from specified product.
3) Each request must reference the Specification Section number and paragraph and include a description of any deviation from the specified functional requirements of the equipment and/or system(s).
4) A demonstration of the proposed equipment and/or system(s) may also be requested. This information must be submitted in compliance with Division 1 Section “Substitutions.”
c) Failure to provide all information may result in the substitute product being rejected.
d) Owner reserves the right to reject any substitute.
2. Substitution Responsibility
a) Contractor shall be responsible for all additional costs, both direct and indirect, including costs for additional equipment, materials and labor necessary to properly integrate a substitute product, including additional costs which may be incurred by other trades, the Owner, Architect or Owner. (i.e., required rack space, box size, support requirements, etc.).

C. (01 26 13 Requests for Interpretation)
   1. Contradictions, discrepancies, or conflicts
      a) This Contractor shall carefully study and compare the Contract Documents and shall at once report to the Authority as set forth in 01 31 00 “Project Management and Coordination” any error, inconsistency or omission discovered.
      b) In the case of a contradiction, conflict, or discrepancy between Division 27 Sections and Divisions 0 and/or 1.
         1) Division 27 Specifications will be considered additive. It is not intended that Division 27 Sections supersede any legal or contractual requirements set forth in Division 0 or 1.
      c) In the case of a contradiction, conflict, or discrepancy between T Series Drawings and/or Division 27 Specification Sections
         1) If during the Bid period the Contractor discovers a contradiction, discrepancy, or conflict of information on any Drawing, between any two drawings, between Drawings and specification Sections, within any Division 27 Section, between related Sections, between individual parts of a Section, or within any part of any Section; the contradiction, discrepancy, or conflicting information shall be called to the attention of the Owner in writing and will be clarified by Addendum.
         2) A contradiction, discrepancy, or conflict of information that has not been clarified in writing at Bid time will be considered to be the more costly of the available options.
         3) If a contradiction, discrepancy, or conflict of information is discovered after award of Contract; the discrepancy or conflict will be submitted to the Owner in writing for evaluation. The result will be clarified by a Change Order. This Change Order will be of $0 or will require a deduct to change the requirement to a less costly option if so decided by the Owner.
            i) If Contractor performs any construction activity knowing it involves a recognized contradiction, discrepancy, or conflict in the contract documents without such notice to the Owner or Owner, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost required for correction.

D. (01 31 13 Project Coordination)
   1. Coordination
      a) Coordination shall commence immediately upon award of contract. Failure of this contractor in coordinating (including providing and extracting related information to and from other trades for review) in a timely manner, shall not result in any subsequent additional reimbursement, special allowances or additional construction time being made for any facet of the project. Work fabricated or installed before properly coordinating with all other trades shall be done at the Contractor's own risk.
      b) Sequence, coordinate, and integrate installations of communications materials and equipment with the Division 26 electrical contractor any all other applicable trades for efficient flow of the Work.

c) The contract document drawings are an outline to indicate the approximate location and arrangement of required work. The drawings shall be followed as closely as possible in coordination and in execution of the work.

d) This contractor shall work in harmony with all building contractors and sub-contractors, so as not to cause any delays in pouring concrete, building masonry walls, etc. This contractor shall consult the Architectural, Plumbing, HVAC and Structural plans in all instances before installing his work so that his work will not interfere with those branches.

e) This contractor shall participate in coordination efforts and in preparation of coordination drawings prior to fabrication or installation of any equipment, materials, etc. Coordinate actual clearances of all installed equipment.

f) Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with the drawings of other trades, this contractor shall work with the trades to correct the conflict while coordinating the project (prior to installation). If the conflict cannot be resolved, refer the matter to the owner's representative for a final decision as to method or material. This contractor shall refer to drawings of all other trades for details, dimensions and locations of other work and route their work so as not to conflict with any other branch. Any work installed or equipment placed in position by this contractor creating a conflict shall be readjusted to the satisfaction of the owner's representative at the expense of this contractor.

g) Plans are diagrammatic indicating design intent and indicating required size, points of termination and, in some cases, suggested routes of raceways, etc. However, it is not intended that drawings indicate fully coordinated conduit routing, all necessary offsets, etc. All cable assemblies, etc. shall be run as straight as possible and symmetrical (perpendicular to or parallel with) with architectural items and in a consistent elevation. Work installed diagonal to building members shall not be permitted.

h) The Contractor shall coordinate his work with all other trades and locate equipment accordingly. This Contractor shall refer to coordination drawings of the other trades. Any communications work fabricated or installed before the above referenced coordination with all other trades shall be done at the respective contractors' risk.

i) It is intended that all apparatus be located symmetrical with architectural elements and shall be installed at exact height and locations as shown on architectural drawings. If a device height or location is in question it shall be the responsibility of this Contractor to immediately seek clarification from the Owner.

E. (01 31 16 Multiple Contract Coordination)

1. Coordinate work with Division 26 Contractor (where applicable); prior to Division 26 Contractor's installation of outlet boxes, conduit, conduit stubs, raceways and any other provisions in support of Division 27 Contractor’s work.
2. Coordinate with all other Contractor’s and the Owner, as applicable and necessary to ensure a clean, professional looking and operating systems.

F. (01 31 19.16 Site Mobilization Meetings)

1. The Contractor shall fully inform himself regarding all peculiarities and limitations of space available for installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. Although the locations of equipment and conduit may be shown on the drawings in certain positions, the architectural details and conditions existing at the job site shall guide the Contractor, coordinating his work with that of others. Provide all offsets as required to provide a neat workmanlike arrangement

G. (01 33 23 Shop Drawings, Product Data, and Samples)
   1. Submittals required after Award of Contract but before starting Work include:
      a) Complete BOM list
         1) BOM shall include the following information for each product:
      b) Product Information Sheets “Datasheets”: Include catalog information, sizing, and technical data on each item to be used on the Project.
         1) Each product datasheet must reference the specific paragraph for which the product is being submitted. Each product must be listed in the exact same order as it appears in the Section for which the products are being submitted.
            i) Datasheets shall each include a clearly identifiable label applied in upper corner of each sheet that clearly references the specification section and drawing (as applicable) to which it applies. Labels shall be consistently affixed in the same location on all sheets unless the labels will obstruct pertinent technical information.
         2) All datasheets shall be original manufacture datasheets, first generation printed copies of manufacturer’s electronic datasheet (i.e. printed copy of a PDF file), or high quality photocopy of original manufacturer’s datasheets.
            i) Fax versions of product datasheets or any photocopies thereof are not acceptable.
            ii) Submit original printing or “clean” reproductions.
         3) Where datasheets depict multiple products, versions or options, the Contractor shall highlight (indicate with an arrow) all applicable model(s), version(s) and option(s) applying to the specific product the Contactor will be providing. Exact catalog number must be indicated. The submitted items must be from “approved materials” as specified in each Specification Section.
         4) Product datasheets shall be “approved” by the Owner before delivery to the Project site. Any product not approved through the submittal process is at the sole risk of the Contractor.
            i) A copy of “Approved” datasheets shall be included in O & M manual requirements
         5) Required Information
            i) Complete Bill of Materials (BOM) List
               (A) The manufacturer’s name (Brand) and full model number shall be used. (Distributor and Contractor assigned names and model numbers are unacceptable).
            ii) Manufacturer Product Datasheet for each product.

(A) Product datasheets shall be manufacturer originals, or first generation printed versions of manufacturer's official electronic product sheets.
(B) Manufacture model shall be highlighted on each sheet.
(C) Datasheets shall be organized to match the order and organization of this section

2. Submission Format
   a) Submit Shop Drawings and Product Data Sheets in a bound form
      1) Submittals shall be supplied in an appropriately sized 3-ring binder(s). Separate binders shall normally be used for each Division 27 Contract.
      2) Manuals shall be bound in hard cover, 3 ring binders with clear plastic "pocket" covers to insert Project Information on the exterior of the Binder.
      3) Maximum individual Binder spine size shall be 3"; utilize multiple binders as required.
   b) Submittal Manuals shall include the information listed below and be assembled as follows:
      1) Binder shall be marked on the cover and spine with the following information
         i) Project Information
            (A) Title of Project
            (B) Name and address of Owner, Contractor, Architect, Owner
            (C) "Submittals for " (specification Section(s)
            (D) Date of Submittal
      2) Organization
         i) The binder is subdivided into specification sections.
         ii) Each Binder shall be organized as follows
            (A) Master Tab 1: Project and contact information
            (B) Master Tab 2: (First) Specification Section
               (1) Section 1: Title Page
               (2) Specification section name & number
               (3) Contractor/Subcontractor Information Including:
               (4) Name, address and phone
               (5) Project manager name and phone
               (6) Section 2: Bill of Materials
               (7) Section 3: Product Datasheets
               (8) Section 4: 11 x 17 inch reduced scale versions of full size shop drawings. Drawings shall be folded, punched and inserted into the binder.
            (C) Master Tab 3 through (x): Additional Specification Section(s)
               (1) Repeat Sections 1-5 above for each Specification Section.
         iii) Division 27 submittals may not be combined with submittals from any other Division.
      3) Full-size shop drawings shall be printed to scale and bound along the left edge of the drawings with the Title block on the right edge.
      4) The Contractor shall provide a record of shop drawings using AutoCAD Release 2000 or higher.

i) Detail drawings may be submitted in Visio 2000 format.

3. Submission
   a) Provide minimum of (5) copies of all submittal items.
      1) Two copies of all Submittals will be retained by the Owner.
      2) Three copies will be returned.
         i) One copy of approved Submittals will be required to prepare Record Drawing for the O&M (Owner's) Manual.
         ii) One Copy for the Project site
         iii) One Copy for the Contractor's records
      3) Provide additional quantities as may be required by other applicable sections (including Division 1), as requested by the Owner, and as required by the Contractor for its own purposes.
   b) Timetable
      1) Contractor shall make all Submittal submissions as soon as practical after award of Contract.
      2) Provide submittals in adequate time so as not to negatively impact the completion of the project or the schedule of other trades.
         i) Contractor shall allow a minimum of 2 weeks in its schedule for the Owner's review of submittals.
4. Review of shop drawings does not relieve the Contractor of responsibility for correct ordering of material and equipment. Contractor review should ensure that equipment will fit in available space.
   a) PARTIAL OR INCOMPLETE SUBMITTALS WILL BE REJECTED PRIOR TO FULL REVIEW.
   b) Unacceptable submittal items:
      1) Fax copies of datasheets
      2) Datasheets that are not legible.
      3) Datasheets that do not clearly depict and/or enumerate all specification requirements.
      4) Non-manufacture datasheets (i.e. from a distributor)
      5) HTML web page printouts that are not the manufacturer's official product datasheet.
      6) Identification of products by Contractor or Distributor assigned part numbers, catalog numbers or private label brand names.

H. (01 41 13 Codes)
   1. Building Codes:
      a) National Electrical Code (NFPA 70)
      b) Life Safety Code (NFPA 101)
      c) Uniform Building Code (Or adopted State Code)
      d) Federal Communications Commission (FCC) Part 68
      e) State specific agencies:
         1) Administrative Building Council
         2) State Board of Health
         3) State Fire Marshal
      f) Local Codes (City, County, etc.)
      g) Local Utility Company requirements

I. (01 41 26 Permits)
   1. Contractor shall obtain and pay for all permits or certificates of inspection and approval required for his branch of the work.
      a) Permits shall be posted in a prominent place at the building site properly protected from weather and physical damage.

J. (01 42 16 Definitions)
   1. Wherever the words "Contractor", "This Contractor" or "Subcontractor" appears in Division 27 specifications, it shall refer to the Division 27 Communications Contractor (or Subcontractor of the Communications Contractor where applicable).
   2. A reference to Owner shall be referring to the Owner's Representative involved in the design of the System(s). The Owner may or may not be affiliated with the Architect and or Engineer for the Project. All information exchanged between the Contractor(s) and the Owner shall be within the information exchange process of the Project. (i.e. through a Construction Manager, General Contractor, Architectural Firm, etc.)
   3. Wherever the words "Designer", "Consultant" or "Engineer" appears in Division 27 specifications or its related drawings, it shall be interpreted to mean the specifying authority responsible for the creation of the Division 27 specifications and related drawings.
   4. Wherever the word "Install" appears on the drawings or in these Division 27 specifications it shall mean to supply all labor, tools and incidental materials necessary to handle, store, mount, terminate, program, configure and adjust product as necessary to fulfill project requirements.
   5. Wherever the word "Provide" appears on plan drawings or in Division 27 specifications, it shall be interpreted to mean that the Contractor shall "Furnish and Install", including all necessary accessories, miscellaneous materials and labor necessary to render the respective system fully operational.
   6. Wherever the word "Work" appears in Division 27 specifications or on communication technology drawings, it shall be interpreted to mean any and all labor, materials, accessories, services, etc. necessary to fulfill project requirements.
   7. Wherever the word "Furnish" appears on the drawings or in these Division 27 specifications it shall mean to supply the specified labor or specified product (context dependant), including all associated shipping, storage and warranty expenses.
   8. Wherever the words "Site", "Project Site", or "Premises" appears in Division 27 specifications or its related drawings, it shall be interpreted to mean all real estate, buildings and structures where work will be performed and where products will be installed and reside.
   9. Wherever the phrase "or Approved equal" appears in Division 27 specifications or its related drawings, the contractor shall interpret this to mean that pre-bid approval of specific models of equipment is required before submission of the Contractor's bid.
   10. Wherever the phrase "or Equal from", or "or Equal by" appears in Division 27 specifications or its related drawings, the Contractor shall interpret this to mean that the Contractor may supply any product manufactured by the given list of manufacturer's meeting or exceeding the overall quality, functional, technical

performance, construction, finish and general fit and fitness as the "Standard of Quality" design product. The final authority as to whether a product is equal shall remain with the Owner. Pre-bid approval is highly recommended.

11. Wherever the phrase "Additional Approved Manufacturer(s)" appears in Division 27 specifications or its related drawings, the Contractor shall interpret this to mean that the Contractor may supply any product manufactured by the given list of manufacturer's meeting or exceeding the overall quality, functional, technical performance, construction, finish and general fit and fitness as the basis of design product. The final authority as to whether a product is equal shall remain with the Owner.
12. Wherever the phrase "Standard of Quality" appears in Division 27 specifications or its related drawings, the Contractor shall interpret this to mean that the listed Manufacturer and Catalog number for each item has the physical, functional, and operational attributes to provide the designed functionality.
13. Substantial Completion:
    a) The point at which the following has been completed:
        1) All specified work, and;
        2) All punch-list items that affect the full and complete use of the system, and;
        3) Successful acceptance testing by the Owner, and;
        4) Successful inspection and demonstration of the work to the Owner's representative, and;
        5) Contractor's delivery of a request for "Letter of Substantial Completion"
            i) The request shall include the Specification Section(s) completed, confirmation of completion of the items listed above, and the requested Substantial Completion date (no more than 7 calendar days prior to this Letter).
        6) Contractor has received a Letter of substantial Completion for the Owner.
14. Nominal Operating Levels: The standard signal voltage/power reference level which a manufacturer has designed its product's inputs and outputs to operate at to achieve the manufacturer's specified performance levels.
15. Wherever the words "This Division" appears in Division 27 specifications or its related drawings, it shall be interpreted to mean these Division 27 specifications and all of its related drawings.
16. Wherever the words "Low Voltage", or "Low-Voltage" appears in Division 27 specifications or its related drawings, it shall be interpreted to mean less than or equal to 70.7 volts, AC or DC.
17. Wherever the words "High Voltage", or "High-Voltage" appears in Division 27 specifications or its related drawings, it shall be interpreted to mean greater then 70.7 volts, AC or DC.

K. (01 43 00 Quality Assurance)
    1. Quality Assurance
        a) Requirements

1) Contractor shall have a minimum five (5) years experience in the installation of Communication Technology system(s) of similar size, type, scope and contract value.
2) The Prime Contractor or his subcontractor responsible for this Section shall have a Registered Communications Distribution Designer (RCDD) on staff that will be ultimately responsible for this Project. The RCDD must have sufficient experience in this type project as to be able to lend adequate technical support to the field forces during installation, the warranty period, and any extended warranty periods or maintenance contracts. If in the opinion of the Owner, the RCDD does not possess adequate qualifications to support the Project, the Owner reserves the right to require the Contractor to assign an RCDD who, in the Owner's opinion, possesses the necessary skills and experience required of this Project.
3) The lead technician(s) on the Project shall carry a current BICSI Technician Certificate or have five years of experience in projects of similar scope.
4) The lead technician(s) on the Project shall have a thorough understanding of the following:
    i) American National Standards Institute/Telecommunications Industry Association/Electronics Industry Association – ANSI/TIA/EIA 568B Commercial Building Telecommunications Cabling Standard.
    ii) American National Standards Institute/Telecommunications Industry Association/Electronics Industry Association – ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and spaces.
    iii) American National Standards Institute/Telecommunications Industry Association – ANSI/TIA/EIA 606 The Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings.
    iv) American National Standards Institute/Telecommunications Industry Association/Electronics Industry Association – ANSI/TIA/EIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
5) Contractor shall be a (factory trained) certified installer for all connectivity products.(cable and terminations).
    i) This minimum requirement shall apply to each Division 27 section independently. If Contractor is incapable of meeting the percent of product value requirement for each section, Contractor shall use a Subcontractor that can meet the percent of product value requirement, in whole, for all products and work of that section for which This Contractor is not qualified.
    ii) The specific Contractor or Subcontractor meeting the requirements for a specific section shall be responsible for the supply of the products, supplemental engineering services and submittals as well as performing all technical labor associated with the installation, training and warranty servicing of work of that section.
6) Contractor shall have substantial business operations located within a 100 mile radius of the project site with a full-time employee staff actively

engaged in the supply, installation and service of systems and equipment of the type and scope herein specified.

7) Contractor shall have full-time employee service staff based within a 100 mile radius of the project site.
8) Contractor shall provide any additional information requested by the Owner as determined appropriate by the Owner to validate a Contractor's (or its Subcontractor's) ability to perform and warranty the specified work in the quality, manner and time frame required.
9) In the absence of a requirement to provide a performance bond the Designer reserves the right to require a financial disclosure of the Contractor and any Subcontractor for the purpose of aiding the Designer in determining the ability of the Contractor or Subcontractor to perform.
10) Designer reserves the right to disqualify the use of any Subcontractor that This Contractor plans to use if the Subcontractor fails to meet the quality assurance requirements. Should this occur, This Contractor shall be required to choose another Subcontractor that does meet these quality assurance requirements.
    i) An equipment vendor not performing the technical labor associated with installation of the work of a given section shall not be considered a Subcontractor.
11) Superintendent/Project Manager
    i) This Contractor shall furnish the services of an experienced superintendent/Project Manager who shall be constantly in charge of the work, together with the qualified Foremen and specialists as required to properly install, connect, adjust, start, operate and test the work involved.
    ii) The superintendent's/Project Manager's qualifications shall be subject to the review and acceptance by the Owner/Owner. Unless the Owner/Owner grants prior special permission, the same communication Superintendent/Project Manager shall be utilized throughout the duration of the project and be responsible for the complete scope of the Contract.

b) Documentation to be submitted upon request pre or post bid for evaluation includes:
1) A complete material list by specification section for each specification section:
    i) Include description, the manufacturer being used, and the manufacturer's part number.
    ii) Submission of this list does not constitute acceptance by the Owner or relieve the Contractor from providing approved items in the proper quantities to fulfill the Scope of this Project.
2) References:
    i) A minimum of five reference accounts at which similar work, both in scope and design for each system specified, has been completed by the Contractor within the last four years.

(A) The list shall include contact names and telephone numbers for each.
(B) Each listed Project shall include a Summary of Work.
(C) Each listed Project shall include initial and final contract amounts.
(D) Each listed Project shall include initial Contract award date and completion date.
(E) Each listed Project shall identify the name of Contractor's project manager and lead technician responsible for the project.

3) List of test equipment:
i) Proposed equipment for use in verifying the installed integrity of copper and fiber optic cable systems on this Project.

4) Technical resume:
i) Provide experience of the Contractor's Superintendent/Project Manager and onsite installation supervisor (Foreman) who will be assigned to this Project.

5) List of technical product training:
i) Training attended by the Contractor's personnel that will be working on this Project.

6) Subcontractors list for Work of this Project.
i) List Scope of Work for each Subcontractor
ii) List References for each subcontractor
iii) Technical resume as described above for each subcontractor
iv) List of technical product training as described above for each subcontractor.

7) Each specification section may detail additional Quality Assurance requirements in the PART I, Quality Assurance paragraph.
i) Submit each item identified in each Specification Section.
(A) Manufacturer Certification documentation as requested in each Section.

8) Documentation substantiating the Contractor's factory authorization and warranty service status for all products specified and all other major products proposed for use by the Contractor.

9) Financial Disclosure.

c) Failure to supply a complete quality assurance submittal; failure to supply accurate references or references which yield favorable performance marks; or failure to supply other quality assurance information required shall be taken as a statement of the Contractor's inability to perform and shall be grounds for the Owner and/or Owner to reject the Contractor's bid.

L. (01 62 00 Product Options)

1. The contract documents are prepared on the basis of a single specific product as the "design equipment," even though other manufacturers' names and models may be listed as acceptable, or equal. The first manufacturer make and model for each product is the "design equipment" or "Standard of Quality".

a) This section is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.

b) This standard will be considered in force for the original response as well as for any additions or changes to this Project. Due to this, there may be items listed in the Products section that are not required under the scope of this contract.

c) Project design is based on the "Standard of Quality" listed products' physical, functional, and operational attributes. The use of any product not listed as the Standard of Quality must be compared for full functionality to the listed Product.

d) When several materials, products or items of equipment are specified by name for one use, the first item shall be considered Owner's preferred product. Contractor may select any one of those specified for requested approval. It shall be the responsibility of the Contractor to provide an item that meets or exceeds the qualities and functional characteristics of the device specifically listed by brand name and model number.

e) The Contractor is responsible for any other ancillary changes required to meet the Project objectives when utilizing substitutions. Approval of items submitted during the submittal process does not relieve the Contractor of this responsibility.

2. Product acceptability and substitutions are determined by criteria as required this section under "Substitutions".

3. Materials installed shall be new, full weight and of the best quality. All similar materials shall be of the same type and manufacturer. All materials, apparatus and equipment shall bear the Underwriter's Laboratory, Inc. label where regularly supplied, or required by Code.

4. In the event that a specified product is discontinued by the manufacturer and is no longer available for purchase, the Contractor shall provide replacement product of equal or greater value, performance and function. The replacement product shall be from the same manufacturer as the specified equipment unless written approval to use an alternate manufacture is obtained from the Owner.

M. (01 65 00 Product Delivery Requirements)

1. Product Procurement

a) The Contractor shall not procure, deliver or install any product until after the contractor's submittal has been reviewed by the Owner and the submittal has been returned to the Contractor's marked "No Exceptions", "Exceptions Noted" or "Exceptions Noted, Submit Record Copy" or "Approved". Advance procurement, delivery or installation of product prior to the return of submittal is entirely at the Contractor's own risk. Contractor should schedule its work and procurement accordingly.

b) Prior to procurement of any equipment or materials, Contractor shall review the model numbers, compatibility and interoperability of all products.

c) Prior to procurement, Contractor shall, through coordination with other trades and through field measurements and project site inspections, verify that products to be supplied can be physically installed as planned.

d) No claim for additional payment will be considered for the return of any equipment determined incompatible, or procured without adhering to the

aforementioned conditions, including claim for reimbursement of manufacturer's "restock" fees.

e) Contractor shall factor all of these conditions into its bid and plan its scheduling and resource needs accordingly to ensure that all work shall be performed according to the Owner's schedule and requirements of this contract.

N. (01 66 00 Product Storage and Handling Requirements)

1. Product Delivery, Storage and Handling

a) Receipt of materials

1) The Contractor is responsible for receiving, handling, storing, and protecting all materials used on this Project until Substantial Completion.

b) Upon request, submit a schedule of equipment and materials required to complete installation, quantity ordered, order date, and promised delivery date.

c) Deliver equipment and materials in accordance with factory shipping requirements.

1) Pack components in factory-fabricated protective containers.

2) Units shall be delivered in sections of such size as will pass through available openings.

d) Until ready for installation, store products in original factory containers.

1) Products shall be stored in a clean, dry space and as additionally recommended by the product manufacturer.

2) Keep products out of the weather and away from construction traffic and debris, including drywall finish dust.

3) Do not exceed structural capacity of the floor or platform on which the products are stored.

e) Until final acceptance of the system, protect all supplied products from damage resulting from moisture, fumes, dirt, dust and debris or any other source of potential damage.

f) Handle all products with care before, during and after installation so as to prevent damage.

1) Replace any products damaged prior to final acceptance with new replacement products.

i) Replacement shall be done at not charge to the owner.

2) Contractor is responsible for the safety and good condition of the materials and equipment installed until final acceptance by the Owner.

g) Save original product shipping containers and related packaging materials for major products until final acceptance.

1) Prior to disposal, check with owner to determine if the owner wishes any of the packaging materials.

2) Deliver specified packaging materials to the owner as requested.

O. (01 71 00 Examination and Preparation)

1. Examination of the Site

a) Contractor shall visit the Site to familiarize himself with the local conditions under which the work is to be performed and correlate his observations with the requirements of the Contract Documents. No allowance shall be made for claims for concealed conditions which the Contractor, in exercise or reasonable diligence

in observations of the Site and review of the local conditions under which the work is to be performed, learned or should have learned of, unless otherwise specifically agreed by Owner and Owner in writing.

b) Before ordering any materials or doing any work, the Contractor shall verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement or size indicated in the drawings or specifications. Any discrepancies found shall be submitted in writing to the Project Manager and Owner for consideration before proceeding with the work.

c) This Contractor must verify all dimensions locating the work and its relation to existing work, all existing conditions and their relation to the work and all man made obstructions and conditions, etc. affecting the completion and proper execution of the work as indicated in the Contract Documents.

P. (01 73 19 Installation)

1. Work and workmanship

a) Provide all required labor, materials, equipment and Contractor's services necessary for complete installation of systems required to comply with the requirements of authorities having jurisdiction, as indicated on Drawings, and as specified.

b) Work shall be functional and complete in every detail, including any and all items required to complete the system, whether or not these items have been enumerated or shown on the Drawings.

c) Special attention shall be given to access to working and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.

d) Each Contractor shall be fully knowledgeable of the details of all Work to be performed by other trades and take necessary steps to integrate and coordinate his Work with other trades.

e) Wherever tables or schedules show quantities of materials, they shall not be used as a final count. These figures serve only as a guide for the Contractor. Each Contractor shall be responsible for furnishing all materials on the Drawings or as specified.

f) The Consultant and Owner's Representative have full power to condemn or reject any Work, materials or equipment not in accordance with these Specifications and Construction Drawings or the manufacturer's specifications or drawings approved by the Owner or Consultant.

g) Work or equipment that is rejected shall be removed and replaced to the satisfaction of the Owner at the Contractor's expense. Work or equipment that is rejected shall be so stated in writing by the Owner or Consultant.

h) Such decisions that the Owner or Consultant may make with respect to questions concerning the quality, fitness of materials, equipment, and workmanship shall be binding upon the parties thereto.

i) All Work shall fully comply with these specifications and related Drawings and all manufacturers recommended installation practices.

j) All Work shall be performed with the best practices of the trade for performance, functionality, safety, endurance, and aesthetics.

k) Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

l) Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible, as appropriate to the application.

m) Set all equipment to accurate line and grade, level all equipment and align all equipment components.

n) Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.

o) No equipment shall be hidden or covered up prior to inspection by the owner's representative. All work that is determined to be unsatisfactory shall be corrected immediately.

p) All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

q) Install all equipment and materials in strict accordance with manufacturer's written instructions. Bring any conflicts between the manufacturer's written instructions and these specifications to the attention of the Designer for recommendations.

r) Upon completion of installation of equipment and communication circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

Q. (01 73 29 Cutting and Patching)

1. Where demolition of existing surfaces are required by the Work, the same shall be restored to at least as good a condition as they were before.
2. Contractor shall be responsible for painting, patching, repairing and replacing any building surface, furnishing, wall/floor/ceiling covering that is damaged or penetrated in the process of performing work on the project site.
3. Additional work required to repair work performed under this Contract shall be at the expense of This Contractor.
4. The Division 27 contractor shall do all cutting as required for the admission of Division 27 work. Unless directed otherwise in field, provide all related patching and painting to match surrounding methods, materials and colors. Any damage done by this contractor to the building during the progress of this contractor's work shall be made good at this contractor's expense. Perform cutting, fitting, and patching and materials as required to:

a) Uncover Work to provide for installation of ill-timed Work.

b) Remove and replace defective Work.

c) Remove and replace Work not conforming to requirements of the Contract Documents.

d) Remove samples of installed Work as specified for testing.

e) Install equipment and materials in existing structures.

f) Upon written instructions from the owner's representative, uncover and restore work to provide for observation of concealed work by owner's representative or by inspection authority having jurisdiction.

g) During cutting and patching operations, protect adjacent installations (structure, finishes, furnishings, etc.). Where applicable, provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to system components and components of other trades.

h) Patch surfaces and building components using new materials matching existing materials and using experienced Installers. Refer to Division 1 for definition of experienced "Installer" or determine qualifications as directed in field by owner's representative.

i) Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. All materials used for patching shall be installed to meet or exceed the smoke and fire rating of the respective surface being patched.

j) Neatly cut and drill all openings in walls and floors required for the installation. Secure approval of Owner's Representative before cutting and drilling in existing facilities. Neatly patch all openings cut.

k) Cutting and patching shall be held to a minimum by arranging with other contractors for all sleeves and openings before construction is started.

l) Provide factory-assembled watertight wall and floor seals, of types and sizes required; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

m) Pipe sleeves shall be fabricated from Schedule 40 rigid, heavy wall, full weight galvanized steel pipe; remove burrs. Use sleeves which are two standard sizes larger than conduit passing through respective sleeve.

n) Provide sleeve seals for piping which penetrates foundation walls below grade, exterior walls or roofs, caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal. Elsewhere modular provide mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

o) Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, bearing walls, fire walls and masonry construction. Sleeves through walls shall be cut flush with both faces. Sleeves through floor shall extend one inch above floor top elevation. Pipes penetrating roof shall use a pipe curb assembly equal to Pate Co. Furnish and set all forms required in masonry walls or foundation to accommodate pipes.

5. Grout

a) Provide non-shrink, nonmetallic grout, premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications.

6. General Joint Sealer Application
   a) Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
   b) Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
   c) Clean all affected surfaces, joints, etc. immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
   d) Apply sealant primer to substrates as recommended by manufacturer. Protect adjacent areas from spillage and migration of sealant, using masking tape. Remove tape immediately after tooling without disturbing seal.
   e) Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
   f) Comply with recommendations of ASTM C 962 for use of elastomeric joint sealers.
   g) Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.
   h) Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
   i) Colors for exposed seals shall be as selected by the Owner's representative from manufacturer's standard colors.
7. Elastomeric Joint Sealers
   a) One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
   b) One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes. Silicone Sealant shall be equal to the following:
      1) "Dow Corning 790", Dow Corning Corp.
      2) "Gesil N SCS 2600", General Electric Co.
      3) A/D Fire Protection Systems.
8. Acrylic-Emulsion Sealants
   a) One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications or interior and protected exterior locations involving joint movement of not more than plus or minimum 5 percent. Subject to compliance with requirements, provide one of the following:

1) "Chem-Calk 600", Bostik Construction Products Div.
2) "AC-20", Pecora Corp.
3) "Sonolac", Sonneborn Building Products Div.
4) "Tremco Acrylic Latex 834", Tremco, Inc.

R. (01 74 16 Site Maintenance)

1. During the progress of the work, the Contractor shall clean up after his men and leave the premises and all portions of the building in which he is working in a clean and safe condition. This cleaning shall occur on a daily basis.

S. (01 74 23 Final Cleaning)

1. Clean all parts of the apparatus and equipment. Exposed parts, which are to be painted, shall be cleaned of cement, plaster and other materials and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all corners and cracks scraped out.

T. (01 77 16 Final Closeout Review)

1. Project Closeout
   a) Contractor shall meet all provisions of Substantial completion as defined earlier in this section and in each related section.
   b) Final Payment
      1) Final payment of contract will not be made until receipt, review and acceptance, by the owner's representative, of all of the following:
         i) Substantial Completion
         ii) Completion of all punch-list items.
         iii) Approved submittals, including shop drawings;
         iv) Owner’s manuals;
         v) Record documentation;
         vi) Certification of warranty;
         vii) Certificate of final acceptance signed by the Owner and the Owner;
         viii) Copies of all training sign-in sheets, signed by owner’s representative;
         ix) Signed delivery receipt indicating that the owner has received all training recordings produced to-date;
         x) All additional applicable closeout provisions of Division 1;
   c) 100% of all closeout documents shall be supplied within 30 calendar days following the substantial completion.

U. (01 77 19 Closeout Requirements)

1. Acceptance Testing
   a) Upon the Designer’s receipt of and approval of the Contractor’s pre-test submittal, the Contractor shall contract the Designer to schedule acceptance testing. Contractor shall allow not less then 10-business days of advance notice to the Owner.
   b) In the presence of the Owner, the Contractor shall demonstrate the presence of all specified products, cabling and installation methods. The Contractor shall demonstrate the operation of the system (and any requested sub-component thereof) and shall be prepared to make any electronic, physical or software related adjustments to the system or any of its sub-components to the

satisfaction of the Owner, as required to achieve full compliance with the specifications.

c) The contactor shall have available at the project site all test equipment, cables, tools and personnel necessary to demonstrate full compliance with these specifications as determined necessary by the designer.

d) During the acceptance testing the Contractor shall have a clean and fresh copy of the contractor's most up-to-date as-built record documentation, printed to scale.

e) This Contractor shall provide all required labor services required to completely verify and test the systems in the presence of the Owner.

f) Verify that each system, as a whole system, meets these Specifications and complies with all applicable standards.

g) Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense.

h) Should the Owner be required to return to the project site to perform acceptance testing more the once for any system the Contractor shall be responsible for all costs, up to $1500 per day, plus travel and expenses, for each return trip to the project site. Payment of this may be required before final payment will be authorized.

2. Supplemental Engineering Services

a) This Contractor is responsible for all supplemental engineering services specifically outlined in these specifications and otherwise required for the completion of the work specified. Contractor shall estimate its costs accordingly, taking into account all information provided.

b) In the event that the Owner is required to provide additional services as a result of Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents, or if the Owner is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Owner's expenses in connection with such additional services shall be paid by the Contractor and may either be deducted from any monies owed to the Contractor, or billed to the contractor, entirely at the discretion of the Owner. The contractor shall be billed at prevailing hourly rates.

c) In the event that the Owner is required to provide additional services as a result of substitution of equivalent materials or equipment by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Owner is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Owner's expenses in connection with such additional services shall be paid by the Contractor. Costs will be calculated based upon the Owners prevailing rates.

V. (01 78 13 Completion and Correction List)

1. Owner shall be furnished with a certificate of final inspection and approval prior to final acceptance of this branch of the work.

W. (01 78 36 Warranties)

1. Warranty Period

a) Specified materials and workmanship provided shall be fully guaranteed by the Contractor for one year from the transfer of title via notice of substantial completion against any defects in materials or workmanship.
    i) Extended (additional) warranty(ies) may be required and will be identified in the individual Specification Section and will be considered additive to this base Contractor Warranty.
    ii) Requirements for Manufacturer's Warranties, required by a Specification Section, shall run concurrent to this base Warranty by the Contractor but may exceed the Contractor's Warranty Period.
    2) Manufacturer's Warranties shall also begin on Substantial Completion; not on purchase of equipment or delivery of equipment to the site.
b) The Warranty shall begin upon Substantial Completion.
    1) Note: Delivery of closeout documents is not a conditional requirement to commencement of the warranty.

2. This warranty shall in no manner cover equipment that has been damaged or rendered unserviceable due to negligence, misuse, acts of vandalism, or tampering by the Owner or anyone other than employees or agents of the Contractor.
    a) The Contractor's obligation under its warranty is limited to the cost of repair of the warranted item or replacement thereof, at the Contractor's option.
    b) Insurance covering said equipment from damage or loss is to be borne by the Contractor until full acceptance of equipment and services.
3. Individual specification sections may have additional warranty requirements for the work in that section. The warranty above will cover all materials and work where not covered by an extended warranty listed in the individual specification section.
4. Warranty Coverage
    a) Specified materials and workmanship provided shall be fully guaranteed by the Contractor against any defects in materials or workmanship.
        1) Contractor shall provide a full "System Warranty" which shall cover all materials, labor and related product shipping expenses for a period of five years from the date of Owner acceptance.
            i) Supplied products with manufacturer's warranties of less than the System Warranty term shall be extended by the Contractor for the full specified term
        2) During this period the Contractor will remedy (at no cost to the owner) any problem with the system, or any of its related components that is the result of defective materials, settings, workmanship, or loss or programming.
        3) Any defective items or work shall be removed and replaced at the Contractor's expense to the satisfaction of the owner's representative and the Owner.
        4) During the Warranty Period, the Contractor shall respond by phone within four (4) business hours of notice by the owner of a problem. Within (1) business day or (72) contiguous hours, which ever comes first, the Contractor shall have qualified personnel onsite to remedy the problem if the problem cannot be quickly be remedied over the phone.
            i) The contractor shall make available to the owner on-call emergency response service labor to the Owner. Cost for emergency service labor

during the warranty period shall not exceed the Contractor's published emergency service rates, or two-times its standard rate, whichever is lower.

5) The period of the Contractor warranty(ies) for any items herein are not exclusive remedies, and the Owner has recourse to any warranties of additional Scope given by the Contractor to the Owner and all other remedies available by law or in equity.

6) Additional Warranty requirements may be added by an individual Specification Section.

i) Scope of these extended (additional) warranty(ies) will be identified in the individual Specification Section and will be considered additive to this base Contractor Warranty.

ii) Requirements for Manufacturer's Warranties, required by a Specification Section, shall run concurrent to this base Contractor Warranty by the Contractor.

(A) Manufacturer's Warranties shall also begin on Substantial Completion; not on purchase of equipment.

X. (01 78 39 Project Record Documents)

1. Project Record Document requirements for Division 27 "Communications" shall be described in Section 27 01 00 "Operation and Maintenance of Communications Systems".

Y. (01 79 00 Demonstration and Training)

1. Training

a) Proper operation in many cases is a function of adequate training of key users on new systems.

1) Each Division 27 section may specify special Training requirements.

i) Training requirements will be for a quantity of hours, allow for multiple trips.

2) If no special requirements are specified in the individual section, allow for 4 hours and 2 trips to provide basic overview, operation and maintenance information.

3) Each Specification Section will indicate any training criteria specific to that Section.

4) Train Owner's maintenance personnel on the procedures and schedules involved in operating, general troubleshooting, and preventative maintenance of the system.

5) All training sessions shall be audio and video recorded. Recordings shall be supplied in DVD formats and playable on standard consumer grade reproduction equipment. Recordings do not need to be professionally edited but shall have intelligible audio and a clear image of the subject trainer and any supplemental visual content critical to the training.

6) Recordings shall be turned over and signed for by an owner's representative at the end of each training session.

7) Contractor shall require all attendees to sign-in for each training session. The sign-in form shall summarize the training to be conducted, specification section and subsection being trained on, as well as the starting time and

duration of training. Following training, a representative of the owner shall sign the form, acknowledging the same. Contractor shall retain the original copy of these forms and turn over a photo copy of the form to the owner's representative as evidence of training. Training conducted without this official record of training shall not be considered as part of the Contractor's training obligation.

b) Schedule training with the Owner's representative, at least 14 days in advance.

c) Contractor shall assume training will be conducted in a minimum of (2) separate sessions, on non-contiguous days and will require separate trips to the project site, and should be bid accordingly.

d) Owner shall have the right to use its allocated training for a period of 365 calendar days following acceptance of the system.

END OF SECTION 27 00 10

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SECTION 27 01 00 - OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. Basic materials, methods and installation guidelines applicable to the installation of all communication systems.
      a) This Section is a “Common Work Results” Section that includes information that is applicable and “Related” to all Division 27 Sections.

B. Related Sections
   1. All Division 27 Sections.

C. Related Drawings
   1. All Technology (T-Series) Drawings

1.3 RECORD DOCUMENTS FOR COMMUNICATIONS SYSTEMS

A. The Operations and Maintenance Manual (Owner’s Manual) paragraph below details the basic information required to be documented.

B. Each specification section will detail applicable additional Record Document requirements in the PART I, Submittals paragraph under Close-out documentation.
   1. All Record Document information, except for full size floor plans and detail drawings, will be placed in the appropriate location in the Operations and Maintenance Manual described below.
   2. Full sized drawing sheets shall be supplied in triplicate and on electronic media.

1.4 OPERATIONS AND MAINTENANCE MANUALS (OWNER’S MANUAL)

A. Prepare Operations and Maintenance Manuals in accordance with Division 1 Section “Maintenance and Operation.” In addition to the requirements specified in Division 1, provide additional information as detailed in each Section and include the following information for equipment items:
   1. Manufacturer’s printed operating procedures to include start-up, break-in, and routine and normal operating instructions, regulation, control stopping, shutdown, and emergency instructions.
   2. Equipment Maintenance Manuals indicating routine preventative maintenance and troubleshooting, disassembly, repair, and reassembly, aligning and adjusting instructions.

B. Schedule:
   1. A review copy of the O&M Manual shall be submitted to the Owner within 2 weeks of substantial completion of the Project.
   2. The corrected reproductions of the Manual shall be submitted within 2 weeks of the return of the review copy by the Owner.

C. Construction
   1. Manuals shall be bound in hard cover, 3 ring binder(s) with clear plastic “pocket” covers to insert Project Information on the exterior of the Binder.
   2. Maximum individual Binder spine size shall be 3”; utilize multiple binders as required.

D. Operations and Maintenance Manuals shall include the information listed below and be assembled as follows:
   1. Binder shall be marked on the cover and spine with the following information:
      a) Project Information
         1) Title of Project
         2) Name and address of Owner, Contractor, and Architect/Engineer
         3) Completion date of Project
      b) Contents of Binder
   2. Section 1:
      a) Index
         1) Provide additional information if multiple binders are utilized.
   3. Section 2 through x (Provide one (1) Tabbed Section for each Specification Section).
      a) Each Specification Section Tab shall include the following information:
         1) Sub Tab 1
            i) Specification Section Identification
         2) Sub Tab 2
            i) Warranty Information
            ii) Copy of “Substantial Completion” Document establishing warranty period.
            iii) Punch List Final Inspection certificate.
         3) Sub Tab 3
            i) A listing of all materials and equipment that was submitted for approval shall be bound into this manual separated into individual sections (by the Division 27 Section number) for each system.
            ii) A List of Drawings included as attachments to the O & M Manual.
               (A) Full Size drawings shall be submitted with the Manual and an index including sheet Title and Number be placed in this Tab
         4) Sub Tab 4
            i) A copy of the Shop Drawings “Product Information Sheets” for each item required to perform Work as specified.
               (A) Include a copy of the “stamped” and “approved” Product Information Sheets for each product utilized on the Project.
         5) Sub Tab 5
            i) Manufacturer provided information (As Applicable)

(A) Installation instructions published by the manufacturer.
(B) Operating instructions published by the manufacturer.
(C) Maintenance Manuals furnished with the equipment.
(1) Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and re-assembly; aligning and adjusting instructions.
(2) Parts list pertaining to that equipment
(D) Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
(E) Manufacturer's printed operating procedures including start-up, break-in, normal operating instructions, regulation, control, stopping, shutdown, and emergency instructions.
(F) Emergency operating instructions or a list of service organizations (including addresses and telephone numbers) capable of servicing various parts of the system.

6) Sub Tab 6
i) Test reports (as applicable)
(A) Infrastructure
(1) Copper Backbone tests
(2) Fiber Optic Backbone Tests
(3) Horizontal cable tests
(B) Systems
(1) As required by the individual Specification Section
ii) Summary test reports shall be placed in the O & M manual.
(A) Provide an electronic copy (CD-ROM) of all test results.
(1) Provide “Reader” software on the disk.
(B) Provide a single copy of each detailed test.
(1) Tests shall be placed in (a) binder(s) in the same order as submitted on the summary reports.
(2) Submit with final “Approved” O & M Manual submission.

7) Sub Tab 7
i) Items listed in individual Division 27 sections and as previously described in the Record Documents paragraph. (Additional Tabs to separate Section(s) requirements.

E. Distribution:
1. Provide one review copy for Consultant approval prior to reproduction.
a) Consultant will review, correct or approve, and return.
2. Provide (5) copies of the complete (corrected) manual.
a) Include one printed copy of test results as detailed above.
b) Provide 5 copies of all attachments (drawings; electronic test reports, etc.).

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

A. Record Documents (A.K.A. AS-BUILTS)
   1. Shall be prepared as outlined above.
   2. Record actual site-specific information.
      a) Make arrangements for providing two complete sets of communication prints which shall be used to provide record drawings which shall be separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed (including routing of all conduit and cables).
      b) Drawings shall serve as work progress report sheets and the Contractor shall make any notations, neat and legible thereon daily as work proceeds. The drawings shall be available for inspection at all times and shall be kept at the job at a location designated by the owner's representative.
      c) Maintain the clean, undamaged set of prints of Contract Drawings as well as a set of submittal drawings and coordination drawings where applicable. Mark the sets to show the actual installation where the installation varies from the Contract Documents as originally shown. Record drawings shall include locations of underground and concealed items if placed other than shown on the Contract Documents. Do not permanently conceal any construction until this required information is recorded. Mark which drawing is most capable of showing conditions fully and accurately. Where shop drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
      d) Record documents shall show changes in: size, type, capacity, etc., of material device or piece of equipment, location of device or piece of equipment; location of outlet or source of building service systems; routing of piping, conduit, or other building services. These drawings shall also record location of concealed equipment, communication service work, conduits and other piping/work by indication of measured dimensions to each line from readily identifiable and accessible walls or corners of building. Indicate all approved substitutions, contract modifications, and actual equipment and materials installed.
      e) Record documents shall include a detail diagram of all mounting devices and method of rigging those devices to the structure. Record documents shall include plan view drawings indicating cable paths, cable types identified, device identification, riser diagrams, system block diagrams and rack layouts. System block diagrams shall indicate device selection and location in signal flow schematically. Contractor shall provide legend defining all devices and symbols used.
      f) For communication work installed below slabs, pavements, grade, etc., these drawings shall also record location of nearby concealed water piping, sewers, wastes, vents, ducts, conduit and other piping, etc. by indication of measured dimensions to each line from readily identifiable and accessible walls or corners of building and from adjacent communication work. Show inverted elevation of underground communication work relative to work installed by other trades.

g) Upon substantial completion of the work make arrangements for obtaining a complete set of CAD computer files for the project. All information from the print record drawings shall be neatly drafted/digitized (using pre-established layering system) into the applicable CAD drawing. Neatly erase and redraft work as required to reflect the work as actually installed. Perform drafting in a manner in which all work shall be shown in its actual locations, existing as well as new, by erasing inaccurate locations and redrawing proper routing/locations. This applies for all concealed work as well as work visible. All work shall be performed using AutoCAD Release 2000 or more recent release of AutoCAD.

h) Affix near the title block on each drawing of the set of record drawing prints the Contractor's Company Names, signature of Contractors' Representative and current date. Deliver one set of prints to the Designer. Deliver the second set of prints, the original reproducibles, the CAD computer files and the marked-up field prints to the architect.

i) All prints shall be signed and dated by the General Contractor, This Contractor and applicable Subcontractor.

j) In addition to the above, provide "as-built" record documentation for shop drawings (and coordination drawings where applicable).

END OF SECTION 27 01 00

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SECTION 27 05 01 - BASIC MATERIALS AND METHODS FOR COMMUNICATIONS

PART 1 MATERIALS AND METHODS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. Basic materials, methods and installation guidelines applicable to the installation of all communication systems.
      a) This Section is a “Common Work Results” Section that includes information that is applicable and “Related” to all Division 27 Sections.

B. Related Sections
   1. All Division 27 Sections.

C. Related Drawings
   1. All Technology (T-Series) Drawings

1.3 QUALITY ASSURANCE

A. Welding
   1. Welding shall be performed by persons licensed by the authority having jurisdiction where the work is performed. This shall apply to all work which is routinely regulated by said authority.

B. High Voltage Wiring
   1. High voltage wiring and connections shall be performed by persons licensed by the authority having jurisdiction where the work is performed. This shall apply to all work which is routinely regulated by same authority.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 RELATED OPERATIONS

A. Welding

1. Onsite welding, where it is necessary, shall not be performed without the express written consent of the owner's representative. All project specifications governing welding shall apply, regardless of whether said specifications are referenced within the Division 27 specifications.

B. High Voltage Wiring

1. Review all high voltage provisions for This Contractor's work with the Division 16 electrical contractor. Coordinate specific device termination, loading and circuiting requirements with the electrical contractor.

3.2 INSTALLATION OF COMMUNICATIONS SYSTEMS

A. General

1. All work installed in finished areas shall be concealed. All work installed in unfinished areas may be exposed at the discretion of the Owner's representative.
2. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, any exceptions to be approved by Owner.
3. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.
4. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
5. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
6. Verify all dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed.
7. The symbols used to indicate the purpose of which the various outlets are intended are identified in the Legend.
8. If during construction it becomes apparent that certain minor changes in layout will affect a neater job or better arrangement, such alterations shall be made as part of the contract. Owner's review shall be obtained before making such changes.
9. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches will not be permitted on any exposed materials, fixtures or fittings. Inside of panels and equipment boxes shall be left clean.
10. Use caution not to exceed the allowed bending radius for respective cables and not to compromise the integrity of the cables during installation by pulling cable management devices too tightly, damaging cables, etc. Raceway/Cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant, where necessary; compound must not deteriorate conductor or insulation.

B. Cable

1. General

a) Provide color-coded jackets to identify runs of different systems.
   1) See related specifications and drawings for applicable color coding.
b) Neatly route cables parallel, perpendicular and plumb to building architectural lines.
c) Neatly comb out multiple cable bundled runs to remove tangling and crossing of cables within the bundles. Neatly dress all cable work and provide vertical and horizontal cable management (or other approved method) for properly dressing all work at racks, control panels, backboards etc. See detail(s) if applicable.
   1) To avoid Alien Crosstalk, do not cinch UTP cables into tight bundles.
d) Plenum-rated hook and loop one-inch-wide tape shall be used wherever wire ties are permitted and wherever plenum rated cable is used.
e) Plenum-rated hook and loop one-inch-wide tape shall never be used in a manner that causes deformation of the cable jacket, damage to the cable, or has any adverse affect on the usability, specifications or longevity of the cable(s) on which it is applied.
f) Plenum-rated hook and loop one-inch-wide tape (Velcro) type wire ties shall be used in plenum spaces; in equipment racks; in rack cabinets, and; in related equipment housing enclosures.

2. Support
   a) All cables shall be supported/anchored every 5 feet (or less) and within 12" of device boxes, outlets, racks/cabinets and cable tray.
   b) Use J-Hook type cable supports for all cables run outside of conduit or cable tray. Bridle rings shall not be used for Communications Technology cables.
   c) Use separate J-Hook cable support systems for cables belonging to different systems and for cables carrying different operating levels. See Cable Separation guidelines in this section.
   d) Loosely secure cables at each J-Hook.
   e) Cables shall not be directly or indirectly supported by a suspended ceiling or any other surface, support, material or structure not permissible for this use by all applicable codes and standards.
   f) Cable trays or messenger strand positioning
      1) Used to route cables in hallways
      2) Each must have a minimum twelve inches (12") vertical clear space above the top of the cable tray or messenger strand, and a minimum six inches (6") clear space below and on each side of the cable tray or messenger strand.
3. Cable Separation
   a) Cables carrying signals of different nominal operating level shall be kept separated to reduce the risk of undesirable cross-talk interference between cables.
      1) As a general rule, for each 25dB of nominal level voltage difference between cables, Contractor shall provide an additional 6 inches of physical separation between the cables. For example: cables with a 25dB voltage difference shall be separated by at least 18 inches. As the difference increases the distance shall increase proportionally.

2) This guideline shall be used to govern the separation of low voltage Communications Technology cabling from AC power circuits as well. For example: A Microphone line running parallel to a 480v power line shall be separated by nearly 27-30 inches.
3) Provide greater separation than this guideline where the contractor believes and/or determines it is necessary to prevent or remedy interference between cables.

b) Keep length of parallel runs to a minimum. Cross cables of different nominal levels at 90 degrees.

c) Provide additional separation as necessary to prevent and remedy any crosstalk which:
1) Adversely affects the performance and usablity of the system, or;
2) Exceeds specific crosstalk perfomance specified in individual specifications.

d) Contractor shall take all precautions necessary to keep low-voltage cable away from sources of EMI and RF interference. Where close proximity is absolutely necessary to satisfactory appearance, performance or installation of the Work, provide all necessary shielding necessary to ensure that ingress interference is minimal and has no negative impact of the Work.

4. Cable Termination

a) The cables terminating at a device outlet shall be left not less than 10 inches to facilitate installation and servicing of devices. Longer working lengths shall be provided as appropriate to the application.

b) All termination types shall correctly match the cable and device termination point. Connectors of the appropriate type, size, color and rating shall be used to match with the mating equipment.

c) Tools as recommended by each specific connector manufacturer shall be used in attachment of all connectors.

d) Spade connectors.
1) Spade type connectors shall be used on cable ends where screw-type terminal connectors are used.
i) All spade connectors shall be insulated. Provide heat shrink type insulation where solder-type or non-insulated spade connectors are used.
2) Spade connectors used shall be rated by the manufacturer for the gauge, insulation, type and stranding of the cable to which it is applied. Spade connectors shall be sized to exactly match the stud size and spacing of mating termination connector.
3) Tools as recommended by the specific connector manufacturer shall be used in attachment of the connector to the cable.
4) When spade connectors are the required to be used for audio circuits operating at <= +8dBv nominal, solder type spade connectors only shall be permitted.
5) No more then two spade connectors shall be permitted under a single terminal. Fewer should be used when recommended by the specific manufacturer’s equipment or connector.

e) Wire Nuts
   1) Wire nuts shall not be used in any audio circuit, except when necessary in the following:
      i) 25 Voltage Constant-Voltage loudspeaker circuits.
      ii) 70 Voltage Constant-Voltage loudspeaker circuits.
   2) Wire nuts shall not be used in any data or voice communications or remote-control circuit.
   3) Wire nuts shall not be used in any circuit which radiates RF energy.
   4) Contractor must advise and gain prior approval of the Owner for any circuit which the Contractor desires to use wirenuts as the means of termination.

f) Drain Wires, Non-insulated Ground Wires and Shields
   1) Drain or non-insulated ground conductors shall be insulated with appropriately sized heat-shrinkable insulated sleeving immediately upon exit from the jacket of the cable. Contractor shall use GREEN colored sleeving unless otherwise necessary to resolve specific color-coding conflicts on a given cable. This methodology shall apply to ALL methods of termination, including inline connectors, device plates, direct equipment terminations etc… Sleeving shall be applied to twisted and braided shields once the internal conductors have been combed out or otherwise removed from the center of the shield.
   2) Wherever a cable contains a non-insulated conductor within a jacketed cable, the conductors, as they exit the manufacturer's jacket, shall have a piece of heat shrinkable sleeving applied equally over the jacket and the exposed insulated conductors. The length of this sleeving shall be 1" for all cable diameters of .250" or less. For cables diameters larger then .250" the length of the sleeving shall be approximately equal to 4 times the diameter of the cable jacket. Note: This added sleeving is recommended but not mandatory when cable termination occurs fully within the confines of a fully insulated and strain relieved connector. Black shall be used unless otherwise necessary for specific cosmetic or cable identification purposes.
   3) A heat-gun of the appropriate temperature, size, type and rating for shrinking the tubing shall be used as recommended by the manufacturer of the sleeving used. Open flame (i.e. matches, cigarette lighters, torches) and direct metal conduction (i.e. soldering iron) methods to shrink the sleeving shall not be permitted. Sleeving which is burnt or otherwise marred shall be removed and replaced.
   4) There shall not be any non-insulated exposed conductors within a device backbox, junction box, or equipment rack/cabinet.

g) Unused Conductors
   1) Unused conductors shall not be "clipped" or removed from any jacketed cable. Conductors which are not required or used at the end of a jacketed cable shall be kept intact. Conductors shall be fully insulated from one and other to prevent shorts which could occur at either end of the cable. Conductor ends shall also be insulated to prevent shorts to other conductive materials which could come in contact with the conductor.

2) Unused conductors shall be kept the same length as the longest conductor of the cable being used.

h) Cable and Conductor Nicks

1) Attention shall be paid to the proper preparation of all cables and all conductors of these cables. There shall not be nicks to cable jackets, conductor insulation, or the conductors themselves.

2) Special attention should be paid to nicked conductors. Should a conductor be nicked during preparation or termination the cable shall be reworked/replaced to remove the nick.

i) Cut, Disconnected, or Not Terminated Cables

1) Any voice, data, or coaxial cable that is cut, disconnected, or not terminated at both ends shall be completely removed end to end. Any labels at either end shall be erased. Record drawings shall reflect the removal of these cables.

END OF SECTION 27 05 01

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. This Section includes requirements and minimum standards for:
      a) Raceways
      b) Fittings
      c) Boxes
      d) Penetrations
      e) Pathway accessories
   2. This Section is a “Common Work Results” Section that includes information that is applicable and “Related” to all Division 27 Sections.
   3. This Section requires the addition of basic items, not specified elsewhere, to the installation of pathways.
      a) Add the following to the pathways:
         1) Provide a pull rope in each installed pathway and leave a pull rope in the pathway after the cabling is installed.
         2) Provide proper identification, labeling, and documentation of key pathway locations and components.
         3) All pathways designed for fiber optic cables will require an innerduct for the installation of the fiber optic cable unless interlocking armored cable construction is utilized.
         4) Provide cable spillways where cabling will drop out of sleeve(s), unsupported for more than six inches:

B. Related Sections
   1. All Division 27 Sections

C. Related Drawings
   1. Technology (T-Series) Drawings

1.3 REFERENCES

A. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.

B. ANSI/TIA/EIA-606-A – The Administrative Standard for the Telecommunications Infrastructure of Commercial Building.

C. "TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL" published by the Building Industry Consulting Services International (BISCI).

1.4 GENERAL INFORMATION

A. NFPA Compliance:
   1. Comply with NFPA 70 "National Electrical Code" for components and installation.
B. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
C. UL Compliance:
   1. Cable tray shall be UL certified.
   2. Sleeves shall be UL listed assemblies.
D. All Work shall fully comply with these Specifications and related Drawings and all manufacturers' recommended installation practices.

1.5 SYSTEM DESCRIPTION / DESCRIPTION OF WORK

A. The work covered by this Specification Section includes any and all requirements for this type work required for proper installation of work specified in each related Division 27 Specification Section and/or as shown on the Drawings.
   1. This Specification Section is a Materials and Methods Section for Division 27. All requirements herein are required by each related Section and will be enforced for each related Section.
   2. Pathways for Communications are to be provided to create a re-usable pathway for Communications cables.

1.6 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal. Product Data and Shop Drawings are not to be submitted separately.
   2. Samples shall be submitted with or immediately following submission of Product Data submittals.
B. Items to be submitted for approval prior to commencement of work:
   1. Product Data
      a) Manufacture datasheets for all items
         1) Data sheets shall include:
            i) Manufacturer name
            ii) Manufacturer model number (as it appears on manufacturer's product data sheet)
            iii) Manufacturer product description
            iv) Paragraph number of this section where the product is specified.
            v) Picture or Drawing of item

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

A. General
1. Part II is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.
a) This standard will be considered in force for the original response as well as for any additions or changes to this Project. Due to this, there may be items listed in the “Products” section that are not required under the Scope of this Contract.

2.2 RACEWAYS

A. Conduits
1. Rigid steel conduit:
a) Threaded rigid steel conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads. It shall be constructed in accordance with ANSI C80.1, Federal Specification WW-C-581; UL listed.
2. Intermediate metallic conduit:
a) Threaded intermediate metallic conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads. It shall be constructed in accordance with ANSI C80.6, Federal Specification WW-C-581; UL listed.
3. Electric metallic tubing:
a) Electric metallic tubing shall be manufactured from mild steel, zinc galvanized both inside and outside. It shall be constructed in accordance with ANSI C80.2, Federal Specification WW-C-563; UL listed.
4. Flexible metallic conduit:
a) Flexible metallic conduit with neoprene jacket shall be spirally wound steel, strip zinc galvanized both inside and outside, integral ground conductor.
1) Unless otherwise indicated, flexible metallic conduit provided for telecommunications cabling can only be provided as a pathway from the telecommunications outlet box to the ceiling space above and cannot exceed 6 meters.
5. Non-metallic raceways
a) Polyvinlychloride (PVC):
1) PVC conduit shall be virgin C300 type, Schedule 40 or 80 (90° C). It shall be constructed in accordance with NEMA TC2 and Federal Specifications W-C-1094A.

B. Surface raceways:
1. Single compartment raceway:
a) Single compartment electrical ivory raceway as indicated, surface mounted base with cover.
1) Provide appropriate elbows (Panduit RAFC10IW-X), tees (Panduit TFC10IW-X), entrance end fitting (Panduit DCEFXIW-X), etc. to follow wall layout.
2) Standard of quality shall be Panduit Panway LDP-10IW8-A.
3) Additional approved manufacturers: Wiremold, Hubbell
2. Large Single compartment raceway:

a) Single compartment electrical ivory raceway as indicated, two-piece surface mounted with snap on cover.
   1) Provide appropriate elbows, tees, entrance end fitting, etc. to follow wall layout. Provide wire T45WR-X retainers at a minimum of every three feet and as necessary to contain cabling.
   2) Standard of quality shall be Panduit Panway T-45.
      i) Additional approved manufacturers: Wiremold, Hubbell

3. Two compartment raceway:
   a) Dual channel electrical ivory raceway as shown on the Drawings, two-piece surface mounted with snap on cover, compartment for power, and compartment for data.
      1) Provide appropriate elbows, tees, entrance end fittings, etc. as recommended by the manufacturer.
      2) Standard of quality shall be Panduit Panway Twin-70.
         i) Additional approved manufacturers: Wiremold, Hubbell

C. Telecommunications/power poles:
   1. Construction:
      a) Two compartment.
      b) 10 foot – 5-inch height and 2 ½ inches x 2 5/16-inch overall width.
      c) Removable covers.
   2. Provide mounting hardware, entrance end fitting, and ceiling trim plate.
   3. Standard of quality shall be Panduit Pan-pole.
      a) Additional approved manufacturer: Wiremold, Hubbell

D. Cable tray:
   1. Wall Mounted
      a) Provide cable tray sized and located as indicated on the Drawings.
      b) Cable tray shall comply with NEMA 8B, 12B, or 12C. Cable tray and all fittings and accessories shall effect a complete structural system in the form of a rigid mechanical tray of compatible material and design, functional to support all cabling.
      c) Provide aluminum, rectangular tube, center spine with rungs perpendicular to the spine and spaced 6 inches on center.
      d) Prefabricated structure consisting of a longitudinal rail with transversely connected members (rungs) that project from one side; single or double tiered; aluminum alloy.
      e) Provide gray-colored manufacturer's rung caps on all rungs.
      f) Sections to be joined by bolted splice connectors.
      g) 4 inches overall depth per tier, 6 inches rung spacing.
      h) Rung ends shall be factory bent upward to a height as indicated on the Drawings.
      i) The rungs shall be positioned at the side of the spine at the top such that the spine is not part of the cable laying area (for example see Mono-Systems "top rung" cable tray).
      j) Provide all manufacturer recommended fittings and accessories for a complete and functional system as indicated.

1) Accessories: Provide crosses, tees, angles, wyes, drops, rises, etc., and other accessories required for the installation specified.

k) Standard of quality shall be Mono Systems 6114-0323 and 9114-0323.

1) Approved manufacturers include: Allied Support Systems, B-Line.

2. Center Hung

a) Provide cable tray sized and located as indicated on the Drawings.

b) Cable tray shall comply with NEMA 8B, 12B, or 12C. Cable tray and all fittings and accessories shall effect a complete structural system in the form of a rigid mechanical tray of compatible material and design, functional to support all cabling.

c) Provide aluminum, rectangular tube, center spine with rungs perpendicular to the spine and spaced 6 inches on center.

d) Prefabricated structure consisting of a longitudinal rail with transversely connected members (rungs) that project from both sides; aluminum alloy.

e) Provide gray-colored manufacturer's rung caps on all rungs.

f) Sections to be joined by bolted splice connectors.

g) 4 inches overall depth per tier, 6 inches rung spacing.

h) Rung ends shall be factory bent upward to a height as indicated on the Drawings.

i) The rungs shall be positioned at the side of the spine at the top such that the spine is not part of the cable laying area (for example see Mono-Systems "top rung" cable tray).

j) Provide all manufacturer recommended fittings and accessories for a complete and functional system as indicated.

1) Accessories: Provide crosses, tees, angles, wyes, drops, rises, etc., and other accessories required for the installation specified.

2) Provide waterfall fittings in every location that cable is designed to exit the tray downward at the end of a run or between the rungs.

3) Support with threaded rod and U-channel supports systems (See Accessories, Supporting Devices – Field Fabricated)

k) Standard of quality shall be Mono Systems.

1) Additional approved manufacturers include: Allied Support Systems, B-Line.

E. Telecommunications cabling support: Where necessary, provide additional cable support to create a re-usable pathway for Communications cables:

1. General

a) Primary pathways are those supporting the cabling infrastructure from the Equipment Rooms/Telecommunications Rooms through the corridors and chases to the secondary pathways.

b) Secondary pathways are those supporting the cabling infrastructure from the primary pathway to telecommunications outlets.

c) Cable supporting devices manufactured with small round surfaces (i.e. bridal rings) are not acceptable.

2. Primary pathways

a) Messenger Strand

1) Anchors shall be securely mounted to building structure at each end.

2) Tensioners shall be installed to connect strand.

3) Additional supports shall be installed with threaded rod from the deck above to support the strand approximately 6-8" above suspended ceiling in all locations.
   i) Support with threaded rod and U-channel supports systems (See Accessories, Supporting Devices – Field Fabricated)
   ii) Properly sized.
      (A) Multiples of strands (100 horizontal cables each) appropriate to handle the required cable quantities plus 25% spare capacity.
      (B) Separate strand for Backbone cables.
   iii) Provide minimum ¼" steel strand with applicable hardware.

b) Open top cable supports
   1) Plenum rated
   2) Complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems.
   3) Shall be mounted to building structure or suspended by threaded rod from the deck above approximately 6-12" above suspended ceiling.
      i) Support with threaded rod and U-channel supports systems (See Accessories, Supporting Devices – Field Fabricated)
      ii) Properly sized.
         (A) Multiples of J-Hooks (80 cables each) appropriate to handle the required cable quantities plus 25% spare capacity.
         (B) Multiples of J-Hooks (300 cables each) appropriate to handle the required cable quantities plus 25% spare capacity.
      iii) Provide Erico CAT32/CAT64 or approved equal for all primary pathway cable support.
      iv) Additional approved manufacturers: B-Line, Panduit

3. Secondary pathways (those extending from the primary pathways to the space above the telecommunications outlets).
   a) J-hooks with galvanized finish to provide smooth surface and corrosion resistance.
   b) Complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems.
   c) Accommodates up to 16 horizontal UTP cables.
   d) Shall be mounted to building structure or suspended by threaded rod from the deck above approximately 6-12" above suspended ceiling.
      1) Support with threaded rod and U-channel supports systems (See Accessories, Supporting Devices – Field Fabricated)
   e) Standard of Quality shall be Erico CAT12xx/CAT21xx
      1) Additional approved manufacturer(s): B-Line, Panduit
4. Small Secondary pathways
   a) Mounting for up to ten 4 pair UTP cables may be supported from ceiling grid support wires (at least every 5').
   b) Standard of quality shall be Erico CAT12TS
      1) Additional approved manufacturer(s): B-line, Panduit

2.3 FITTINGS

A. Rigid steel or intermediate metallic conduit:

1. Fittings shall be threaded zinc galvanized steel.
2. At least one bushing shall be grounding type
    a) Equipped with a ground lug
    b) Provide on each conduit or sleeve where surface extends below ceiling line.

B. Electric metallic tubing:
1. Fittings shall be compression type.
2. At least one bushing shall be grounding type
    a) Equipped with a ground lug
    b) Provide on each conduit or sleeve where surface extends below ceiling line.

C. Flexible metallic conduit:
1. Fittings shall be suitable for the specific application.
2. Use oil-tight fittings with neoprene jacketed flexible metallic conduit.

D. Non-metallic conduit:
1. Fittings shall be of the same type and manufacturer as the raceway, connected in accordance with manufacturer's written instructions.

E. Expansion:
1. Expansion fittings shall be of a type suitable for the particular condition and shall be complete with bonding jumper.

2.4 BOXES

A. Box Eliminator devices
1. Standard outlet size brackets that securely clamp to drywall.
2. Available in single and dual gang sizes.
3. Standard of quality shall be Caddy by Erico MP-1
    a) Additional approved manufacturer(s):

B. Floor Boxes
1. Shall be utilize only with prior Owner approval.
2. FSR type boxes; see Division 26 specifications for exact sizing.
3. Separate Telecommunications and Electrical compartments.
4. A minimum of two 1" conduits or a 1 ¼" conduit for Communications cables.

C. Outlet boxes:
1. General:
    a) Stamped steel, code gauge, galvanized, minimum 2 ½ inches deep.
    b) Provide single or double gang outlet boxes as indicated in details on the Drawings.
2. In masonry or tile walls:
    a) Rectangular boxes, 4" square, with square corners minimum 2 ½ inches deep where the box is at the end of the run.
        1) Provide 1" deep single or 2 device trim ring.
    b) Rectangular boxes, 4 11/16" square, with square corners minimum 2 ½ inches deep where the box is in a continuing run.

1) Provide 1” deep single or 2 device trim ring.

3. In gypsum board walls
   a) Single and dual gang outlet boxes with a depth of 3 to 3.5”.
4. Surface mounted and exterior use:
   a) Single or dual gang Cast aluminum boxes with threaded hubs
5. No through-wall boxes or utility boxes will be accepted.
6. Where surface raceway is indicated, provide outlet boxes designed for use with the raceway by the same manufacturer as the surface raceway.

D. Junction boxes:
1. Covers shall be screw attached (unless otherwise noted on the drawing) and of same type of material as the box. All covers shall be easily accessed.
2. Boxes in exterior or moist locations shall meet NEMA 3R (at minimum)
   a) The box must meet the NEMA requirements for the atmospheric condition in which the box is installed.
3. Surface raceway boxes
   a) Where surface raceway is indicated, provide junction boxes by the same manufacturer as the surface raceway.

E. Pull boxes:
1. Required after every 100’ or after 180 degrees of bends in a conduit run.
2. Shall be sized as follows:
   a) One 4” conduit straight through pull:
      i) 15” wide, 60” long, and 8” deep; minimum.
      ii) Add 8” to the width for each additional conduit.
      iii) Information about other trade sizes; reference EIA/TIA 569 standard.

F. Splice boxes:
1. Required after every 100’ or after 180 degrees of bends in a conduit run.
2. Used to hold splice hardware.
3. Shall be sized as follows:
   a) One 4” conduit straight through pull:
      i) 42” wide, 66” long, and 11” deep; minimum.
      ii) Add 7” to the width for each additional conduit.
      iii) Information about other trade sizes; reference EIA/TIA 569 standard.

G. Poke-thru systems:
1. Assembly consisting of disposable plate, barriered raceway, conduit adaptor, housing, base, barrier, and faceplate.
   a) Provide Wiremold RC900-FF3 series multi-service poke-thru with 341-H/B assembly and FP2R faceplates as indicated.
      1) Additional approved manufacturers: Hubbell, Walker

2.5 ACCESSORIES

A. Pull wires:
1. Pull wires shall be nylon type as manufactured by Arnco or approved equal.

2. Provide in all empty conduits, sleeves, raceways, and all cabling pathways for future use.
    a) Additional approved manufacturers: Greenlee, Condux

B. Fiber optic innderduct:
1. NEMA TC 5, UL listed, corrugated, specifically designed for optical fiber cable pathways.
    a) Fiber optic innerduct shall be orange in color.
    b) Innerduct shall be 1-inch minimum inside diameter, and a minimum pulling strength of 600 pounds.
    c) Each innerduct shall include a factory installed pull rope.
    d) Each duct shall be suited for the environment in which it is installed.
    e) Standard of Quality shall be Carlon DF4X1C-xxxx for installation in Riser rated applications; and, Carlon CF4X1C-xxxx for installation in Plenum environments.
        1) Additional approved Manufacturers: Arnco, Endot, Opti-Com, Pyramid

C. Cable spillways
1. Provide Bejed BJ-2049B-002 Spillway on four-inch sleeves; provide Bejed BJ-2049A-001 Cable Spillway on two-inch sleeves.
    a) Additional approved manufacturers: B-Line, Panduit

D. Labels
1. Standard of quality shall be Brady
    a) Additional approved manufacturers: Panduit, Hellerman-Tyton

E. Penetrations through floors and walls
1. Sleeves through floors and walls:
    a) All penetrations through floors or walls to allow Division 27 cable or pathway to pass through will require a UL listed device for the purpose of penetrating the construction.
    b) Penetrations through walls of spaces utilizing a chemical or pressure system for fire suppression must utilize Wiremold FS series penetration unless an alternate assembly is pre-approved by the Owner.
    c) Refer the Penetration Sectional View Drawings for UL listed assemblies.
        1) Concrete, block, brick, and gypsum drywall construction providing a fire rating of greater than one hour for walls and floors will require a UL rated sleeve assembly installed to manufacturer’s requirements allowing the penetration(s) to not degrade the designed fire rating of the wall or floor.
            i) Standard of quality shall be as manufactured by Unique Fire Stop Products (USFP). Utilize USFP’s Threaded Penetrator system for all fire-rated penetrations.
            ii) Additional approved manufacturers: Specified Technologies E-Z Path, Wiremold FS Series
        2) All other penetrations and gypsum drywall constructed walls providing a fire rating of one hour or less will require a UL rated sleeve assembly installed to manufacturer’s requirements allowing the penetration(s) to not degrade the designed fire rating of the wall or floor.
            i) Standard of quality shall be as manufactured by Unique Fire Stop Products (USFP). Utilize USFP’s Smooth Penetrator system for all fire-rated penetrations.

ii) Additional approved manufacturers: Specified Technologies E-Z Path, Wiremold FS Series

3) All penetrations found to be improperly sleeved after the installation of cabling will be sleeved and firestopped to restore the proper aesthetics and required fire rating to the obstruction.

i) Standard of quality shall be as manufactured by Unique Fire Stop Products (USFP). Utilize USFP's split-sleeve system for all fire rated penetrations.

d) Penetrations into fire rated walls with gypsum board construction.

1) All penetrations required in gypsum board walls for installation of horizontal cabling, where conduit is not stubbed into the ceiling cavity for this purpose, will require a sleeved penetration through the drywall membrane or the wall cap.

i) Each penetration will require a UL listed sleeve assembly installed by an installer trained on proper installation of the sleeving device.

ii) Standard of quality shall be as manufactured by Unique Fire Stop Products (USFP). Utilize USFP's Membrane Penetrator or Cap Penetrator system for all fire rated penetrations.

iii) Additional approved manufacturers: Specified Technologies E-Z Path, Wiremold FS Series

2) Standard of quality shall be Unique Fire Stop Products.

i) Additional approved manufacturers: Specified Technologies E-Z Path, Wiremold FS Series

F. Supporting devices – Field Fabricated:

1. General

a) Shop or field-fabricated supports or manufactured supports assembled from U-channel components.

b) Steel brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

c) All steel components utilized to fabricate supports shall be of U.S. manufacture.

2. Coatings:

a) Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

b) Where possible, supports shall have a finish similar to the device it is supporting.

1) Where installed below the finished ceiling line, the support shall be painted to match the finish of the device it is supporting.

3. Material Types

a) Concrete and masonry anchors:

1) Shall be a guaranteed anchoring system with field training available.

i) Standard of quality will be as manufactured by Hilti or approved equal.

ii) All onsite personnel performing this work will be required to be manufacturer trained on the anchoring system being utilized, and upon request, to show proof of manufacturer's training certification.

b) Raceway supports:
   1) Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

c) Fasteners:
   1) Types, materials, and construction features as follows:
      i) Expansion anchors:
         (A) Carbon steel wedge or sleeve type
      ii) Toggle bolts:
         (A) All steel springhead type
      iii) Powder-driven threaded studs:
         (A) Heat-treated steel, designed specifically for the intended service.

d) Conduit sealing bushings:
   1) Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

e) Cable supports for vertical conduit:
   1) Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

f) Threaded Rod Stock (All-Thread Rod)
   1) Available in ¼", 3/8", ½", and 5/8" sizes.
      i) Utilize ½" for supporting of 12" ladder racks and cable trays.
      ii) Utilize 5/8" for supporting of 24" ladder racks and cable trays.
   2) Rod lengths over 6' will require a "Rod Stiffener" installation for ½" and 5/8" rods.
      i) A section of U-Channel stock is placed around the rod and stiffener clamp assemblies used to clamp to rod.
         (A) Place clamps a minimum of 6" from the top and bottom of the rod and every 18" in between.
         (B) Standard of quality shall be B-Line SC228
            (1) Additional approved manufacturer(s): Unistrut Diversified Products, GS Metals Corp., Haydon Corp., Kin-Line Inc.

g) U-channel systems:
   1) 16-gauge steel channels, with 9/16-inch diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

4. Slotted metal angle and U-channel systems:
   a) Standard of quality shall be Unistrut Diversified Products

1) Additional approved manufacturers: Allied Tube & Conduit, American Electric, B-Line Systems, Inc., Cinch Clamp Co., Inc., GS Metals Corp., Haydon Corp., Kin-Line Inc.

PART 3 EXECUTION

3.1 GENERAL

A. Minimum raceway size shall be as necessary to comply with fill ratio of referenced standards, but in no case less than one and one quarter inch (1 1/4 inch).
B. Provide specified pull wires in all cabling pathways.
C. Ground and bond all systems in accordance with the NEC and ANSI/TIA/EIA 607.
D. All installation material and practices shall fully comply with NFPA 70 “National Electrical Code” and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.
E. Coordinate work with the building structural systems and electrical installation.
F. All work shall fully comply with these Specifications and related Drawings and all manufacturers’ recommended installation practices.

3.2 PATHWAY INSTALLATION

A. Raceways
1. Conduit Usage:
a) Rigid Galvanized Steel (GRC):
1) All exposed conduit installed above grade outside the building envelope.
2) All conduits installed in moist locations.
b) Electric Metallic Tubing (EMT):
1) All conduits within the building envelope.
c) Polyvinylchloride (PVC):
1) Underground which may continue from underground through floor slab to Equipment Room/Telecommunications Room.
d) Flexible Metal Conduit (FMC):
1) Unless otherwise indicated, FMC can only be provided for secondary pathways from the ceiling space to the telecommunications outlet box.
2) Maximum length shall not exceed 6 meters.
2. Conduit installation:
a) Provide all conduit terminations with locknuts and bushings. Provide conduits 1 ½ inches and larger with insulating bushings and locknuts inside and outside the enclosure.
1) At least one bushing per conduit shall be grounding type
i) Equipped with a ground lug
ii) Provide on each conduit or sleeve where surface extends below ceiling line and install Bonding Conductor to TMGB.
b) Support conduits by pipe straps or trapeze hangers. Space supports not more than 8 feet on center. Secure supports by means of toggle bolts, inserts or expansion bolts.

c) Space wall brackets supporting conduits not more than 4 feet 6 inches on center. Secure supports by means of toggle bolts, inserts or expansion bolts.

d) Support conduits directly from structural systems not from ceiling suspensions systems.
   1) Provide additional support at junction or pull boxes.

e) Wherever possible, conceal raceways under floors, in walls, above ceilings or in furred spaces in finishes areas.

f) Support single conduits 1 ½ inches and larger by means of rod and cast ring hangers. Support multiple runs in similar manner or use common trapeze hanger.
   1) Trapeze hanger:
      i) Unistrut P2000 or P4000, or equal by Allied Support systems or Superstrut, as required for span and loading.
      ii) Provide end caps on hangers.
      iii) Fasten conduits by means of heavy galvanized straps.

g) Provide two-hole sheet metal pipe straps for all surface mounted conduit supports on walls up to a height of 8 feet above the finished floor. Pinch type hangers similar to minerallac type may only be used at heights greater than 8 feet.

h) Protect conduits during construction with temporary plugs or caps. Securely cap all conduit until wire or cable is installed.

i) Minimum conduit size is 1 inch.

j) Do not install conduit in concrete slab.

k) Provide expansion fittings where raceway crosses the building expansion joints. (O.X. Type AX, EX, EXDS, TX, EXE, or approved equal).

l) Route and maintain conduits as shown on the Drawings.
   1) If no specific routing information appears on the Drawings, the routing shown shall be considered diagrammatic.
      i) In such a case, the Contractor shall coordinate his Work with the different trades so that interferences between conduit, cable tray, piping, equipment, architectural, and structural work shall be avoided.
         (A) Should an interference arise, the Contractor shall inform the Consultant before proceeding with the Work.
         (B) Should the Contractor fail to contact the Consultant and interferences develop, the Owner's Representative will decide which equipment, piping, etc. must be replaced, regardless of which was installed first. The relocation shall be performed at no expense to the Owner.

m) There shall not be more than the equivalent of 180 degrees of bends in any single run of conduit between adequately sized pull.

n) Conduit bends
   1) Bends shall be made so that the conduit will not be flattened or kinked and the internal diameter of the conduit will not be reduced.
   2) The radius of the curve of the inner edge of any bend shall not be less than as indicated by the National Electrical Code and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.

3) In no case shall any conduit be bent or any fabricated elbow be applied to less than the allowable bending radius as specified by the cable manufacturer of the installed conductor.
4) When necessary to make field bends, use tools designed for conduit bending.
i) Heating of metallic conduit to facilitate bending is not permitted.

o) A conduit run shall not be longer than 100’ between pull boxes for conduit runs inside a building.
p) The Contractor shall not cut, burn, or drill any structural member to mount electrical equipment or to facilitate tray or conduit installations without having previously received approval, in writing, from the Architect/Engineer/Consultant.
q) Mount all conduits a minimum of 7 inches above any accessible type ceiling.
r) Maintain conduit runs at least 6 inches from insulated pipes, steam lines or any other hot pipes they pass. Where the lines are not insulated, the clearances shall be increased until the temperature of the conduit, with no live conductors enclosed, does not rise above the ambient temperature of the installation area.
s) Conceal all raceways except where otherwise indicated.
1) Provide flashing and counter-flashing or pitch pockets for waterproofing of all raceways, outlets, fittings, etc. that penetrate the roof.
2) Route all raceways parallel or perpendicular to the building lines with symmetrical bends.
3) Provide sleeves in forms for new concrete walls, floor slabs, and partitions for passage of raceways.
i) Seal in an approved manner all raceway openings and sleeves through fire rated walls, floors, and ceilings after raceway installation.
t) Waterproof all sleeved raceways where required.

B. Surface Raceway
1. Surface raceway installation
a) Provide surface raceways as indicated.
b) Coordinate installation with casework before installation. Field verify lengths to be installed before ordering equipment.
c) Install plumb and level.
d) Anchor all raceways to walls with the anchors designed for that particular wall construction. Secure raceway at a minimum of every 2 feet and not less than 6 inches from raceway ends.
e) Install raceway per the manufacturer’s written recommendation, including necessary entrance, end and bend fittings.
f) Provide all of the manufacturer’s recommended fittings and accessories.
g) Where surface raceway is provided for a secondary pathway from the outlet to the ceiling space, extend surface raceway into the ceiling space not less than 4 inches.

C. Telecommunications/power poles
1. Mount straight and anchor to building structure above the ceiling line.
2. Provide mounting hardware, entrance end fitting, and ceiling trim plate.

D. Cable Tray

1. Planning
    a) Contractor shall plan entire cable tray system layout and all components required to provide a complete system, verifying dimensions and right-of-way clearances as needed.
    b) Design
        1) Wall mounted
            i) Where 12” capacity is indicated on the drawings a single tiered 12” rung size tray will be utilized.
            ii) Where 24” capacity is indicated on the drawings a two tiered 12” rung size tray will be utilized.
        2) Suspended
            i) Where 12” capacity is indicated on the drawings a double sided 6” rung size tray will be utilized.
            ii) Where 24” capacity is indicated on the drawings a double sided 12” rung size tray will be utilized.
2. Coordination and positioning
    a) Coordinate positioning with other trades to assure maximum accessibility.
        1) Tray shall be mounted securely along the wall at a minimum of 6” (lower tier) above the ceiling line.
            i) Where two 12” trays connect to a two-tier unit, the upper tray may continue at 12” (upper tier) above the accessible ceiling.
            ii) Where tray cannot be wall mounted, (transversing hallways, etc.) mount span securely to wall at each end and provide ½” threaded rod supports, anchored into the concrete deck above, every 4’ at minimum.
        2) Minimum access should be 12 inches clear above the tray (each tier) and 12 inches clear beside the tray to facilitate moves, adds and changes for telecommunications cabling.
3. Installation
    a) Cable tray shall be routed as shown schematically by Contract Documents, run level and true to building lines.
    b) Changes in direction, changes in elevation, tees, crosses, and bends shall be made with manufactured fittings and accessories.
    c) Where conduits terminate above a cable tray, the conduit shall be provided with an insulating bushing.
    d) Mounting heights shall be sufficient to clear light fixtures, piping, and equipment and permit ready access through lay-in ceiling grids. Do not install less than 6 inches above ceiling.
    e) Cable tray shall be grounded by a separate stranded #6 AWG copper ground conductor attached to the building grounding electrode system and connected to nearest section of the cable tray with UL approved aluminum/copper termination.
        1) See “Grounding and Bonding” specification for further details.
    f) Cable tray shall be installed in accessible area. Provide raceway system of equivalent cross section area of cable tray where ceiling system is not accessible.

g) Cable tray and all fittings and accessories shall effect a complete structural system in the form of a rigid mechanical tray of compatible material and design, functional to support all cabling.

h) Transition cable tray system around physical obstructions using manufacturer's recommended turns, sweeps, transition products, and materials to create a complete continuous cabling pathway free of obstructions and maintaining specified clearances.

i) Where physical discontinuity is necessary, mechanically support cabling over the discontinuity as specified. Bond the ends of the cable tray together electrically over any discontinuity.
   1) Fire-wall penetrations shall be made with 4" sleeves (4 per 12" of tray width minimum).
      i) Utilize requirements of the NFPA NEC to determine correct construction and sizing of wall penetration if tray is to penetrate fire rated wall.
   2) Ground and bond the system in accordance with the NEC and ANSI/TIA/EIA 607.
   3) Do not use copper fittings or hardware to connect any bonding conductor to aluminum cable tray.

j) Provide support for cable trays at a minimum of 4' 6" on center and at all splices, tees, elbows, bends, intersections, and transitions.
   1) Support with threaded rod and U-channel supports systems
      i) 12" width – ½" ATR; 24" width – 5/8" ATR
   2) Rod lengths over 6' will require a "Rod Stiffener" installation.
      i) A section of U-Channel stock is placed around the rod and stiffener clamp assemblies used to clamp to rod
         (A) Place clamps a minimum of 6" from the top and bottom of the rod and every 18" in between.

k) Install system free of all sharp edges, burrs, or projections.

l) Provide rung caps on rung ends as specified.

m) Provide waterfall fittings in every location that cable is designed to exit the tray downward at the end of a run or between the rungs.

n) Route parallel and perpendicular to building surfaces.

o) Mount cable tray in such a fashion as to be re-usable.
   1) Install as straight and flat as practical and perpendicular to building lines.
      i) Utilize manufactured 45 degree transitions up and down to change elevations.
      ii) Utilize manufactured 45 or wide sweep 90-degree fittings to change route.
         (A) Mount cable tray at approximately 6-12" above accessible ceiling.
         (B) Locate in a position to allow at least 12" clearance on each side of the cable tray for access.

4. Install as a complete system in accordance with manufacturer's installation instructions indicated on the Drawings and to ensure electrical continuity of the system and

adequate support for the cabling. Provide all manufacturer's recommended fittings and accessories.

5. Supports shall be attached to building structure.

E. Messenger Strand
   1. Anchors shall be securely mounted to building structure at each end.
   2. Tensioners shall be installed to connect strand.
   3. Additional supports shall be installed with threaded rod from the deck above to support the strand approximately 6-8" above suspended ceiling in all locations.
      a) Support with threaded rod and U-channel supports systems (See Accessories, Supporting Devices – Field Fabricated)
      b) Properly sized.
         1) Multiples of strands (100 horizontal cables each) appropriate to handle the required cable quantities plus 25% spare capacity.
         2) Separate strand for Backbone cables.

F. Open top discreet cable supports (J-Hooks)
   1. Primary pathways (corridors, vertical chases, etc.) plenum rated, adjustable cable support that complies with UL cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems and accommodates up to 425 horizontal UTP cables or multiples of CAT32 (80 cables each) appropriate to handle the required cable quantities plus 25% spare capacity.
      a) Install j-hook pathway, supporting at least every 5', as straight as possible perpendicular to building structure at approximately 12" above accessible ceiling.
      b) Attachment of J-Hooks must be to building structure directly or utilize a minimum of ¼" all-thread rod anchored into deck above.
   2. Secondary pathways (those extending from the primary pathways to the space above the telecommunications outlets) J-hooks with galvanized finish to provide smooth surface and corrosion resistance that complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems and accommodates up to 16 horizontal UTP cables.
      a) Install j-hook pathway, supporting at least every 5', as straight as possible perpendicular to building structure at approximately 12" above accessible ceiling.
      b) Attachment of J-Hooks must be to building structure directly or utilize a minimum of ¼" all-thread rod anchored into deck above.
      c) Exception: Cable routes of less than ten 4 pair UTP (or equivalent weight) may be supported with ceiling grid support wiring when utilizing a support manufactured for that purpose.
         1) Must be supported every 5'
         2) Cannot interfere with the removal of the ceiling tile
         3) Must be installed approximately 12" above ceiling

3.3 BOXES

A. Outlet boxes:

1. Provide outlet boxes flush with the surface unless otherwise noted and properly centered in ceiling tiles, wall finishes, or casework elements. Heights as indicated or to match existing outlet boxes.
    a) Install all telecommunication video outlet with control for locations indiacted to be wall hung TV's or monitors 8 feet above finished floor or 12 inches below finished ceiling, whichever is lower.
2. Provide outlet boxes of a type appropriate for the use and location. Gang adjacent devices in multiple gang boxes under a common finish plate.
3. Boxes shall be securely and rigidly attached and supported plumb, level, and true to building lines by any of the following methods:
    a) Double bar installation for metal stud walls. Bar hanger punch, mounting clips, and retainer clips shall be used in strict accordance with manufacturer's instructions. Factory pre-punched stud holes shall not be used to support the bar hangers.
    b) Steel stud installed behind box for support without caddy-type mounting clips for metal stud wall construction.
    c) Caddy screw gun bracket installed behind box for support. Installation shall be per manufacturer's instructions.
4. Finish plates shall not span different types of wall finishes either vertically or horizontally. Plates shall cover mortar joints and cut openings completely.
5. Outlet, junction, and pull boxes and their covers shall have corrosion protection suitable for the atmosphere in which they are installed. Provide gaskets for all boxes installed outside or in other wet or damp locations (tunnels, crawlspaces, pits, etc.).
6. Outlet boxes shall be protected from plaster. Debris shall be thoroughly cleaned from the box before installation of conductors.
7. Floor boxes shall be installed flush and true with the floor.
8. Finish plates:
    a) Install a blank coverplate for each new or existing unused outlet box.

B. Junction and pull boxes
1. Provide junction and pull boxes as indicated in the Contract Documents and as required.
2. Provide junction and pull boxes in accessible spaces or behind access panels. Boxes located above snap-in or lay-in removable ceilings will be considered accessible.
3. Provide junction and pull boxes where necessary to facilitate the installation of raceways and pulling of wire or cable.
4. Provide junction and pull boxes sized in accordance with NEC and installed such that conduit entry will permit the longest radius for conductors contained therein.
5. Provide junction and pull boxes such that conduits enter and exit across from each other on opposite sides of the junction box. Do not provide junction and pull boxes in place of conduit bends.
6. Support all such boxes in accordance with the National Electrical Code.

C. Mounting heights
1. Exceptions:
    a) At junction of different materials in wall finishes.

b) Where outlet would occur in moldings, break in wall surface or unsuitable location in the tile, wood, or similar finish.
c) Where outlets would conflict with locations of wall-mounted equipment such as radiators, convectors, unit heaters, etc.
d) As noted otherwise.
e) Where electrical outlet on that wall is of different height.

3.4 PENETRATIONS THROUGH FLOORS AND WALLS

A. General:
1. Provide, locate and set sleeves where conduit passes through floors, walls, and other concrete or masonry structural materials except where tunnels, chases or shafts are provided in the constructions.
a) Sleeves through poured-in-place concrete floors shall be set before the pour and shall be of a design that will seal against passage of water between sleeves and concrete floor.
2. Provide bushings on all conduit sleeves.
3. Extend all wall sleeves a minimum of 2 inches or as required to allow the installation of conduit bushings.
4. Extend floor sleeves 4-6 inches above finished floors unless otherwise specified.
5. The void between the sleeve wall and conduit shall be neatly filled with an approved fire stop material.

B. Quantity and sizing:
1. Penetrations through floors, access through walls of Equipment Rooms and/or Telecommunications Rooms, and obstructions along a backbone or primary horizontal cabling route.
a) Provide the required quantity of 4-inch sleeve assemblies as specified with a minimum of one 4-inch sleeve. Properly firestop after installation of the telecommunications cabling.
b) Install sizes and quantities as specifically noted on the prints, or the quantity required so as to accommodate all planned cables, not exceeding a 40 percent maximum fill ratio in each sleeve, plus one spare 4-inch sleeve.
2. Penetrations through walls or along secondary horizontal cabling routes.
a) Provide a 2-inch or 4-inch sleeve assembly as specified with a minimum of one 2-inch sleeve. Properly fire stop after installation of the telecommunications cabling.
b) Install sizes and quantities as specifically noted on the prints, or the quantity required so as to accommodate all planned cables, not exceeding a 40 percent maximum fill ratio in each sleeve, plus one spare 4-inch sleeve.

C. Construction:
1. All penetrations through floors or walls to allow Division 27 cable or pathway to pass through will require a UL listed device for the purpose of penetrating the construction.
a) Concrete, block, brick, and gypsum drywall construction providing a fire rating of greater than one hour for walls and floors will require a UL rated sleeve assembly installed to manufacturer’s requirements allowing the penetration(s) to not degrade the designed fire rating of the wall or floor.

1) Each penetration will require a UL listed sleeve assembly installed by an installer trained on proper installation of the sleeving device.
2) Each penetration shall have the accompanying certification paperwork completely filled out and attached to the building structure adjacent to the penetration.

2. All other penetrations and gypsum drywall constructed walls providing a fire rating of one hour or less will require a UL rated sleeve assembly installed to manufacturer's requirements allowing the penetration(s) to not degrade the designed fire rating of the wall or floor.
   a) Each penetration will require a UL listed sleeve assembly installed by an installer trained on proper installation of the sleeving device.
   b) Each penetration shall have the accompanying certification paperwork completely filled out and attached to the building structure adjacent to the penetration. A copy of this paperwork will be required in the O & M Manual.
3. All penetrations found to be improperly sleeved after the installation of cabling will be sleeved and firestopped to restore the proper aesthetics and required fire rating to the obstruction.
   a) Each penetration will require a UL listed sleeve assembly installed by an installer trained on proper installation of the sleeving device.
   b) Each penetration shall have the accompanying certification paperwork completely filled out and attached to the building structure adjacent to the penetration. A copy of this paperwork will be required in the O & M Manual.
4. All penetrations required in gypsum board walls for installation of horizontal cabling, where conduit is not stubbed into the ceiling cavity for this purpose, will require a sleeved penetration through the drywall membrane or the wall cap.
5. Each penetration will require a UL listed sleeve assembly installed by an installer trained on proper installation of the sleeving device.

3.5 SUPPORTS

A. General:
   1. Coatings
      a) Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.
      b) Concrete and masonry anchors
         1) Shall be a guaranteed anchoring system with field training available.
            i) All onsite personnel will be required to be manufacturer trained on the anchoring system being utilized, and upon request, to show proof of manufacturer's training certification.

B. Manufactured supporting devices:
   1. Raceway supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
   2. Fasteners: Types, materials, and construction features as follows:
      a) Expansion anchors: Carbon steel wedge or sleeve type

b) Toggle bolts: All steel springhead type

c) Powder-driven threaded studs: Heat-treated steel, designed specifically for the intended service.

3. Conduit sealing bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

4. Cable supports for vertical conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

5. U-channel systems: 16-gauge steel channels, with 9/16-inch diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

C. Fabricated supporting devices:

1. General: Shop or field-fabricated supports or manufactured supports assembled from U-channel components.

2. Steel brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

3. Raceway supports: Comply with the NEC and the following requirements.

a) Conform to the manufacturer's recommendations for selection and installation of supports.

b) Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs. provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.

c) Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

d) Support parallel runs of horizontal raceways together on trapeze-type hangers.

e) Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers for 1 ½ inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use ¼ inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

f) Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

g) In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

4. Miscellaneous supports:
    a) Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, pull boxes, junction boxes, and other devices.
    b) Support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.
5. Conduit seals:
    a) Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
6. Fastening:
    a) Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to; conduits, raceways, cables, cable traps, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
        1) Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
        2) Holes cut to depth of more than 1 ½ inch in reinforced concrete beams or to depth of more than ¾ inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
        3) Ensure that the load applied to any fasteners does not exceed 25 percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.
7. Raceway supports: Hanger spacing shall be as required for proper and adequate support of raceway, but in no case shall be less than one hanger per 5 feet of raceway length.

END OF SECTION 27 05 28

SECTION 27 05 50 - FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:

1. This Section is a “Common Work Results” Section that includes information that is applicable and “Related” to all Division 27 Sections.
    a) Refer to related Section 27 05 28 “Pathways for Communications Systems” for Sleeving requirements.
    b) This Section includes firestopping for the following:
        1) Penetrations through fire-resistance/-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
        2) Penetrations through fire-resistance/-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
        3) Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
        4) Sealant joints in fire-resistance/-rated construction.
    c) Label each firestopped sleeve with the label furnished with the sleeve assembly; each certification label shall be copied and added to the O & M Manual.
2. System includes but is not limited to:
    a) Firestopping Compounds

B. Related Sections

1. All Division 27 Sections

C. Related Drawings

1. Technology (T-Series) Drawings

1.3 GENERAL INFORMATION

A. Definitions:

1. Firestopping
    a) A material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flames, smoke, and/or hot gasses through penetrations in fire-rated wall and floor assemblies.

B. All Work shall fully comply with these specifications and related Drawings and all manufacturers recommended installation practices.

1.4 SYSTEM DESCRITION / DESCRIPTION OF WORK

A. General:
   1. Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gasses.
   2. Firestopping may be factory installed in a re-usable sleeve assembly or may be a removable/ re-usable material(s) inserted into a sleeve assembly to provide adequate protection.
   3. Refer to related Division 27 Section “Pathways for Communications Systems” for Sleeving requirements.

B. Fire stopping requirements/locations are not indicated on drawings. It shall be the responsibility of this contractor to review all architectural and other drawings to determine fire/smoke rated walls and floors and rating requirements of same. This contractor shall provide all required fire stopping work associated with all Division 27 penetrations. Provide fire stop pillows, putty and/or sealant, as applicable, with minimum UL classification for 1 hour fire and cold side temperature ratings.
   1. At a minimum, provide firestopping to equal or exceed the rating of the wall or floor.
   2. Provide Fire Stop Putty equal to Nelson FSP #AA400 series, or by 3M Fire Protection Products; Fire Protection Services, Inc.; UL Classified for 3 hour fire and cold side temperature ratings, reusable when penetrating items are removed or added and requiring no special tools, mixing, curing or drying time.

C. System Performance requirements:
   1. Provide re-usable firestopping system(s) in all backbone pathway and major horizontal routes.
   2. F-rated through-penetration firestop systems:
      a) Provide through-penetration firestop systems with F rating indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
   3. T-rated through-penetration firestop systems:
      a) Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814 where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupied floor areas. T-rated assemblies are required where the following conditions exist:
         1) Firestop systems protect penetrations located outside of wall cavities.
         2) Firestop systems protect penetrations located outside fire-resistive shaft enclosures.
         3) Firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
         4) Firestop systems protect penetrating items larger than a 4-inch (100 mm) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.
   4. Fire-resistive joint sealants:

a) Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

5. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
   a) For floor penetrations with annular spaces exceeding 4 inches (100 mm) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floorloads involved either by installing floor plates or by other means.
   b) For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
6. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.5 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal. Product Data and Shop Drawings are not to be submitted separately.
   2. Samples shall be submitted with or immediately following submission of Product Data submittals.

B. Items to be submitted for approval prior to commencement of work:
   1. Product Data
      a) Manufacture datasheets for all items
         1) Data sheets shall include
            i) Manufacturer name
            ii) Manufacturer model number (as it appears on manufacturer's product data sheet)
            iii) Manufacturer product description
            iv) Paragraph number of this section where the product is specified.
   2. Shop Drawings
      a) System block wiring diagram, detailed.

C. Quality Assurance / Control Submittals
   1. RCDD Certification for the staff member responsible for this project.
   2. Resume of the last 10 projects of the RCDD responsible for this project
   3. BICSI Technician's certificate for each lead Technician(s) on the project

D. Closeout Submittal
   1. Manufacturer's Material Safety Data Sheets (MSDS) for each item.
   2. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

A. General
   1. This section is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.
   2. This standard will be considered in force for the original response as well as for any additions or changes to this Project. Due to this, there may be items listed in the Products section that are not required under the scope of this contract.

2.2 FIRESTOPPING, GENERAL

A. Compatibility:
   1. Provide firestopping components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories:
   1. Provide components for each firestopping system required to install fill materials and to comply with "System Performance Requirements" Article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Firestopping materials shall be asbestos-free and shall not contain flammable solvents. Accessories include but are not limited to the following:
      a) Permanent forming/damming/backing materials including the following:
         1) Semi-refractory fiber (mineral wool) insulation
         2) Ceramic fiber
         3) Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state
         4) Fire-rated formboard
         5) Joint fillers for joint sealants
      b) Temporary forming materials
      c) Substrate primers
      d) Collars
      e) Steel sleeves

C. Applications:
   1. Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.3 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Subject to compliance with requirements, provide one or more of the following types:

B. Ceramic-fiber and mastic coating:
   1. Ceramic fibers in bulk form formulated for use with mastic coating and ceramic fiber manufacturer's mastic coating.
      a) Standard of quality shall be 3M Fire Protection Products
         1) Additional approved manufacturer(s): Thermal Ceramics, FireMaster Bulk, FireMaster Mastic

C. Ceramic-fiber sealant:

1. Single-component formulation of ceramic fibers and inorganic binders.
    a) Standard of quality shall be 3M Fire Protection Products
        1) Additional approved manufacturer(s): Metacaulk 525, The RectorSeal Corporation

D. Endothermic, latex compound sealant:
1. Single-component, endothermic, latex formulation.
    a) Standard of quality shall be 3M Fire Protection Products
        1) Additional approved manufacturer(s): Fyre-Shield, Tremco Inc., Flame-Safe FS500/600 Series, International Protective Coatings Corp., Flame-Safe FS900/FST900 Series, International Protective Coating Corp., Cafco TYPS Type 1, Isolatek International, STI LC150, Specified Technologies, Inc.

E. Intumescent, latex sealant:
1. Single-component, intumescent latex formulation.
    a) Standard of quality shall be Fire Barrier CP 25WB Caulk, 3M Fire Protection Products
        1) Additional approved manufacturer(s): Metacaulk 950, The RectorSeal Corporation, Cafco TPS Type 1, Isolatek International, STI SSS100, Specified Technologies, Inc., Hilti

F. Intumescent putty:
1. Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
    a) Standard of quality shall be Fire Barrier Moldable Putty, 3M Fire Protection Products
        1) Additional approved manufacturer(s): Intumescent Putty, General Electric Co., Flame-Safe FSP1000 Putty, International Protective Coatings Corp., Cafco TPS Types P and EP, Isolatek International, Hilti

G. Intumescent wrap strips:
1. Single-component, elastomeric sheet with aluminum foil on one side.
    a) Standard of quality shall be Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products
        1) Additional approved manufacturer(s): CS2420 intumescent wrap, Hilti Construction Chemicals, Inc., STI SSW Red, Specified Technologies, Inc.

H. Pillows/bags:
1. Reusable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
    a) Standard of quality shall be Firestop Pillows, Bio Fireshield, Inc.
        1) Additional approved manufacturer(s): KBS Sealbags, International Protective Coatings Corp., SSB Pillows, Specified Technologies, Inc., 3M Fire Protection Products

I. Intumescent collars:
    a) Standard of quality shall be Cafco TPS Type D, Isolated International
    b) Additional approved manufacturer(s):STI SSC Collars, Specified Technologies, Inc., 3M Fire Protection Products

2.4 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric sealant standard:
   1. Provide manufacturer's standard chemically curing, elastomeric sealants for base polymer indicated that complies with ASTM C 920 requirements, including those referenced for type, grade, class, and uses; and requirements specified in this Section applicable to fire-resistive joint sealants.

B. Single-component, neutral-curing silicone sealant:
   1. Type S, Grade NS, Class 25, exposure-related Use NT, and joint-substrate related Uses M, G, A, and (as applicable to joint substrates indicated) O.
      a) Additional movement capability:
         1) Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
            i) 50 percent movement in both extension and compression for a total of 100 percent movement.
            ii) 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

C. Single-component, nonsag, urethane sealant:
   1. Type S, Grade NS, Class 25, and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

D. Products: Subject to compliance with requirements, provide one of the following:
   1. Single-component, neutral-curing, silicone sealant:
      a) Dow Corning 790, Dow Corning Corp.
      b) Dow Corning 795, Dow Corning Corp.
      c) Silpruf, General Electric Co.
      d) Ultraglaze, General Electric Co.
      e) Omniseal, Sonneborn Building Products Div. Chem Rex, Inc.
      f) Hilti
      g) FS-One
   2. Single-component, nonsag, urethane sealant:
      a) Isoflex 880 GB, Harry S. Peterson Co., Inc.
      b) Isoflex 881, Harry S. Peterson Co., Inc.
      c) Vulkem 921, Mameco International Inc.
      d) Sikaflex-15LM, Sika Corp.
      e) NP-1, Sonneborn building Products Civ., Chem Rex, Inc.

2.5 FIRE STOPPING FOR ALL OTHER WALL AND FLOOR OPENINGS

A. Provide Fire Stop Sealant shall be equal to Nelson #AA491 series, or by 3M Fire Protection Products; Fire Protection Services, Inc.; UL Classified for 3 hour fire and cold side temperature ratings, non-sagging, permanently flexible, non-toxic, non-shrinking, water/air/smoke-tight and easily re-penetrated. The following shall be considered equal.

1. For Floor Openings: Instant Firestop; 305-SL.
2. For Wall Openings: Instant Firestop; 344-GG.
3. Mineral Felt: Instant Firestop; Type MW.
4. For Insulated Pipes: Instant Firestop; Type PI.
5. For Fill Areas: Instant Firestop; C-1000.

B. Apply sealant primer to substrates as recommended by manufacturer (if any). Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

C. Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental conditions:

1. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation:

1. Ventilate firestopping compounds per manufacturers' instructions by natural means or, when this is inadequate, forced air circulation.

3.2 SEQUENCING AND SCHEDULING

A. Do not cover up those firestopping installations that will become concealed behind other construction until the Architect/Engineer/Consultant has examined each installation

3.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to the Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multi-component materials.

1. Coordinate the delivery date of firestopping materials with the scheduled date of installation to minimize amount of storage time required at the Project site.
2. Store with a copy of the manufacturers MSDS sheet.
    a) Submit a copy of each sheet to the site manager.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

C. Damaged or expired materials shall be removed from the site and shall not be used in the Work.

3.4 FIRE-TEST-RESPONSE CHARACTERISTICS: PROVIDE FIRESTOPPING THAT COMPLIES WITH THE FOLLOWING REQUIREMENTS AND THOSE SPECIFIED IN THE "SYSTEM PERFORMANCE REQUIREMENTS" ARTICLE IN THIS SECTION.

A. Firestopping tests are to be performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is an agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.

B. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water (2.5 Pa) is maintained at a distance of 0.78 inch (20 mm) below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:

1. Through-penetration firestop system products shall bear classification marking of qualified testing and inspecting agency.
2. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.

C. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water (2.5 Pa) as measured 0.78 inch (20 mm) from the face exposed to furnace fire. Provide systems complying with the following requirements:

1. Fire-resistance rating of joint sealants
   a) As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
2. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

D. Where no UL test firestop application exists, manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation.

E. Firestopping systems and their locations in the Project are not specifically indicated in the Drawings.

F. It is the sole responsibility of the Firestopping Contractor to install tested and approved systems that comply with all applicable codes, standards and/or agencies having jurisdiction.

3.5 INSTALLER QUALIFICATIONS:

A. Engage an installer with not less than two years experience in the installation of firestopping similar in material, design, and extent to that indicated for this Project.

3.6 SINGLE-SOURCE RESPONSIBILITY:

A. Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

3.7 PROVIDE FIRESTOPPING PRODUCTS CONTAINING NO DETECTABLE ASBESTOS AS DETERMINED BY THE METHOD SPECIFIED IN 40 CFR PART 763, SUBPART F, APPENDIX A, SECTION 1, "POLARIZED LIGHT MICROSCOPY."

3.8 COORDINATING WORK:

A. Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

3.9 EXAMINATION

A. Examine substrates and conditions with installer present for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.10 PREPARATION

A. Surface cleaning:
   1. Clean out openings and joints immediately before installation of firestopping to comply with firestopping manufacturer’s recommendations and the following requirements:
      a) Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
      b) Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
      c) Remove laitance and form release agents from concrete.

B. Masking tape:
   1. Use masking tape to prevent firestopping from contact with the following:
      a) Adjoining surfaces that will remain exposed upon completion of Work.
      b) Surfaces that would otherwise be permanently stained or damaged by such contact or cleaning methods used to remove smears from firestopping materials.
   2. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.

3.11 GENERAL FIRE STOPPING MATERIAL APPLICATION

A. Clean all affected surfaces, joints, etc. immediately before applying fire stopping to comply with recommendations of manufacturer.

B. Comply with fire stop material manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

C. Install fire stop materials, including forming, packing, and other accessory materials, to fill openings around services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

D. Caulk between sleeves and pipes with rockwool and caulk around sleeves with sealing compound. Material must meet all applicable fire ratings required.

E. Patch shall be equal to rockwool, firestop, caulk or approved "rated" patch.

F. Where a smoke and/or fire-resistance classification is indicated on architectural drawings or otherwise, provide the following as applicable.

G. Fire stop pillows, putty and/or sealant with minimum UL classification for 3 hour fire and cold side temperature ratings for all penetrations.

H. Access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating required; Provide UL Label on each fire-rated access door.

I. Wall and Floor Opening Fire Stopping for Open Cable Tray or J-Hook Paths

J. Provide Fire Stop Pillows equal to Nelson FSP #AA500 PLW or #AA501 PLW or by Fire Protection Services, Inc.; 3M Fire Protection Products as required, UL Classified for 3 hour fire and cold side temperature ratings, quickly removable and reusable, non-toxic and requiring no special tools.

K. Wall & Floor Opening Fire Stopping for Work Likely to Require Ongoing Moves, Adds and Changes

L. All Work shall comply with manufacturer's written installation instructions.

1. Seal all holes to ensure a flame/gas/smoke resistant seal.
2. Do not permit UL firestop systems to hamper the performance of fire dampers in ductwork.

3.12 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General:

1. Comply with the "System Performance Requirements" Article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3.13 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General:

1. Comply with the "System Performance Requirements" Article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at the position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration,

and providing uniform, cross-sectional shapes and depths relative to joint width at optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and before skinning or curing begins. Form smooth, uniform beads of configuration indicated or as required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or that are not approved by the sealant manufacturer.

3.14 FIELD QUALITY CONTROL

A. Do not proceed to enclose firestopping with other construction until examinations are completed.

B. Where deficiencies are found, repair or replace firestopping at no additional expense to the Owner so that Work complies with requirements.

3.15 CLEANING

A. Remove excess fill materials and sealants adjacent to openings and joints as Work progresses. Use methods and cleaning materials approved by manufacturers of firestopping products and products in which openings and joints occur. Return all surfaces to their original condition.

B. During and after the curing period, protect firestopping from contact with contaminating substances and from damage resulting from construction operations or other causes so that they are without deterioration or damage or at time of Substantial Completion.

1. If damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 27 05 50

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SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. Labeling of Communications Systems
   2. Labeling of Life Safety and Security Systems
      a) This Section is a “Common Work Results” Section that includes information that is applicable and “Related” to all Division 27 Sections.
   3. System includes but is not limited to:
      a) Labels

B. Related Sections
   1. All Division 27 Sections

C. Related Drawings
   1. Technology (T-Series) Drawings

1.3 REFERENCES

A. “TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL” published by the Building Industry Consulting Services International (BISCI).

1.4 SYSTEM DESCRIPTION / DESCRIPTION OF WORK

A. Furnish and install labeling for all Communication products, including but not limited to:
   1. Patch panels
   2. Device plates
   3. Cabling
   4. Equipment racks
   5. Building Distribution Frame <BDF>/Entrance Facility <EF>
   6. Equipment room(s) <ERxxxx>
   7. Telecommunications room(s) <TRxxx>
   8. Structured cabling, including horizontal and backbone cabling
   9. Communications cabling cross-connects
   10. Communications backboards

B. Labeling system shall be an ANSI/TIA/EIA-606 compliant system - The Administrative Standard for the Telecommunications Infrastructure of Commercial Building Identification System.
   1. See Drawings for graphical representation.

1.5 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal. Product Data and Shop Drawings are not to be submitted separately.
   2. Samples shall be submitted with or immediately following submission of Product Data submittals.

B. Product Data
   1. Manufacture datasheets for all labels

C. Shop Drawings
   1. Labeling system diagram, detailed.

D. Quality Assurance
   1. RCDD Certificate for the Contractor's staff member(s) with ultimate responsibility for ensuring Contractor compliance with work of this section.
   2. BISCI Technician Certificate for the technicians performing work of this section

E. Closeout Submittals
   1. A diagram of the labeling scheme used on the Project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady
B. Panduit
C. Hellerman/Tyton
D. Brother

2.2 GENERAL

1. This section is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.
2. This standard will be considered in force for the original response as well as for any additions or changes to this Project. Due to this, there may be items listed in the Products section that are not required under the scope of this contract.
3. Products required by the Drawings but not listed in Part 2, will be evaluated as a performance specification based on the information provided on the Drawings.

2.3 LABELS

A. Labels
   1. Labels shall have a white background and black print.
   2. Provide alphanumeric, clearly typewritten labels at all designated points as follows:

a) Horizontal Cables
   1) 4 pair UTP cables
      i) Standard of quality shall be Brady PTL-31-642
   2) 4 pair STP cables
      i) Standard of quality shall be Brady PTL-21-642
   3) RG-6 Coaxial
      i) Standard of quality shall be Brady PTL-31-642
b) Telecommunications outlet port
   1) Standard of quality shall be Panduit PLL-46-Y2-1
c) Telecommunications outlet faceplate:
   1) Standard of quality shall be Panduit JLEFPS-1
d) Patch panel ports
   1) Standard of quality shall be Panduit JLCPL-1
e) Patch Panels
   1) Standard of quality shall be Brady PTL-20-422
f) Backbone cables
   1) 100 pair Copper cables
      i) Standard of quality shall be Brady PTL-34-642
   2) Fiber Optic Cables
      i) Standard of quality shall be Brady PTL-21-642
   3) Cable Bundles
      i) Standard of quality shall be Brady PTL-12-109
   4) 110 style blocks
      i) Standard of quality shall be Panduit DSL-110
      ii) Use with Panduit P110LH
   5) Telecommunications Backboards
      i) Standard of quality shall be Brady PTL-37-422
   6) Racks and Cabinets
      i) Standard of quality shall be Brady PTL-42-422

PART 3 EXECUTION

3.1 GENERAL

A. This section is designed to provide the vendor with a standard of quality and functionality for the installation of technology systems infrastructure. Not all procedures will be necessary for the installation of this Project. However, this standard will be considered in force for the original response as well as for any additions or changes to this Project.

B. Contractor SHALL work with Owners Telecommunications representative to gain approval of labeling plan BEFORE any cable labeling is started.

C. Jacks in patch panels shall be installed with room numbers in sequential numerical order and in floor order.

3.2 INSTALLATION

A. Labels
   1. Apply all labels shall be installed parallel to the dominate visual lines of the product being labeled.

2. Labels shall be clearly legible and appropriately sized for the application.
3. Provide alphanumeric, clearly typewritten labels at all designated points as follows:
    a) See for graphical representation of labeling scheme.
    b) Horizontal cabling:
        1) Cabling to ER/TR from outlets and devices
            i) ER/TR # - Outlet Room Number - Patch Panel #/Port #.
            ii) Example: ER01-211-B22 where Equipment Room is identified as ER01, the cable travels to room 211 and the cable is landed on patch panel B position 22 (of 48) in the ER.
            iii) Locate label on cable jacket between 3 and 6 inches of each end of the cable.
        2) Cabling between horizontal outlets/devices
            i) Label local input cables.
            ii) Locate label on cable jacket between 3 and 6 inches of each end of the cable.
            iii) Label each cable as to its signal type, purpose, and destination. Add a numeric suffix to uniquely identify multiple cables of duplicate signal type, purpose or destination.
    c) Telecommunications outlet ports and faceplates:
        1) ER/TR# - Outlet Room Number – Patch panel #/ Jack #.
        2) Example: ER01-211 faceplate number and B22 through B25 jack numbers for a 4 port faceplate where Equipment Room is identified as ER01, the cable is landed on patch panel B position 22 through 25 (of 48) in the ER and travels to room 211.
        3) Locate the faceplate label, excluding the jack designation at the top of the faceplate. Locate the individual jack designation numbers immediately above each jack on the faceplate.
        4) Label local input terminations as follows: F Connector – Camera, RCA yellow – Local Video, RCA white – L Audio, RCA red– R Audio, BNC – Local Video, Horizontal UTP – Local Control.
    d) Patch panels and patch panel ports:
        1) Label each patch panel A-Z, top-to-bottom
            i) Locate label on the front upper left corner of all patch panels
        2) Locate on the front of all patch panels, directly above or below (as indicated by the manufacturer) each jack position (1 through 24) in the patch panel; place the room number corresponding to the room number used on the faceplate for each port.
        3) Labeling shall be in numerical order and correspond to the telecommunications outlet faceplate scheme.
    e) Backbone cabling:
        1) Service designation – ER#/TR#.
        2) Service designation – CB = Copper Backbone, FB = Fiber Backbone, VB = Video Backbone. Example: CB – ER01/TR02.
        3) Locate label on cable jacket within 6 inches of each end of the cable and at key pull points along pathway.
    f) Cross-connect blocks, 110 style

1) Locate on the front of all patch panels directly above or below (as indicated by the manufacturer) each position in the block.
2) Labeling shall be in numerical order and correspond to the telecommunications outlet faceplate scheme or opposite end labeling dependant on use.
3) Label the upper left corner of each block designating the service of that particular block. Do not terminate mixed services on the same block.

g) Cross-connect blocks, 66 style
1) Locate on the front of all patch panels directly above or below (as indicated by the manufacturer) each position in the block.
2) Labeling shall be in numerical order and correspond to the telecommunications outlet faceplate scheme or opposite end labeling dependant on use.
3) Label the upper left corner of each block designating the service of that particular block. Do not terminate mixed services on the same block.

h) Communications Backboards (TBB)
1) Backboard # with the prefix TBB, followed by the numeric backboard number in the room, followed by the suffix identifying the room in which the backboard is located. Example: TBB–01-ER-xxx.
2) Label each 4’x8’ sheet and each partial sheet, in numerical order left-to-right as facing the front of the backboards.

i) Equipment Racks
1) Device ID. Example: ER01 – 02.
2) Label each cabinet/rack in numerical order left-to-right as facing front of cabinet/rack bays.

j) Telephone Patch Cables
1) Labeled with the same unique identifier at both ends of the assembly.

3.3 TRAINING

A. Conduct a walk through of the project site and demonstrate the presence and location of all key labeling elements used.

B. Furnish handouts to all owner personnel attending training that clearly depicts the labeling schema used on the project.

END OF SECTION 27 05 53

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SECTION 27 08 10 - VERIFICATION TESTING OF STRUCTURED CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. The work covered by this Specification Section includes any and all requirements for this type work required for proper Commissioning of work specified in each related Division 27 Specification Section and/or as shown on the Drawings.
   2. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing of the work called for in the Contract Documents.
      a) This Section is a “Common Work Results” Section that includes information that is applicable and “Related” to all Division 27 Sections.

B. Related Sections
   1. All Division 27 Sections

C. Related Drawings
   1. Technology (T-Series) Drawings

1.3 REFERENCES

A. All testing procedures and field-test instruments shall comply with applicable requirements of:
   1. ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources
   2. ANSI/EIA/TIA-455-50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements
   3. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
   4. ANSI/TIA/EIA-455-133A, Measurement of Fiber or Cable Length Using an OTDR.
   5. ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
   6. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant.
   7. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
   8. ANSI/TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard,
   9. TIA/EIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

B. ANSI/TIA/EIA-568-C.2 – Balanced Twisted Pair Telecommunications Cabling and Components Standard
C. ANSI/TIA/EIA-568-C.3 – Optical Fiber Cabling Components Standard
D. ANSI/TIA/EIA-568-C.4 – Standard on Coaxial Cabling Components
E. "TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL" published by the Building Industry Consulting Services International (BISCI).

1.4 SYSTEM DESCRIPTION / DESCRIPTION OF WORK

A. General
1. Testing shall be carried out in accordance with this document.
2. Testing shall be performed on each cabling link (connector to connector).
3. Testing shall not include any active devices or passive devices within the link other than cable, connectors, and splices.
a) Link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
4. Contractor shall maintain and provide to ISU a Microsoft Excel spreadsheet in electronic format of all connections installed with the following fields filled out. *NO DATA PORTS WILL BE ACTIVATED UNTIL THIS SHEET IS PROVIDED FULLY FILLED OUT TO OWNER*:
a) Room Number
b) Jack Label
c) Wire label
d) IDF Room Number
e) Rack Label for patch panel
f) Patch Panel label
g) Patch panel port
h) Cable Length
i) Data switch rack label (if connected to data switch)
j) Data switch label (if connected to data switch)
k) Data switch port number (if connected to data switch)

B. Copper (Twisted Pair) Testing
1. Copper Cat 6A Installation: field test requirements upon completion of the installation
a) General Requirements (Category 6A)
1) Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA/EIA-568B-2.10*"Transmission Performance Specifications for 4-pair 100Ω Category 6A Cabling"*. This document will be referred to as the "TIA Cat 6A Standard."
2) The installed twisted-pair horizontal links shall be tested from the MDF/IDF (ER/TR) in the telecommunications room to the telecommunication wall outlet in the work area against the "*Permanent Link*" performance limits specification as defined in the TIA Cat 6A Standard.
3) One hundred percent of the installed cabling links must be tested and must pass the requirements of the standards mentioned above and as further detailed in Part 3. Any failing link must be diagnosed and corrected. The

corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation (below).

b) Qualifications
   1) Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BiCSi or the ACP (Association of Cabling Professionals).

c) Coordination/Verification:
   1) A representative of the Owner shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing commences.
   2) A representative of the Owner may elect to select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in Section A.3. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative *shall repeat 100% testing and the cost shall be borne by the installation contractor.*

C. FIBER OPTIC Testing

1. GENERAL

a) The testing Tier shall be as indicated on the Detail Drawings.
   1) Testing Tiers requirements are as described below.
   2) If not otherwise noted:
      i) All fiber optic Intra-Building Links shall be tested as Tier 1.
      ii) All fiber optic Inter-Building Links shall be tested as Tier 2.

b) Every fiber optic cabling link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standards ANSI/TIA/EIA-568-C.1, "*Commercial Building Telecommunications Cabling Standard, Part 1, General Requirements*," and TIA/EIA TSB140, "*Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems*."

c) ANSI/TIA/EIA-568-B.1, defines the passive cabling network, to include cable, connectors, and splices (if present), between two optical fiber patch panels (connecting hardware). The test does not, however, include the performance of the connector at the interface with the test equipment.

d) 100% of the installed cabling links must be tested and must pass the requirements as specified within this document. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance Part 3.

e) The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests in Part 3.

f) A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

2. Qualifications

a) Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization.

1) Manufacturer of the fiber optic cable and/or the fiber optic connectors.
2) Manufacturer of the test equipment used for the field certification.
3) Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida; ACP [Association of Cabling Professionals™] Cabling Business Institute located in Dallas, Texas)

3. Coordination/Verification

a) The Owner or the Owner's representative shall be invited to witness and/or review field-testing.

1) The Owner or the Owner's representative shall be notified of the start date of the testing phase five (5) business days before testing commences.
2) The Owner or the Owner's representative will select a random sample of 5% of the installed links. The Owner or the Owner's representative shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, *the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Owner.*
3) All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode and singlemode links and channels and OTDR traces and event tables for multimode and singlemode links and channels.

4. Acceptance of test results.

a) Unless otherwise specified by the Owner or the Owners representative, each cabling link shall be in compliance with the following test limits:

1) Optical loss testing

i) Backbone (multimode and singlemode) link

(A) The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA/EIA-568-B.1.

(1) Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)
(2) Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
(3) Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
(4) Maximum allowable connector_loss = 0.75 dB
(5) Splice_Attn (dB) = number_of_splices * splice_loss (dB)
(6) Maximum allowable splice_loss = 0.3 dB

(7) The values for the Attenuation_Coefficient (dB/km) are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

ii) Horizontal (multimode) link

(A) The acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum 90 m (295 ft) distance.

(B) The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one pair at the telecommunications outlet/connector and one pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.

(C) A horizontal link in an Open Office Cabling network with a consolidation point may be tested using a fixed upper limit for attenuation of 2.75 dB.

iii) Centralized (multimode) link

(A) The acceptable link attenuation for a multimode centralized optical fiber cabling system is based on the maximum 300 m (984 ft) distance.

(B) The centralized link may be tested using a fixed upper limit for attenuation of 3.3 dB. This value is based on the loss of three (3) connector pairs, one pair at the telecommunications outlet/connector, one pair at the consolidation point and one pair at the horizontal cross-connect, plus 300 m (984 ft) of optical fiber cable.

(C) A horizontal link in an Open Office Cabling network with a consolidation point may be tested using a fixed upper limit for attenuation of 4.1 dB.

2) OTDR testing

i) Reflective events (connections) shall not exceed 0.75 dB.

ii) Non-reflective events (splices) shall not exceed 0.3 dB.

3) Magnified endface inspection

i) Fiber connections shall be visually inspected for endface quality.

ii) Scratched, pitted or dirty connectors shall be diagnosed and corrected.

b) All installed cabling links and channels shall be field-tested and pass the test requirements and analysis as described in Part 3. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that

the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation in accordance with Part 3.

c) Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

1.5 SUBMITTALS

A. General

1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal. Product Data and Shop Drawings are not to be submitted separately.
2. Samples shall be submitted with or immediately following submission of Product Data submittals.

B. Equipment Data

1. Manufacture datasheets for all twisted pair test equipment
2. Manufacturers datasheets for fiber optic field-test instruments including optical loss test sets (OLTS; power meter and source), optical time domain reflectometer (OTDR) and inspection scope as applicable.

C. Quality Assurance / Control Submittals

1. RCDD Certification for the staff member responsible for this project.
2. Resume of the last 10 projects of the RCDD responsible for this project
3. BICSI Technician's certificate for each lead Technician(s) on the project

D. Closeout Submittal

1. Copper (Twisted Pair) Test Result Documentation
   a) The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.
   b) The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test. The popular 'csv' format (comma separated value format) does not provide adequate protection and shall not be acceptable unless specified by the end user.
   c) The database for the completed job, including twisted-pair copper cabling links if applicable, shall be stored and delivered on USB flash drive. This USB flash drive shall include the software tools required to view, inspect, and print any selection of test reports.
   d) Circuit IDs reported by the test instrument shall match the specified label ID.
   e) A copy of the test results shall be provided that lists all the links that have been tested with the following summary information. The copy may be delivered on paper or electronically as specified by the end user.
      1) The identification of the link in accordance with the naming convention defined in the overall system documentation
      2) The overall Pass/Fail evaluation of the link-under-test

3) The date and time the test results were saved in the memory of the tester

f) General Information to be provided in the electronic data base containing the test result information for each link:
1) The identification of the customer site as specified by the end-user
2) The overall Pass/Fail evaluation of the link-under-test
3) The name of the standard selected to execute the stored test results
4) The value of the NVP of the cable installed; used for length calculations
5) The date and time the test results were saved in the memory of the tester
6) The brand name, model and serial number of the tester
7) The revision of the tester software and the revision of the test standards database in the tester

g) The detailed test results data to be provided in the electronic database for each tested link must contain the information as set forth in Part 3.

2. Fiber Optic Test Result Documentation

a) The OLTS and OTDR test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

b) The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test. The popular ‘csv’ format (comma separated value format) does not provide adequate protection and shall not be acceptable unless specified by the end user.

c) The database for the completed job, including twisted-pair copper cabling links if applicable, shall be stored and delivered on USB flash drive. This USB flash drive shall include the software tools required to view, inspect, and print any selection of test reports.

d) Circuit IDs reported by the test instrument shall match the specified label ID.

e) A copy of the test results shall be provided that lists all the links that have been tested with the following summary information. The copy may be delivered on paper or electronically as specified by the end user.
1) The identification of the link in accordance with the naming convention defined in the overall system documentation
2) The overall Pass/Fail evaluation of the link-under-test
3) The date and time the test results were saved in the memory of the tester

f) General Information to be provided in the electronic data base containing the test result information for each link:
1) The identification of the customer site as specified by the end-user
2) The overall Pass/Fail evaluation of the link-under-test
3) The name of the standard selected to execute the stored test results
4) The value of the ‘index of refraction’ used for length calculations
5) The date and time the test results were saved in the memory of the tester
6) The brand name, model and serial number of the tester
7) The revision of the tester software and the revision of the test standards database in the tester

g) The detailed test results data to be provided in the electronic database for each tested optical fiber must contain the following information

1) The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation
2) Tier 1:
    (A) The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference between the measured attenuation and the test limit value).
    (B) The link length shall be reported for each optical fiber for which the test limit was calculated based on the formulas above.
3) Tier 2:
    i) All Tier 1 test results.
    ii) The overall OTDR loss (attenuation) and length.
    iii) The OTDR event loss at each wavelength and event location.
    iv) The OTDR trace at each wavelength.
4) Tier 3:
    i) All Tier 1 and 2 test results.
    ii) A picture of the magnified connector endface.
    iii) The pass status based upon visual inspection.

PART 2 PRODUCTS

A. Copper (Twisted Pair) Test Equipment
    1. Category 6A Compliance
        a) The test equipment (tester) shall comply with the accuracy requirements for level III field testers as defined in the TIA Cat 6A Document. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy *plus* adapter contribution) are specified in Table B.2.10 of the TIA Cat 6A Standard.
        b) The test plug shall fall within the values specified in E.3.2.2 Modular test plug NEXT loss requirements of the TIA Cat 6A Standard.
        c) The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
        d) The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.
        e) The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests (detailed in Part 3). Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

f) A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.

2. Utilize the appropriate test equipment as manufactured by Datacom Technologies, Fluke, MicroTest, Scope, WaveTek, WireScope or approved equal. Print test results from the test unit used. Documentation shall include meter catalog number, serial number, manufacturer, cable identifier, Equipment Room/Telecommunications Room identifier, cable type, NVP settings, meter readings, test date, calibration information, and operator responsible for tests.

B. Fiber Optic Test Equipment

1. The test equipment shall be within the calibration period recommended by the manufacturer.
2. Fiber optic test jumpers and adapters shall be of high quality and shall not show excessive wear.
3. Optical Loss Test Set (OLTS)
   a) An OLTS is comprised of two components: an optical light source and an optical power meter. After making a reference measurement, the source and meter are located at opposite ends of the fiber under test. A source and meter may be contained within the same package to enable bi-directional testing without swapping end test equipment.
   b) Multimode optical fiber light source
      1) Provide dual LED light sources with central wavelengths of 850nm (±30nm) and 1300nm (±20nm).
      2) Output power of -20dB minimum.
      3) Shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with a Category 1 light source.
   c) Singlemode optical fiber light source
      1) Provide dual laser light sources with central wavelengths of 1310nm (±20nm) and 1550nm (±20nm).
      2) Output power of –10dB minimum.
      3) Shall meet the requirements of ANSI/EIA/TIA-526-7.
   d) Power Meter
      1) Provide 850nm, 1300nm, 1310nm and 1500nm wavelength test capability
      2) Shall meet the requirements of ANSI/EIA/TIA-526-14A and ANSI/EIA/TIA-526-7.
      3) Power measurement uncertainty of ± 0.25 dB.
      4) Store reference power measurement.
      5) Save at least 100 results in internal memory.
      6) PC interface (serial or USB)
   e) Optional requirements that lead to faster, more efficient testing

1) Dual-wavelength single-adapter light source
2) Dual-fiber automated testing
3) Fiber length measurement using time-of-flight technology
4) Automated loss budget calculation and pass/fail analysis

f) Optical Time Domain Reflectometer (OTDR)
1) Shall have a bright, color transmissive LCD display with backlight.
2) Shall have rechargeable Li-Ion battery for 8 hours of normal operation.
3) Weight with battery and module of not more than 4.5lb and volume of not more 200in³.
4) Internal non-volatile memory and removable memory device with at least 16MB capacity for results storage.
5) Serial and USB ports to transfer data to a PC.
6) Multimode OTDR
i) Wavelengths of 850nm (± 20nm) and 1300nm (± 20nm).
ii) Event deadzones of 1m maximum at 850nm and 2m maximum at 1300nm.
iii) Attenuation deadzones of 6m maximum at 850nm and 15m maximum at 1300nm.
iv) Distance range at least 2000m.
v) Dynamic range at least 10dB at 850nm and 1300nm.

g) Optional requirements
1) Integrated OLTS
2) Integrated optical power meter
3) Integrated video microscope

4. Fiber Microscope
a) Magnification of 250X or 400X for endface inspection
b) Optional requirements
1) Video camera and display showing magnified endface image
2) Camera probe tips permitting inspection through adapters
3) Capability to save image
c) Standard of Quality Shall be Westover Scientific

PART 3 EXECUTION

3.1 GENERAL

A. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.

B. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

3.2 COPPER (TWISTED PAIR) TESTING

A. General
1. Field-test instruments shall have the latest software and firmware installed.

2. Link test results from the Test Equipment shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
3. Testing shall be performed on each cabling segment (panel to connector or connector to connector).
4. Testing of the cabling shall be performed using high-quality test cords of the same Category and manufacturer as the cabling under test.

B. Performance Test Parameters (Category 6A)
1. The test parameters for Cat 6A are defined in TIA Cat 6A standard, which refers to the ANSI/TIA/EIA-568B-2.10 standard. Test results shall at a minimum show alien attenuation crosstalk ratio far-end (AACRF), alien far-end crosstalk (AFEXT), alien near-end crosstalk (ANEXT), power sum alien attenuation crosstalk ratio far-end (PSAACRF), power sum alien far-end crosstalk (PSAFEXT), and power sum alien near-end crosstalk (PSANEXT).

3.3 OPTICAL FIBER CABLE TESTING

A. General
1. Field-test instruments shall have the latest software and firmware installed.
2. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
3. Fiber endfaces shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers. Scratched, pitted or dirty connectors shall be diagnosed and corrected.
    a) It is preferable that the endface images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.
4. Testing shall be performed on each cabling segment (connector to connector).
5. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.
6. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for OLTS testing shall be between 1 m and 5 m in length. The test cords for OTDR testing shall be approximately 100 m for the launch cable and at least 25 m for the receive cable.

B. Performance Test Parameters
1. Three tiers of certification are available that vary in thoroughness of infrastructure analysis.
    a) Tier 1: optical loss testing
    b) Tier 2: optical loss and OTDR testing
    c) Tier 3: optical loss and OTDR testing and magnified endface inspection
2. Tier 3 certification is recommended unless otherwise specified by the end-user.
3. Optical loss testing (Tiers 1, 2 and 3)

a) Backbone link: The backbone link shall be tested bi-directionally at both operating wavelengths to account for attenuation deltas associated with wavelength. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation (Section C.3.iv) shall be used to determine limit (acceptance) values.
   1) Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.
   2) Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method.
   3) The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA/EIA standard 568-B
   4) Link Attenuation (dB) = Cable_Attn (dB)+ Connector_Attn (dB) + Splice_Attn (dB)
      i) Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
      ii) Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
      iii) Maximum allowable connector_loss = 0.75 dB
      iv) Splice_Attn (dB) = number_of_splices (S) * splice_loss (dB)
      v) Maximum allowable splice_loss = 0.3 dB
      vi) The values for the Attenuation_Coefficient (dB/km) are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km))
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

   5) Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
   6) The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1; or the equivalent method. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

b) Horizontal (multimode) link: The acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum 90 m (295 ft) distance. The horizontal optical fiber cabling link segments need to be tested at only one (1) wavelength. Because of the short length of cabling, attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at

850 nm *or* 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper method.

1) The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one pair at the telecommunications outlet/connector and one pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.
2) A horizontal link in an Open Office Cabling network with a consolidation point may be tested using a fixed upper limit for attenuation of 2.75 dB.

c) Centralized (multimode) link: The acceptable link attenuation for a multimode centralized optical fiber cabling system is based on the maximum 300 m (984 ft) distance. The centralized optical fiber cabling link segments need to be tested at only (1) wavelength. Because of the short length of cabling, attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm *or* 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper method. Testing at 850 nm is recommended unless otherwise specified by the end user.

1) The centralized link may be tested using a fixed upper limit for attenuation of 3.3 dB. This value is based on the loss of three (3) connector pairs, one pair at the telecommunications outlet/connector, one pair at the consolidation point and one pair at the horizontal cross-connect, plus 300 m (984 ft) of optical fiber cable.
2) A horizontal link in an Open Office Cabling network with a consolidation point may be tested using a fixed upper limit for attenuation of 4.1 dB.

d) Optional requirements:

1) Each horizontal and centralized link shall be tested bi-directionally since the direction of the signal transmission often cannot be predicted at the time of installation. This is especially true for non-polarized connectors.
2) Each horizontal and centralized link shall be tested at both 850nm and 1300nm to confirm no attenuation differences due to wavelength even over short links.

4. OTDR Testing (Tiers 2 and 3).

a) Backbone, horizontal and centralized links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.

1) Backbone multimode: 850nm and 1300nm
2) Backbone singlemode: 1310nm and 1550nm
3) Horizontal multimode: 850nm or 1300nm
4) Centralized multimode: 850nm or 1300nm (850nm recommended unless otherwise specified by the end user)

b) Each fiber link and channel shall be tested in one direction.

c) A launch cable shall be installed between the OTDR and the first link connection. The launch cable shall be approximately 100m (328ft) in length and of the same fiber type as the link under test.

d) A receive cable shall be installed after the last link connection. The receive cable shall be at least 25m (82ft) in length and of the same fiber type as the link under test.

e) Reflective events (connections) exceeding 0.75 dB shall be identified, recorded and remedied to be less than 0.75 dB.

f) Non-reflective events exceeding 0.3 dB shall be identified recorded and remedied to be less than 0.3 dB. . Non-reflective events shall only be accepted for splices along the cabling. There shall be no losses acceptable for cable bends.

g) Optional requirements

1) Bi-directional link testing.

2) Segment attenuation coefficient if segment length > 1000m (3280ft). The segment attenuation coefficient shall not exceed 3.5 dB/km at 850nm and 1.5 dB at 1300 dB. Fibers exceeding these attenuation coefficients shall be replaced.

5. Magnified Endface Inspection (Tier 3)

a) Fiber connections shall be visually inspected for endface quality. High loss and reflectance can result from improperly terminated, poorly polished or dirty connectors.

b) Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers.

c) Scratched, pitted or dirty connectors shall be diagnosed and corrected.

d) Optional requirements

1) The endface image shall be saved and included in the test documentation package.

6. Length Measurement

a) The length of each fiber shall be recorded.

b) It is preferable that the optical length be measured using an OLTS or OTDR.

7. Polarity Testing

a) Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with subclause 10.3 of ANSI/TIA/EIA-568-B.1. The polarity of the paired duplex fibers shall be verified using an OLTS.

C. Performance Test Parameters (OSP Cable)

1. Campus Backbone OSP Fiber Optic cable testing.

a) Fiber optic cabling: Test all fiber optic cabling completely in accordance with ANSI/TIA/EIA-568-A, Annex H.

1) All fibers shall be proof tested by the manufacturer at a minimum load of 6000 kPa. All fibers shall be 100 percent attenuation tested by the manufacturer for compliance with the specified performance requirements. Provide manufacturer's test results and performance certification before installation.

2) Perform 100 percent attenuation test on all fiber optic cabling on the reel after receipt and before installation. Submit results to Owner for comparison against manufacturer's certified test results.

3) If any test results fail to meet the manufacturer's certified test results or are non-compliant with this Section, the cable shall be rejected.

4) Test and document all fiber optic cables from both ends on each terminated strand with a properly calibrated Optical Time Domain Reflectometer (OTDR) as manufactured by Siecor or approved equal. Documentation shall include OTDR catalog number, serial number, manufacturer, strand identifier, meter readings, test date, calibration information, and operator responsible for tests. All OTDR testing shall be fully compliant with ANSI/EIA/TIA-455-8.
5) Provide 100 meters of like fiber to project OTDR cable examination beyond the “dead zone.”
6) Test and record all fiber losses and submit to Owner for approval. Provide all test information on printouts and on electronic files. Perform test as segments of the fiber installation are completed and as directed by the Owner

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SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. Supply and installation of a complete and working Horizontal Cabling Systems for
      a) Voice / Telephone
      b) Data / Network
         1) Including Data provisions for Other Systems (i.e. Video Surveillance, Access Control, Control Data, Intrusion Detection, etc.).
   2. System includes but is not limited to:
      a) Horizontal cabling.
      b) Station outlets including frames, connector modules, and cover plates.
      c) Patch panels

B. Related Sections
   1. All Division 27 Sections
   2. Common Work Results
      a) Division 27 – “Operation and Maintenance of Structured Cabling and Enclosures”
      b) Division 27 – “Basic Materials and Methods”
      c) Division 27 – “Grounding and Bonding for Communications Systems”
      d) Division 27 - “Pathways for Communications Systems”.
      e) Division 27 – “Firestopping for Communications Systems”
      f) Division 27 – “Identification for Communications Systems”
      g) Division 27 – “Commissioning of Structured Cabling”
   3. Interrelated Sections
      a) Division 27 – “Communications Cabinets, Racks, Frames and Enclosures”
      b) Division 27 – “Communications Cable Management and Ladder Rack”

C. Related Drawings
   1. Technology (T-Series) Drawings

1.3 REFERENCES

A. ANSI/TIA/EIA-568-C.0 – Generic Telecommunications Cabling for Customer Premisers.
B. ANSI/TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
C. ANSI/TIA/EIA-568-C.2 – Balanced Twisted Pair Telecommunications Cabling and Components Standard

D. ANSI/TIA/EIA-568-C.4 – Standard on Coaxial Cabling Components
E. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.
F. ANSI/TIA/EIA-606-A – The Administrative Standard for the Telecommunications Infrastructure of Commercial Building.
G. "TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL" published by the Building Industry Consulting Services International (BISCI).

1.4 SYSTEM DESCRIPTION / DESCRIPTION OF WORK

A. The system shall be a 4 pair UTP copper Horizontal cabling system.
   1. Provide, test, and label all cables and terminations devices as described below and as shown on the plans.
   2. The system shall be an ANSI/TIA/EIA 568-B Category 6A compliant Unshielded Twisted Pair (UTP) horizontal cabling system.
   3. The Horizontal voice cabling systems shall be a Category 6A compliant system.
   4. The Horizontal data cabling system shall be a Category 6A compliant system.
   5. System shall meet or exceed the requirements for the PanGen System Warranty 25-year warranty and shall include the 25 year PanGen System Warranty. Contractor shall provide PanGen System Warranty documentation at project close out. Or,cabling manufacturer and/or contractor shall provide a total system warranty equal to or better than the PanGen System Warranty 25 year warranty. System Warranty documentation shall be provided to Owner Telecommunications department at project close out.
   6. See related Drawings for specific Project requirements.
   7. The system shall consist of total connectivity for a complete and permanent installed communications link.
   8. Refer to detail drawings for terminations standards and positioning of termination devices Provide, test, and label all cables and terminations devices as described below and as shown on the plans.
   9. The cable distance between the termination point with a Communications Room(s) and the station outlet(s) shall be no greater then 90 meters (295 ft).
   10. The total channel distance shall not exceed 100 meters (328 feet) distance between equipment in the Communications room and station equipment, including all patch cables and station attachment cables
   11. All system cables shall be continuous between points of termination, without splices.
   12. All system cables shall be UL/NEC rated for the location, manner and site conditions in which the cables are installed. This includes, but is not limited to:
       a) Use of the cable rated for the application
       b) Not exceeding fill capacities of raceways
       c) All cable used shall be in compliance with Local, State, and Federal laws (at minimum the NFPA published "National Electric Code") as to acceptability for placement in the designed pathway. This includes, but is not limited to, cable fill capacities of raceways and plenum vs. non-plenum construction. ONLY Plenum station cable shall be installed on the Indiana State University campus. The

Contractor shall provide and install the appropriate cable for the appropriate conditions.

1.5 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal. Product Data and Shop Drawings are not to be submitted separately.
   2. Samples shall be submitted with or immediately following submission of Product Data submittals.

B. Items to be submitted for approval prior to commencement of work:
   1. Product Data
      a) Manufacture datasheets for all cable
      b) Manufacture datasheets for all connectors
         1) Data sheets shall include
            i) Manufacturer name
            ii) Manufacturer model number (as it appears on manufacturer's product data sheet)
            iii) Manufacturer product description
            iv) Paragraph number of this section where the product is specified.
            v) Picture or Drawing of item

C. Quality Assurance / Control Submittals
   1. RCDD Certification for the staff member responsible for this project.
   2. Resume of the last 10 projects of the RCDD responsible for this project
   3. BICSI Technician's certificate for each lead Technician(s) on the project

D. Closeout Submittal
   1. Communication Room Rack Layouts, drawing to scaled, depicting devices and rack space occupied by each installed component.
   2. A diagram of the labeling scheme used on the Project.
   3. Additional closeout documentation as required in Division 1 and Division 27 "General Requirements for Communications".
   4. Contractor shall provide PanGen System Warranty documentation at project close out. Or,cabling manufacturer and/or contractor shall provide a total system warranty equal to or better than the PanGen System Warranty 25 year warranty.

1.6 WARRANTY

A. Additional requirements: All cabling and connectivity products manufacturers, including patch cords, shall have in place an agreement recognizing each other for complete execution of warranty as specified. All performance and applications warranties shall be channel rated.
   1. The cable manufacturer and the connectivity products manufacturer shall have a partnership agreement established in order to provide the required warranty.
   2. Required warranty:

a) The ANSI/TIA/EIA 568-B Proposed Category 6A compliant cable system shall include as a minimum a 25-year PanGen System Warranty. Or,cabling manufacturer and/or contractor shall provide a total system warranty equal to or better than the PanGen System Warranty 25 year warranty.

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

A. General

1. This section is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.
2. This standard will be considered in force for the original response as well as for any additions or changes to this Project. Due to this, there may be items listed in the Products section that are not required under the scope of this contract.
3. Products required by the Drawings but not enumerated will be evaluated as a performance specification based on the information provided on the Drawings.

2.2 CABLES

A. General

1. All cables on this Project shall be color-coded. ***See Detail drawings for color code.
2. CMP (OFNP) and CMR (OFNR) references below are as required by the NEC published by the National Fire Protection Association.
   a) Cables not specifically identified otherwise, shall be provided with CMP classification.
   b) Exceptions:
      1) Proper cable classification is ultimately determined by building construction; reductions in classification for cables, not clarified or altered by addendum to the specifications, shall require a contract cost deduction through a change order.

B. Twisted Pair Cables

1. Electrical Requirements:
   a) All Twisted Pair cable is required to have the appropriate Category classification as defined by EIA/TIA/ANSI 568C. The compliance to these electrical characteristics must be third party verified by the manufacturer. Part 1 of this specification Section will define the appropriate Category for each cable.
   b) Recognized Categories:
      1) Category 1-2, Category 3, Category 5e, Category 6, Category 6A
      2) All requirements and testing parameters as set forth by EIA/TIA 568C.
2. Construction
   a) All Twisted pair cable will be properly constructed for the environmental conditions and to meet all applicable codes.
   b) The following basic construction types are recognized for this Project:
      1) Premise Distribution 4 pair Cables - Category 6A
         i) Fully ANSI/EI/TIA 568C.1 Category 6A compliant

ii) Cable shall have 2 individual insulated 24 AWG solid copper conductors formed into a twisted pair.
iii) Cable must be constructed of four individually insulated Unshielded Twisted Pairs (UTP)
iv) The cable construction must be available in plenum (CMP) and non-plenum riser (CMR) rated constructions.
v) This cable construction is used in indoor pathways primarily as horizontal cabling but may also be used as backbone cable.
vi) Standard of quality shall be as manufactured by Panduit Cable PUP6AM04BU-UG.
(A) Additional approved manufacturer(s):
(B) General Cable 7132849
(C) CommScope 2091B BLU C6A 4/23 U/UTP W1000 | 760107201
(D) Belden 10GXW13
(E) Mohawk M59146

2.3 TERMINATION HARDWARE

A. General
1. Suggested layout of termination hardware is indicated on the Drawings. Contractor shall coordinate layout of termination hardware with the Owner's Representative before installation.
2. Provide one single manufacturer for all twisted-pair termination hardware used together in a permanent link or whenever a Category Certification is required.
3. Termination devices on this Project shall be color-coded. ****See Detail Drawings for details.
4. Terminate all UTP cabling utilizing the T568B wiring configuration.
5. The manufacturer of the cable and the manufacturer of the connectivity products shall have a partnership agreement established in order to provide the required warranty. See Warranty requirements above and in related Section 27 00 01.00. Contractor shall provide Owner warranty documentation at project close out.

   All devices shall be UL listed as required by the NEC published by the National Fire Protection Association.
6. All RJ-45 twisted pair termination devices are required to have the appropriate Category classification as defined by EIA/TIA/ANSI 568B. The compliance to these electrical characteristics must be third party verified by the manufacturer. Part 1 of this specification Section will define the appropriate Category for each cable.
   a) Recognized Categories:
      1) Category 1-2, Category 3, Category 5e, Category 6, Category 6A.
      2) All requirements and testing parameters as set forth by the latest update to EIA/TIA 568B.

B. Station Outlet
1. The following basic termination devices are available and recognized for this Project.
   a) Flush Faceplate – Single Gang
      1) Sloped faceplate Frame

2) Four position minimum on each faceplate
3) Electrical Ivory color unless otherwise specified
4) May be mounted on an outlet box, bracket, or raceway.
5) Must use module inserts below.
6) Standard of quality shall be Panduit CFPSL4xxY

b) Quad Jack Frame
1) Four position minimum on each frame
2) Electrical Ivory color unless otherwise specified
3) May be mounted on an outlet box, bracket, or raceway.
4) Will require a faceplate with standard duplex electrical outlet cut-out
5) Standard of quality shall be Panduit CFG4xx

c) Faceplate Blank Insert
1) Provide blanks for all un-used positions in faceplates, surface boxes, or jack frames.
2) Color to match outlet faceplate as described above; Electrical Ivory color unless otherwise specified
3) Standard of quality shall be Panduit CMBxx-X

d) Wall-Phone Jack
1) Stainless Steel faceplate with mounting posts for keyhole slot telephone mounting
2) May be mounted on an outlet box, bracket, or raceway.
3) Standard of quality shall be Panduit KWP6PY.

e) Category 6A jack insert RJ-45
1) Fully compliant ANSI/TIA/EIA 568B Category 6A RJ45 modular jack.
2) Color shall be Blue for all locations identified as being voice locations. Color shall be Electrical Ivory for all locations identified as data locations. Coordinate with Owner's Representative or Architect/Engineer.
3) Standard of quality shall be Panduit CJ6X88TGxx

C. Communications Room Equipment Rack(s)
1. The following basic termination devices are available and recognized for this Project.
a) UTP Cat 6A Patch Panel 24 port
1) Panel shall be black steel with PCB connection between interfaces
2) Shall provide 24 ports in 1.75" of rack space (1 RU).
3) Must have labeling areas on front and rear
4) Fully compliant ANSI/TIA/EIA 568B Category 6A
5) RJ45 jack interface on front and 110 style IDC connections on rear
6) Mountable in EIA standard 19" rack/cabinet rails.
7) Standard of quality shall be Panduit CPPL24WBLY 24-Port Modular Patch Panel with Labels fully loaded with Panduit CJ6X88TGBL Category 6A Jack Modules.

PART 3 EXECUTION

3.1 GENERAL

A. This section is designed to provide the vendor with a standard of quality and functionality for the installation of technology systems infrastructure. Not all procedures will be

necessary for the installation of this Project. However, this standard will be considered in force for the original response as well as for any additions or changes to this Project.

3.2 INSTALLATION

A. Coordination
   1. Review and coordinate proper pathways prior to installation.

B. General
   1. Cable routing shall follow building structure lines and shall be installed with adequate length to reach to any location within the equipment racks with at least 5 feet of service loop at each end.
   2. At point of final terminations, excess cable and the service loop shall be stored and dressed neatly.
      a) At the station end of the cable the service loop shall be stored above the ceiling line at an accessible point and support with an approved device designed for that purpose.
      b) Within a Communications Room the service loop shall dressed and stored within the ladder rack.
   3. Strain relief techniques shall be applied to all cables to lessen the risk of physical cable damage and to provide proper aesthetic value.
   4. Route all cabling and pathways parallel to building surfaces and at 90 degrees angles to the rafters and trusses.
   5. Cable runs shall be continuous and without splices.
   6. Wiring shall be free from grounds, shorts, opens, and reversals. Strain relief shall be provided at all connection points.

C. Protection
   1. Maintain protection of all cabling throughout the entire duration of the project. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades. Cabling shall be bundled, supported, and protected up out of the way of other trades any time it is determined necessary to ensure the safety or personnel and protection of the cable.
   2. Do not terminate cables designated for different services onto the same patch panel unless otherwise clearly indicated on the drawings. Coordinate with Owner before any terminations are made.
   3. No not exceed minimum bend radius or pulling tension specifications set forth by the product manufacturer.
   4. Cable Separation and Organization
      a) Horizontal cables of all service types (i.e. Voice, Data, Control, RF, etc….) shall be organized and kept segregated within cable trays, ladder rack, wire management and other pathways to the degree physically possible.
      b) Cables of different services shall not be intertwined.
      c) Terminate all cabling on specified termination hardware in numerical order and on specified outlets.

D. Labeling
   1. Every cable shall have a label applied to the jacket at each end.
   2. Each terminating device and port shall have a unique identifier.
   3. Label all cabling and terminations as specified and indicated on related drawings.

E. Use of Raceways
   1. Install cabling within conduit and in surface raceway where specified in this or related sections and as indicated on the drawings.
   2. Cabling shall be installed in a concealed manner. Cables may be visible only in the following areas;
      a) Equipment Rooms
      b) Telecommunications Rooms
      c) Building spaces equipped with cable trays, but without finished ceilings to conceal the cables.
   3. Install cabling in Cable Tray / and Ladder rack where specified and/or indicated on the drawings.
   4. Support cables using approved products and methods whenever conduit, surface raceway and cable tray are not specified. Cable supports shall be attached directly to building structure.

F. Cabling on backboards and in Equipment racks
   1. Neatly dress, support, and securely attach all cabling.

G. Termination
   1. Terminate each end of every cable provided.
   2. Terminate all UTP cabling utilizing the T568B wiring configuration.
   3. Terminate each cable from a station outlet in numerical order on adjacent ports on the specified termination hardware within the appropriate Communications Room.
   4. Terminate cables using the tools and connectors specified and as recommended by the cable/connector manufacturer.

H. Separation from Sources of Interference
   1. Route cables at least 1.2m (4 foot) from motors or transformers; 30 cm (1 foot) from conduit and cables used for AC power distribution; 12 cm (5 inches) from fluorescent lighting fixtures.

I. Cable Supports
   1. Where cabling is not supported by cable tray or conduit, provide necessary cable support as specified. Provide nylon cable tie at the support to contain cabling within the support. Do not bundle cable between supports. Provide cable support as specified at intervals not to exceed 5 feet. Do not secure cabling to the support. Do not use cable supports with round surfaces (i.e. bridal rings).

J. Horizontal cabling
   1. The length of patch cords and cross connect jumpers installed in the Telecommunications Room shall be 5 m (15 ft) total or less.
   2. The length of patch cords and cross connect jumpers installed in the Equipment Room shall be 5 m (15 ft) total or less.

3. Locate telecommunications outlets so that the cable assembly required to reach work area equipment will be no more than 5 m (15 ft) long.
4. Provide service loops on all cables at the station end of 2 feet (coiled above the ceiling and with a minimum of 6 inches at the telecommunications outlet coiled in the box or raceway.
5. Provide service loop at the Equipment Room/Telecommunications Room end of 5 feet coiled above the ceiling or neatly bundled in ladder rack above the cabinet/rack.
6. Install telecommunications outlets securely at work area locations.
7. Any necessary electrical components (e.g., impedance-matching devices) at outlets shall be located outside the faceplate via a standard plug connection.
8. Provide surface raceway on all walls where existing pathway has not been provided and cables cannot be concealed inside the wall cavity. Do not conceal cabling inside of block walls. Install surface raceway “level” straight and securely anchored to walls with screws, bolts, or anchors as appropriate.
9. Provide a 6 inch service loop on each horizontal UTP cable that breaks out from the harness for termination and do not violate the minimum bend radius of the cable.

3.3 TESTING

A. All cables shall be fully tested and verified compliant with these specifications.
   1. See: “Commissioning of Structured Cabling” for UTP Horizontal performance testing parameters and procedures.
B. The Owner reserves the right to have a representative present during any or all testing procedures. Verification testing of copper and fiber will be performed at or near Project completion by the Consultant for quality assurance.
C. Upon verification testing, if the Consultant finds the test results do not match the Contractor’s results, the Consultant or a third party may at the Owner’s request retest all of the cabling and submit those results to the Owner and deduct the verification testing costs from the Contractor’s Contract amount.

END OF SECTION 27 15 13

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SECTION 27 16 00 - COMMUNICATIONS CONNECTING CORDS, DEVICES, AND ADAPTERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   1. Supplementary to Division 1, Refer to Division 27 Section(s) for additive information where applicable.

1.2 SUMMARY

A. Section Includes:
   1. Cable Assemblies, Devices, and Adapters for Communications
      a) Voice / Telephone
      b) Data / Network
   2. General requirements are as follows:
      a) Provide cable assemblies and devices with electrical/optical properties to match the designed infrastructure.
   3. Special requirements are as noted on Drawings.
   4. All Work shall fully comply with these specifications and related Drawings and all manufacturers recommended installation practices.

B. Products Supplied But Not Installed Under This Section
   1. None

C. Products Installed But Not Supplied Under This Section
   1. None

D. Related Sections
   1. All Division 27 Sections

E. Related Drawings
   1. Technology (T-Series) Drawings

1.3 SYSTEM DESCRIPTION

A. Provide the following cable assemblies (cords), Devices, and adapters: (only provide if specifically requested by Owner)
   1. Telephone Patch Cables
      a) Category 6A cables, 3-5 feet in length as required for the Equipment Room/Telecommunications Room end.
      b) Confirm Color for telephone cables
      c) Labeled with the same unique identifier at both ends of the assembly.
      d) Provide a quantity of 1 for each horizontal telephone cable installed.

B. Labels:

1. Provide alphanumeric, clearly typewritten labels at all designated points as follows:
2. See Detail Drawings for graphical representation of labeling scheme.

1.4 SUBMITTALS

A. General
   1. Product Data and Shop Drawing submittals for work of this section shall be SUBMITTED TOGETHER, complete, as a single submittal. Product Data and Shop Drawings are not to be submitted separately.
   2. Samples shall be submitted with or immediately following submission of Product Data submittals.

B. Items to be submitted for approval prior to commencement of work:
   1. Product Data
      a) Manufacture datasheets for all cable assemblies
      b) Manufacture datasheets for all devices
      c) Manufacture datasheets for all adapters
         1) Data sheets shall include
            i) Manufacturer name
            ii) Manufacturer model number (as it appears on manufacturer's product data sheet)
            iii) Manufacturer product description
            iv) Paragraph number of this section where the product is specified.
            v) Picture or Drawing of item

C. Closeout Submittal
   1. Cable color code utilized for patching.
   2. Labeling scheme utilized for cable assemblies.

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

A. General
   1. As required in Division 27 Section 27 00 01 "General Requirements for Communications"
   2. This section is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.
   3. This standard will be considered in force for the original response as well as for any additions or changes to this Project. Due to this, there may be items listed in the Products section that are not required under the scope of this contract.
   4. Products required by the Drawings but not listed in Part 2, will be evaluated as a performance specification based on the information provided on the Drawings.

2.2 CABLES

A. Copper Cable Assemblies (Twisted Pair)
   1. Category 6A Copper patch cables

a) Copper patch cables shall be ANSI/TIA/EIA 568A Proposed Category 6A compliant with eight position RJ45 modular plugs on each end. Use T568B wiring. Apply an identifying label to each end of the cable assembly (same identifier on each end of the cable and a unique identifier for each patch cable on the Project regardless of installed location).

b) Color Coding:

1)	Critical Building Systems	Red
2)	Voice Over IP	Orange
3)	Classroom	Black
4)	Administrative	Yellow
5)	Cross-Over connections	Blue
6)	Straight-Through uplinks	Green
7)	Network Management	Purple
8)	IP Video	White
9)	Work Area (Attachment)	Gray

c) UTP Cable Assemblies Category 6A, coordinate with Owner prior to purchasing cables. In most cases data patch cables will be six inch.

1) Standard of quality shall be Panduit
   i) 6 inch with labels added
   ii) 3 foot with labels added
   iii) 5 foot with labels added
   iv) 7 foot with labels added
   v) 10 foot with labels added
   vi) 14 foot with labels added
   vii) 20 foot with labels added
2) Additional Approved Manufacturers:

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. This section is designed to provide the vendor with a standard of quality and functionality for the installation of technology systems infrastructure. Not all procedures will be necessary for the installation of this Project. However, this standard will be considered in force for the original response as well as for any additions or changes to this Project.

3.2 INSTALLATION PRACTICES

A. Standards: The minimum criteria for proper installation can be found in the *TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL* published by the Building Industry Consulting Services International. The vendor must refer to this publication for cable installation practices. This Specification may take exception to optional statements within this manual. Treat any conflict per this Specification under discrepancies or Conflicts.

B. The following items should be considered to be minimum standards for this Project:

1. The vendor is responsible for receiving, handling, storing, and protecting all materials used on this Project until the Project is signed as complete.

C. General Requirements:

1. Throughout the entire installation the Contractor must maintain complete protection of all cabling. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades. Cabling shall be bundled, supported, and protected up out of the way of other trades any time it is determined by the Architect/Engineer to be necessary.

3.3 LABELING

A. Provide labeling as specified in Part I.
B. Label all items listed in quantities required by the drawings and specifications.
C. Apply all labels straight and legible.

END OF SECTION 27 16 00

SECTION 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Division 28 Specifications and Drawings.

1.2 SUMMARY

A. Basic materials, methods and installation guidelines applicable to the work of all Division 28 documents.

B. The information included in this Section apply too and are additional requirements for all of Division 28 documents.

C. Thoroughly review entire bid documents, including all drawings and specifications prior to bidding and include all indicated work in bid.

1.3 REQUIREMENTS

A. Project Coordination

1. Commence coordination immediately upon award of contract. Coordination includes providing and extracting related information to and from other trades for review. Failure to coordinate in a timely manner shall not result in any subsequent additional reimbursement, special allowances or additional construction time being made for any facet of the project. Work fabricated or installed before properly coordinating with all other trades shall be done at the Contractor's own risk.
2. Work in harmony with all building trades, so as not to cause any delays. Sequence, coordinate, and integrate installations of communications materials and equipment with all other applicable trades for efficient flow of the Work. In addition, contact and coordinate/facilitate work of local communications service providers for incoming communications services. Execute connections with local services providers complete as indicated.
3. The drawings indicate the approximate location and arrangement of required work. The drawings shall be followed as closely as possible in coordination and in execution of the work.

4. Participate in coordination efforts and in preparation of coordination drawings prior to fabrication or installation of any equipment, materials, etc. Coordinate actual clearances of all installed equipment.
5. Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with the drawings of other trades, work with the trades to correct the conflict while coordinating the project. If the conflict cannot be resolved, refer the matter to the owner's representative for a final decision as to method or material. Refer to drawings of all other trades for details, dimensions and locations of other work and route their work so as not to conflict with any other branch. Any work installed or equipment placed in position by this contractor creating a conflict shall be readjusted to the satisfaction of the owner's representative at the expense of this contractor.
6. All products furnished of a given type shall be by a single manufacturer; shall bear the same brand name; shall be of the same finish color and texture; and shall be from the same product model series, unless otherwise noted.
7. Plans are diagrammatic indicating design intent and indicating required size, points of termination and, in some cases, suggested routes of raceways, etc. However, it is not intended that drawings indicate fully coordinated conduit routing, all necessary offsets, etc. Provide all cable assemblies, etc. as straight as possible and symmetrical (perpendicular to or parallel with) with architectural items and in a consistent elevation. Do not provide work installed diagonal to building members.

B. Product Data

1. Provide complete product master material list per individual specification section. Each product item must reference the specific paragraph for which the product is being submitted. See following example of product master material list:

Specification Paragraph	Manufacturer	Part Number	Description
2.2	Genetec	Autovu	License plate and vehicle recognition
2.3.B	Hanwha	PNM-9085RQZ	Multi-Sensor Camera
2.3.C	Hanwha	PRN-6400DB4	64CH 8K 400Mbps H.265 AI NVR

2. Provide the following information for each product:

   a. The manufacturer’s name (Brand) and full model number.

b. Product Information Sheets “Datasheets”: Include catalog information, sizing, and technical data on each item to be used on the Project.
c. Each product datasheet must reference the specific paragraph for which the product is being submitted. Each product must be listed in the exact same order as it appears in the Section for which the products are being submitted.
d. Datasheets shall each include a clearly identifiable label applied in upper corner of each sheet that clearly references the specification section and drawing (as applicable) to which it applies. Labels shall be consistently affixed in the same location on all sheets unless the labels will obstruct pertinent technical information.

3. All datasheets shall be original manufacture datasheets, first generation printed copies of manufacturer’s electronic datasheet (i.e. printed copy of a PDF file), or high-quality photocopy of original manufacturer’s datasheets.
4. Where datasheets depict multiple products, versions or options, the Contractor shall highlight (indicate with an arrow) all applicable model(s), version(s) and option(s) applying to the specific product the Contactor will be providing. Exact catalog number must be indicated. The submitted items must be from “approved materials” as specified in each Specification Section.
5. Do not combine with submittals from any other Division.
6. Provide detailed schematic connectivity drawings as requested.

C. Operation and Maintenance Manuals

1. Prepare Operations and Maintenance Manuals in accordance with Division 1 Section “Maintenance and Operation.” In addition to the requirements specified in Division 1, provide additional information as detailed in each Section and include the following information for equipment items:

a. Contractor shall submit prior to 50 percent job completion four maintenance manuals. Manuals are to indicate all information relative to maintenance and operating instructions for all new electrical equipment.
b. Operations and Maintenance (O&M) manuals shall be provided for each item of equipment. O&M submittals shall be submitted in expandable 3-ring binders. Binders shall contain a sufficient number of dividers to permit an orderly filing of submittals. Each divider shall be labeled as to contents. O&M submittals shall include but not be limited to the following:

1) Installation instructions and schematic drawings.
2) Operating and maintenance instructions.
3) Complete parts list with manufacturer's model numbers.
4) Complete set of approved shop drawings.
5) Complete wiring diagrams showing all connections and internal wiring diagrams of all equipment, including module diagrams. Factory typical wiring diagrams are not acceptable.

D. Building Codes:

1. National Electrical Code (NFPA 70)
2. Life Safety Code (NFPA 101)
3. Uniform Building Code (Or adopted State Code)
4. Federal Communications Commission (FCC) Part 68
5. State specific agencies:

    a. Administrative Building Council
    b. State Board of Health
    c. State Fire Marshal

6. Local Codes (City, County, etc.)
7. Local Utility Company requirements

E. Standards

1. ANSI/TIA 568 Commercial Building Telecommunications Cabling Standard.
2. ANSI/TIA 569 Commercial Building Standard for Telecommunications Pathways and spaces.
3. ANSI/TIA 606 The Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. ANSI/TIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. ANSI/BICSI 007-2020, Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
6. ASIS – Physical Asset Protection (PAP)
7. ASIS – Security Awareness (SA)

F. Permits

1. Contractor shall obtain and pay for all permits or certificates of inspection and approval required for his branch of the work.
2. Permits shall be posted in a prominent place at the building site properly protected from weather and physical damage.

G. Definitions

1. Wherever the word “Install” appears on the drawings or in these Division 28 specifications it shall mean to supply all labor, tools and incidental materials necessary to handle, store, mount, terminate, program, configure and adjust product as necessary to fulfill project requirements.
2. Wherever the word "Provide" appears on plan drawings or in Division 28 specifications, it shall be interpreted to mean that the Contractor shall "Furnish and Install", including all necessary accessories, miscellaneous materials and labor necessary to render the respective system fully operational.

3. Wherever the word "Work" appears in Division 28 specifications or on communication technology drawings, it shall be interpreted to mean any and all labor, materials, accessories, services, etc. necessary to fulfill project requirements.
4. Wherever the word “Furnish” appears on the drawings or in these Division 28 specifications it shall mean to supply the specified labor or specified product, including all associated shipping, storage and warranty expenses.
5. Wherever the words “Site”, “Project Site”, or “Premises” appears in Division 28 specifications or its related drawings, it shall be interpreted to mean all real estate, buildings and structures where work will be performed and where products will be installed and reside.
6. Wherever the phrase “Standard of Quality” appears in Division 28 specifications or its related drawings, the Contractor shall interpret this to mean that the listed Manufacturer and Catalog number for each item has the physical, functional, and operational attributes to provide the designed functionality.
7. EAC – Electronic Access Control
8. VSS – Video Surveillance System

H. Quality Assurance

1. Contractor shall have a minimum five (5) years’ experience in the installation of Communication Technology system(s) of similar size, type, scope and contract value.
2. The lead technician(s) on the Project shall have a thorough understanding of the following:

    a. ANSI/TIA/EIA 568 Commercial Building Telecommunications Cabling Standard.
    b. ANSI/TIA/EIA 569 Commercial Building Standard for Telecommunications Pathways and spaces.
    c. ANSI/TIA/EIA 606 The Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings.
    d. ANSI/TIA/EIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
    e. ANSI/BICSI 007-2020, Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
    f. ASIS – Security Management Standard: Physical Asset Protection (PAP)
    g. ASIS – Facilities Physical Security Measures Guideline (FPSM)

3. Contractor shall be a (factory trained) certified installer for all systems provided in Division 28.

    a. This minimum requirement shall apply to each Division 28 section independently. If Contractor is incapable of meeting the percent of product value requirement for each section, Contractor shall use a Subcontractor that can meet the percent of product value requirement, in whole, for all products and work of that section for which This Contractor is not qualified.
    b. The specific Contractor or Subcontractor meeting the requirements for a specific section shall be responsible for the supply of the products, supplemental

engineering services and submittals as well as performing all technical labor associated with the installation, training and warranty servicing of work of that section.

4. Contractor shall have substantial business operations located within a 100-mile radius of the project site with a full-time employee staff actively engaged in the supply, installation and service of systems and equipment of the type and scope herein specified.
5. Contractor shall have full-time employee service staff based within a 100-mile radius of the project site.
6. Contractor shall provide any additional information requested by the Owner as determined appropriate by the Owner to validate a Contractor's (or its Subcontractor's) ability to perform and warranty the specified work in the quality, manner and time frame required.
7. Superintendent/Project Manager

    a. This Contractor shall furnish the services of an experienced superintendent/Project Manager who shall be constantly in charge of the work, together with the qualified Foremen and specialists as required to properly install, connect, adjust, start, operate and test the work involved.
    b. The superintendent's/Project Manager's qualifications shall be subject to the review and acceptance by the Owner/Owner. Unless the Owner/Owner grants prior special permission, the same communication Superintendent/Project Manager shall be utilized throughout the duration of the project and be responsible for the complete scope of the Contract.

I. Product Delivery Requirements

1. The Contractor shall not procure, deliver or install any product until after the contractor's submittal has been reviewed by the Owner and the submittal has been returned to the Contractor's marked "Reviewed as Submitted" or "Reviewed as Noted". Advance procurement, delivery or installation of product prior to the return of submittal is entirely at the Contractor's own risk. Contractor should schedule its work and procurement accordingly.
2. Prior to procurement of any equipment or materials, Contractor shall review the model numbers, compatibility and interoperability of all products.
3. Prior to procurement, Contractor shall, through coordination with other trades and through field measurements and project site inspections, verify that products to be supplied can be physically installed as planned.
4. No claim for additional payment will be considered for the return of any equipment determined incompatible, or procured without adhering to the aforementioned conditions, including claim for reimbursement of manufacturer's "restock" fees.
5. Contractor shall factor all of these conditions into its bid and plan its scheduling and resource needs accordingly to ensure that all work shall be performed according to the Owner's schedule and requirements of this contract.

J. Product Storage and Handling Requirements

1. The Contractor is responsible for receiving, handling, storing, and protecting all materials used on this Project until Substantial Completion.
2. Pack components in factory-fabricated protective containers.
3. Units shall be delivered in sections of such size as will pass through available openings.
4. Until ready for installation, store products in original factory containers.
5. Products shall be stored in a clean, dry space and as additionally recommended by the product manufacturer.
6. Keep products out of the weather and away from construction traffic and debris, including drywall finish dust.
7. Do not exceed structural capacity of the floor or platform on which the products are stored.
8. Until final acceptance of the system, protect all supplied products from damage resulting from moisture, fumes, dirt, dust and debris or any other source of potential damage.
9. Handle all products with care before, during and after installation so as to prevent damage.
10. Replace any products damaged prior to final acceptance with new replacement products.
11. Replacement shall be at Contractor's expense.
12. Contractor is responsible for the safety and good condition of the materials and equipment installed until final acceptance by the Owner.
13. Save original product shipping containers and related packaging materials for major products until final acceptance.
14. Prior to disposal, check with owner to determine if the owner wishes any of the packaging materials.

K. Examination and Preparation

1. Contractor shall visit the Site to familiarize himself with the local conditions under which the work is to be performed and correlate his observations with the requirements of the Contract Documents. No allowance shall be made for claims for concealed conditions which the Contractor, in exercise or reasonable diligence in observations of the Site and review of the local conditions under which the work is to be performed, learned or should have learned of, unless otherwise specifically agreed by Owner and Owner in writing.
2. Before ordering any materials or doing any work, the Contractor shall verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement or size indicated in the drawings or specifications. Any discrepancies found shall be submitted in writing to the Project Manager and Owner for consideration before proceeding with the work.
3. This Contractor must verify all dimensions locating the work and its relation to existing work, all existing conditions and their relation to the work and all manmade obstructions and conditions, etc. affecting the completion and proper execution of the work as indicated in the Contract Documents.

L. Installation

1. Provide all required labor, materials, equipment and Contractor's services necessary for complete installation of systems required to comply with the requirements of authorities having jurisdiction, as indicated on Drawings, and as specified.
2. Work shall be functional and complete in every detail, including any and all items required to complete the system, whether or not these items have been enumerated or shown on the Drawings.
3. Special attention shall be given to access to working and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.
4. Each Contractor shall be fully knowledgeable of the details of all Work to be performed by other trades and take necessary steps to integrate and coordinate his Work with other trades.
5. Wherever tables or schedules show quantities of materials, they shall not be used as a final count. These figures serve only as a guide for the Contractor. Each Contractor shall be responsible for furnishing all materials on the Drawings or as specified.
6. The Consultant and Owner's Representative have full power to condemn or reject any Work, materials or equipment not in accordance with these Specifications and Construction Drawings or the manufacturer's specifications or drawings approved by the Owner or Consultant.
7. Work or equipment that is rejected shall be removed and replaced to the satisfaction of the Owner at the Contractor's expense. Work or equipment that is rejected shall be so stated in writing by the Owner or Consultant.
8. Such decisions that the Owner or Consultant may make with respect to questions concerning the quality, fitness of materials, equipment, and workmanship shall be binding upon the parties thereto.
9. All Work shall fully comply with these specifications and related Drawings and all manufacturers recommended installation practices.
10. All Work shall be performed with the best practices of the trade for performance, functionality, safety, endurance, and aesthetics.
11. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
12. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible, as appropriate to the application.
13. Set all equipment to accurate line and grade, level all equipment and align all equipment components.
14. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.
15. No equipment shall be hidden or covered up prior to inspection by the owner's representative. All work that is determined to be unsatisfactory shall be corrected immediately.
16. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.
17. Install all equipment and materials in strict accordance with manufacturer's written instructions. Bring any conflicts between the manufacturer's written instructions and these specifications to the attention of the Designer for recommendations.

18. Upon completion of installation of equipment and communication circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

M. Cutting and Patching

1. Where demolition of existing surfaces are required by the Work, the same shall be restored to at least as good a condition as they were before.
2. Contractor shall be responsible for painting, patching, repairing and replacing any building surface, furnishing, wall/floor/ceiling covering that is damaged or penetrated in the process of performing work on the project site.
3. Additional work required to repair work performed under this Contract shall be at the expense of This Contractor.
4. The Division 28 contractor shall do all cutting as required for the admission of Division 28 work. Unless directed otherwise in field, provide all related patching and painting to match surrounding methods, materials and colors. Any damage done by this contractor to the building during the progress of this contractor’s work shall be made good at this contractor's expense.

N. Site Maintenance

1. During the progress of the work, the Contractor shall clean and leave the premises and all portions of the building in a clean and safe condition. This cleaning shall occur on a daily basis.

O. Final Cleaning

1. Clean all parts of the apparatus and equipment. Exposed parts, which are to be painted, shall be cleaned of cement, plaster and other materials and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all corners and cracks scraped out.

P. Closeout Requirements

1. Upon the Designer’s receipt of and approval of the Contractor’s pre-test submittal, the Contractor shall contract the Designer to schedule acceptance testing. Contractor shall allow not less than 10-business days of advance notice to the Owner.
2. In the presence of the Owner, the Contractor shall demonstrate the presence of all specified products, cabling and installation methods. The Contractor shall demonstrate the operation of the system (and any requested sub-component thereof) and shall be prepared to make any electronic, physical or software related adjustments to the system or any of its sub-components to the satisfaction of the Owner, as required to achieve full compliance with the specifications.

3. The contactor shall have available at the project site all test equipment, cables, tools and personnel necessary to demonstrate full compliance with these specifications as determined necessary by the designer.
4. During the acceptance testing the Contractor shall have a clean and fresh copy of the contractor's most up-to-date as-built record documentation, printed to scale.
5. This Contractor shall provide all required labor services required to completely verify and test the systems in the presence of the Owner.
6. Verify that each system, as a whole system, meets these Specifications and complies with all applicable standards.
7. Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense.

Q. Warranties

1. Specified materials and workmanship provided shall be fully guaranteed by the Contractor for one year from the transfer of title via notice of substantial completion against any defects in materials or workmanship.
2. Extended (additional) warranty(s) may be required and will be identified in the individual Specification Section and will be considered additive to this base Contractor Warranty.
3. Requirements for Manufacturer's Warranties, required by a Specification Section, shall run concurrent to this base Warranty by the Contractor but may exceed the Contractor's Warranty Period.
4. Manufacturer's Warranties shall also begin upon Substantial Completion.
5. The Warranty shall begin upon Substantial Completion.
6. This warranty shall in no manner cover equipment that has been damaged or rendered unserviceable due to negligence, misuse, acts of vandalism, or tampering by the Owner or anyone other than employees or agents of the Contractor.
7. The Contractor's obligation under its warranty is limited to the cost of repair of the warranted item or replacement thereof, at the Contractor's option.
8. Insurance covering said equipment from damage or loss is to be borne by the Contractor until full acceptance of equipment and services.
9. Individual specification sections may have additional warranty requirements for the work in that section. The warranty above will cover all materials and work where not covered by an extended warranty listed in the individual specification section.
10. Specified materials and workmanship provided shall be fully guaranteed by the Contractor against any defects in materials or workmanship.
11. Contractor shall provide a full "System Warranty" which shall cover all materials, labor and related product shipping expenses for a period of five years from the date of Owner acceptance.
12. Supplied products with manufacturer's warranties of less than the System Warranty term shall be extended by the Contractor for the full specified term.
13. During this period the Contractor will remedy (at no cost to the owner) any problem with the system, or any of its related components that is the result of defective materials, settings, workmanship, or loss or programming.
14. Any defective items or work shall be removed and replaced at the Contractor's expense to the satisfaction of the owner's representative and the Owner.

15. The period of the Contractor warranty(s) for any items herein are not exclusive remedies, and the Owner has recourse to any warranties of additional Scope given by the Contractor to the Owner and all other remedies available by law or in equity.
16. Additional Warranty requirements may be added by an individual Specification Section.
17. Scope of these extended (additional) warranty(s) will be identified in the individual Specification Section and will be considered additive to this base Contractor Warranty.
18. Requirements for Manufacturer's Warranties, required by a Specification Section, shall run concurrent to this base Contractor Warranty by the Contractor.
19. Manufacturer's Warranties shall also begin on Substantial Completion.

R. Demonstration and Training

1. Each Division 28 section may specify special Training requirements.
2. Training requirements will be for a quantity of hours, allow for multiple trips.
3. If no special requirements are specified in the individual section, provide for training and multiple trips for complete operation and maintenance information per section.
4. Train Owner's maintenance personnel on the procedures and schedules involved in operating, general troubleshooting, and preventative maintenance of the system.
5. Contractor shall require all attendees to sign-in for each training session. The sign-in form shall summarize the training to be conducted, specification section and subsection being trained on, as well as the starting time and duration of training. Following training, a representative of the owner shall sign the form, acknowledging the same. Contractor shall retain the original copy of these forms and turn over a photocopy of the form to the owner's representative as evidence of training. Training conducted without this official record of training shall not be considered as part of the Contractor's training obligation.
6. Schedule training with the Owner's representative, at least 14 days in advance.

PART 2 - PRODUCTS

2.1 ASSIGNMENT OF MISCELLANEOUS WORK

A. Excavating and backfilling for telecommunications work shall be by telecommunications contractor.

1. Properly support banks of excavation with safety sheet pile. Install necessary guards. Provide adequate pumping equipment and keep excavation free of water.
2. Excavate pipe trenches to proper depth. Where rock is encountered, excavate to 6 inches below pipe and refill to 6 inches above pipe with compacted granular fill. Granular fill shall consist of dune sand, gravel or other suitable material containing not more than 10 percent by weight passing #200 sieve and 100 percent passing 1-inch sieve.
3. Excavation for utilities shall not be backfilled until all required tests are performed and approved by Engineer and the utility company.

4. Whenever underground feeders are run below footings and grade beams, contractor shall backfill the void with poured, steel-reinforced concrete to elevation of bottom of footing or grade beam.
5. Backfill within building lines shall be made with granular fill or compacted backfill material laid in 6-inch layers and tamped to specified compaction after each layer.
6. Backfill under paved area shall be made with granular fill compacted backfill material laid in 12-inch layers and tamped to compaction after each layer.
7. Backfill under open yards or fields shall be made with non-compacted backfill laid in layers not to exceed 24 inches deep. Sand trenches may be allowed to settle naturally and shall be refilled back to grade as required during first year after final acceptance.
8. Contractor shall refill, regrade and refinish any area that becomes unsatisfactory due to settlement within one year after final acceptance.
9. Contractor shall verify all existing grades, inverts, utilities, obstacles and topographical conditions prior to any trenching, excavation or underground installation. In event existing conditions are such as to prevent installation in accordance with Drawings, contractor shall immediately notify Engineer.
10. Provide appropriate plastic marker tape buried directly above underground electric and communication lines continuously along length of lines. Marker tape shall be located 12 inches below finished grade, but no closer than 12 inches above underground lines. Tape shall be a minimum of 6 inches wide.
11. Refer to Division 31 Section “Earth Moving,” for additional requirements. In event of conflict between this section and Division 31 Section “Earth Moving,” Division 31 Section “Earth Moving” shall apply, unless otherwise indicated by Engineer.

B. Provide sleeved penetrations for all cabling access where applicable.

1. Where conduits pass through walls, roofs, ceilings, or floors, contractor shall set sleeves when floors, walls, ceilings or roofs are constructed. If any holes are cut in finished work where sleeves have been omitted, cutting shall be done with a concrete coring machine or other approved means and only with consent of Engineer. All such holes are to be carefully cut and shall not be larger than necessary. These holes are to be entirely covered by escutcheon plates when work is completed. Sleeves shall be made of pipe or rolled sheet steel no lighter than No. 18 gauge.
2. Where conduits pass through sleeves in exterior walls above grade, annular space shall be caulked with oakum and filled inside and out with non-hardening, waterproof sealant finished off flush with both faces of wall.
3. Provide penetration seals for all conduits penetrating the building wall below grade.

    a. Description: The pipe to wall penetration closures shall be "Link-Seal" or equal, as manufactured by PSI/Thunderline Corporation – Houston, TX. Seals shall be modular type, consisting of synthetic rubber shaped to continuously fill the annular space between the pipe and wall opening. After the seal assembly is positioned in the sleeve, the rubber sealing elements shall provide an absolutely water-right seal between the pipe and wall opening. The seal shall be constructed as to provide insulation between the pipe and wall, thus reducing changes of cathodic reaction between these two members.

b. Wall Opening: Provide “Century-Line” sleeves or equal as manufactured by PSI/Thunderline Corporation – Houston, TX. Contractor shall determine the required inside diameter of each individual wall opening of sleeve before ordering, fabricating or installing. The inside diameter of each wall opening shall be sized as recommended by the manufacturer to fit the pipe and Link-Seal to assure a water-tight joint. Sizing (correct Link-Seal model and number of links per seal) may be obtained through manufacturer's catalog. If pipe O.D is non-standard due to coating, insulation, etc. consult Thunderline's factory for engineering assistance and recommendation before proceeding with wall opening detail.

c. Holes through Structural members: Holes required for conduit of size 5-inches and smaller shall be cut in field at expense of this contractor. Obtain structural engineer’s approval in writing prior to any cutting.

d. Pitch Pockets: Required for conduit penetrating roof. Seal sleeves and provide flashing.

e. Dust Protection: Provide temporary partitions or barriers required to protect existing building or facility. Coordinate necessity and location of such protection with Owner.

f. Painting of telecommunications cabling and components is not permitted. Notify painting contractor that painting of telecommunications cabling and conmponents is not permitted. Protect cabling as necessary to avoid painting.

2.2 MATERIALS AND EQUIPMENT

A. Equipment shall be new, listed by UL and shall conform to NEMA and ICEA standards.

B. Materials used for like service shall be by same manufacturer.

C. All materials and equipment, including any hangers, supports, fastenings or accessory fittings, shall have corrosion protection suitable for atmosphere in which they are installed, whether located indoors or out. Care shall be taken during installation to assure integrity of corrosion protection.

D. All screws, bolts, nuts, clamps, fittings or other fastening devices shall be made up tight. All bolts, screws, nuts and other threaded devices shall have standard threads and heads so they may be installed and replaced when necessary without special tools.

2.3 PRODUCT AND MATERIAL APPROVAL

A. A Specification followed by one or more manufacturers is limited to those manufacturers. Names of other manufacturers may be submitted for approval to Engineer a minimum of ten (10) days prior to receiving bids. Approval will be issued by Addendum if granted.

B. A Specification followed by one or more manufacturers and "or approved equal" is open to all equal products or materials; however, Contractor shall supply one of listed manufacturers at no additional cost if Engineer finds substituted product unsatisfactory.

2.4 CAULKING AND FIRESTOPPING

A. In addition to the requirements in Division 07 Section “Penetration Firestopping,” comply with this Article.

B. All raceway and sleeve penetrations of fire barriers shall be sealed to achieve fire resistance equivalent to fire separation.

1. Maintain fire rating per ASTM E-814 and UL 1479.
2. This assembly must also maintain a watertight seal between floor or wall and pipe.

C. For other penetrations through non-rated walls, partitions, floors and ceilings, caulk the space between raceways and raceway sleeves with non-staining, waterproof gun grade compound. Apply caulking compound by the gun method using nozzles of a proper size to fit the width of joint. Prepare the joint for caulking by packing it tightly with a resilient foam or rope yarn.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Maintain fire rating per ASTM E-814 and UL 1479.
2. Penetration sealant:

a. 3M Brand "Moldable Putty Pads": and "Moldable Putty Stix"
b. 3M Brand "Fire Barrier" Caulk, Putty or Penetrating Sealing Systems
c. Dow Corning "Fire Stop Foam: and "Fire Stop Sealant" systems
d. Insta-Foam Products, Inc. "Insta-Fire Seal Silicone RTV Foam"
e. Standard Oil Engineering Materials Company, "Frye Putty"
f. Chase technology "Chase Foam #CTC PR-855"

3. Intumescent Sealant for use at openings and sleeves involving flexible cable.

a. 3M Brand "Fire Barrier" caulk or putty, FS-195 Wrap Strip and CS-195 Composite Sheet.
b. Dow Corning "Fire Stop Intumescent Wrap Strip"
c. Fox Couplings, Inc. "The Fox Cast-in-Place Coupling"

4. Performance Characteristic: Firestopping materials shall conform to both Flame (F) and Temperature (T) ratings as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test.

a. ^{o}F Rating shall be a minimum of one hour but not less than the fire resistance rating of the assembly being penetrated.
b. Conduct the fire test with a minimum positive pressure differential of 0.01 inches of water column.

5. Quality Assurance: Installer qualifications – a firm specializing in firestopping installation with not less than two years of experience or trained and approved by firestopping manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF COMMUNICATIONS SYSTEMS

A. General

1. All work installed in finished areas shall be concealed.
2. Install systems, materials, and equipment to conform with approved documents.
3. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.
4. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
5. Verify all dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Proposed dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed.
6. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches will not be permitted on any exposed materials, fixtures or fittings. Inside of panels and equipment boxes shall be left clean.
7. Use caution not to exceed the allowed bend radius for respective cables and not to compromise the integrity of the cables during installation by pulling cable management devices too tightly, damaging cables, etc. Raceway/Cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant, where necessary; compound must not deteriorate conductor or insulation.

B. Cable

1. Provide color-coded jackets to identify different systems.
2. Neatly comb out multiple cable bundled runs to remove tangling and crossing of cables within the bundles. Neatly dress all cable work and provide vertical and horizontal cable management (or other approved method) for properly dressing all work at racks, control panels, backboards etc.
3. Provide spacing between cable bundles to help dissipate heat. Do not cinch cables into tight bundles.
4. Nylon cable ties are not permitted. Bundle cables with “Velcro” style cable straps with a minimum of 1-inch width.
5. All cables shall be supported every 5 feet (or less) and within 12" of device boxes, outlets, racks/cabinets and cable tray.
6. Use separate J-Hook cable support systems for cables belonging to different systems and for cables carrying different operating levels.
7. Loosely secure cables at each J-Hook.

8. Cables shall not be directly or indirectly supported by a suspended ceiling or any other surface, support, material or structure not permissible for this use by all applicable codes and standards.
9. Cables carrying signals of different nominal operating level shall be kept separated to reduce the risk of undesirable cross-talk interference between cables.
10. Keep length of parallel runs to a minimum. Cross cables of different nominal levels at 90 degrees.
11. Provide additional separation as necessary to prevent and remedy any crosstalk.
12. Contractor shall take all precautions necessary to keep low-voltage cable away from sources of EMI and RF interference. Where close proximity is absolutely necessary to satisfactory appearance, performance or installation of the Work, provide all necessary shielding necessary to ensure that ingress interference is minimal and has no negative impact of the Work.
13. Provide a minimum of 12 inches cable slack where terminating at a device outlet to facilitate installation and servicing of devices. Longer working lengths shall be provided as appropriate to the application.
14. All termination types shall correctly match the cable and device termination point. Connectors of the appropriate type, size, color and rating shall be used to match with the mating equipment.
15. Tools as recommended by each specific connector manufacturer shall be used in attachment of all connectors.
16. When spade connectors are the required to be used for audio circuits operating at <= +8dBv nominal, solder type spade connectors only shall be permitted.
17. No more than two spade connectors shall be permitted under a single terminal. Fewer should be used when recommended by the specific manufacturer's equipment or connector.
18. Wire Nuts

    a. Wire nuts shall not be used in any audio circuit, except when necessary in the following:

        1) 25 Voltage Constant-Voltage loudspeaker circuits.
        2) 70 Voltage Constant-Voltage loudspeaker circuits.

    b. Wire nuts shall not be used in any data or voice communications or remote control circuit.
    c. Wire nuts shall not be used in any circuit which radiates RF energy.
    d. Contractor must advise and gain prior approval of the Owner for any circuit which the Contractor desires to use wirenuts as the means of termination.

19. Drain Wires, Non-insulated Ground Wires and Shields

    a. Drain or non-insulated ground conductors shall be insulated with appropriately sized heat-shrinkable insulated sleeving immediately upon exit from the jacket of the cable. Contractor shall use GREEN colored sleeving unless otherwise necessary to resolve specific color-coding conflicts on a given cable. This

methodology shall apply to ALL methods of termination, including inline connectors, device plates, direct equipment terminations etc… Sleeving shall be applied to twisted and braided shields once the internal conductors have been combed out or otherwise removed from the center of the shield.

b. Wherever a cable contains a non-insulated conductor within a jacketed cable, the conductors, as they exit the manufacturer's jacket, shall have a piece of heat shrinkable sleeving applied equally over the jacket and the exposed insulated conductors. The length of this sleeving shall be 1" for all cable diameters of .250" or less. For cables diameters larger than .250" the length of the sleeving shall be approximately equal to 4 times the diameter of the cable jacket. Note: This added sleeving is recommended but not mandatory when cable termination occurs fully within the confines of a fully insulated and strain relieved connector. Black shall be used unless otherwise necessary for specific cosmetic or cable identification purposes.

c. A heat-gun of the appropriate temperature, size, type and rating for shrinking the tubing shall be used as recommended by the manufacturer of the sleeving used. Open flame (i.e. matches, cigarette lighters, torches) and direct metal conduction (i.e. soldering iron) methods to shrink the sleeving shall not be permitted. Sleeving which is burnt or otherwise marred shall be removed and replaced.

d. There shall not be any non-insulated exposed conductors within a device backbox, junction box, or equipment rack/cabinet.

20. Unused Conductors

a. Unused conductors shall not be "clipped" or removed from any jacketed cable. Conductors which are not required or used at the end of a jacketed cable shall be kept intact. Conductors shall be fully insulated from one and other to prevent shorts which could occur at either end of the cable. Conductor ends shall also be insulated to prevent shorts to other conductive materials which could come in contact with the conductor.

b. Unused conductors shall be kept the same length as the longest conductor of the cable being used.

c. Attention shall be paid to the proper preparation of all cables and all conductors of these cables. There shall not be nicks to cable jackets, conductor insulation, or the conductors themselves.

d. Special attention should be paid to nicked conductors. Should a conductor be nicked during preparation or termination the cable shall be reworked/replaced to remove the nick.

e. Any voice, data, or coaxial cable that is cut, disconnected, or not terminated at both ends shall be completely removed end to end. Any labels at either end shall be erased. Record drawings shall reflect the removal of these cables.

3.2 ATTACHING TO BUILDING CONSTRUCTION

A. Attach supports to structural members (beams, joists, etc.) rather than to floor or roof slabs. Do not attach to ceiling support wires.

B. Where equipment and raceway are suspended from existing concrete or masonry construction, use expansion shields to attach supports to construction. Expansion shield bolt diameter shall be same size as support rod diameter, hereinafter specified. Expansion shields shall be Star Double, Star Gloxin, Star Loxin or approved equal.

C. Where existing masonry is not suitable to receive and hold expansion shield or where other means of attachment is advantageous, submit alternate method for approval by Engineer.

D. Equipment to be installed in groups shall not be mounted directly to masonry or concrete walls. Mount 1- by 1-inch structural channel such as Unistrut, to wall and secure equipment to these channels.

E. Where raceways are suspended from structural steel building framing or supporting members, provide beam clamps for attaching piping device to building member.

F. Obtain approval from Owner and structural engineer before cutting or welding to structural members, or before hanging heavy equipment.

3.3 ESCUTCHEONS

A. Provide chrome plated escutcheons on material, leaving and entering walls, floors, ceilings, etc.

3.4 EQUIPMENT INSTALLATION

A. All equipment must be installed such that maintenance and service may be properly accomplished. If necessary, the Owner, at their option, may require the contractor to demonstrate the service on any piece of equipment to determine sufficient service space exists. If the service space is not adequate, the equipment shall be relocated at no additional cost to the Owner such that sufficient service space is achieved.

3.5 OCCUPATIONAL SAFETY & HEALTH STANDARDS

A. All work shall comply with current requirements of U.S. Department of Labor-Occupational Safety & Health Administration, entitled Occupational Safety and Health Standards; National Consensus Standards and Established Federal Standards.

3.6 DEMOLITION

A. In addition to the requirements in Division 02 Section “Selective Demolition,” comply with this Article.

1. Scope of Work: Provide demolition required for removal of systems and equipment made obsolete by this Project and as determined by the Architect/Engineer.
2. Work Included:

a. Non-destructive removal of systems, materials, and equipment for reuse or salvage as shown on Drawings or requested by Owner.
b. Removal of all debris from site and legal disposal of same.
c. Removal of all abandoned or obsolete exposed materials and equipment for a clean and finished installation.
d. Removal of all abandoned or obsolete raceways, wiring, cabling, or electrical devices of any kind.

B. Conditions

1. Coordination: Adjacent areas need to remain in operation and services to these areas need to be maintained. A schedule will be worked out prior to beginning work and as many criteria for operation as possible will be explained. Contractor cooperation shall be expected in all conditions.
2. Phasing:

a. Prior to commencing demolition in any area of the work, notify the Owner and Architect/Engineer five (5) working days in advance to insure that no adjacent occupied areas will be disrupted.
b. Demolition phasing must be approved by Architect/Engineer prior to commencement of operations.
c. Removal of debris and construction traffic will be limited to specified areas. Confirm all operations with Architect/Engineer prior to commencement of work.

3. Adjacent Materials:

a. During the execution of the work, primary consideration shall be given to protecting from damaging the structure, furnishings, finishes, and the like which are not specifically indicated to be removed and disposed.
b. Provide and maintain temporary partitions or dust barriers adequate to keep dirt, dust, noise and other particles from being transferred to adjacent areas.
c. Existing items or surfaces to remain which are damaged as a result of this work shall be refinished, repaired, or replaced to the satisfaction of the Architect/Engineer and Owner at no additional cost.

C. Materials

1. Patching: Materials used for patching shall be in conformance with the applicable sections of the Project Manual. Where materials are not specifically described but required for proper completion of the work, they shall be as selected by the Contractor subject to approval of the Architect/Engineer. Materials used and workmanship shall match surrounding areas as much as possible, unless otherwise directed.

D. Demolition

1. Site Inspection

    a. The Contract Documents do not propose to show all systems, materials, or equipment existing on the project that will require demolition.
    b. Before commencing the work of this Section, verify with the Architect/Engineer and Owner all systems, materials, and equipment to be removed and those to be preserved.

2. Scheduling

    a. Schedule all work in a careful manner with all necessary considerations for public and adjacent areas.
    b. Avoid interference with the use of adjacent areas and passage to and from these areas.

3. Abandoned Materials and Equipment: Items so indicated on Contract Documents to be removed and not indicated or specified to be saved or retained, shall be demolished, removed, demounted, or disconnected in the best possible manner to ensure that no damage will result to other adjacent items or surfaces to remain.
4. Salvage

    a. During removal of items so indicated, caution shall be used to eliminate damage to any equipment having salvage value.
    b. All reusable salvaged material shall remain the property of the Owner and be retained for his inspection. Only items so inspected and rejected by the Owner shall be disposed by the Contractor. All other such items shall be turned over and deposited as directed by the Owner.

5. Disposal and Clean Up

    a. Areas in which demolition and salvage work is being done shall be cleaned daily.
    b. Dirt, dust, debris, unsalvageable and reusable items, and the like shall be totally removed from the project site daily. Under no circumstances shall such refuse be allowed to collect for longer periods.
    c. Refuse shall not be allowed to block, or otherwise impair, circulation in corridors, stairs, sidewalks, or other traffic areas.

END OF SECTION 28 05 00

SECTION 28 13 00 – KEYLESS ENTRY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a new Keyless Entry System.

B. The system shall monitor and control facility access, and shall perform alarm monitoring, camera, and video monitoring (when integrated with a compatible integrated Video Surveillance System), communications loss monitoring, and temperature monitoring. The system shall also maintain a database of system activity, personnel access control information, and system user passwords and user role permissions. The system shall provide control and access to users on Local Area Networks (LAN), Wide Area Networks (WAN), wireless networks, and the Internet. The system shall provide email and/or text message alerts for all alarm conditions and threats.

C. The system includes but not limited to the following:

1. Software
2. Firmware
3. Control Panels
4. Intrusion Detection
5. Wiring

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including:

1. Drawings:

a. Division 27 and 28 drawings.

2. Related Specification Sections:

a. Division 27 and 28 specifications.

1.3 PERFORMANCE REQUIREMENTS

A. The system shall be certified to meet the following standards:

1. ISO 9000

2. System shall be RoHS (Restriction of Hazardous Substances) compliant and meet proposed amendments to the reduction of toxic substances in manufacturing as stated in the Environmental Design of Electrical Equipment Act (EDEE)
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency and marked for intended location and application.
4. Installation shall comply with NECA 1-2010 “Standard Practice of Good Workmanship in Electrical Construction”
5. Installation shall comply with NEC/NFPA 70E “Standard for Electrical Safety in the Workplace”
6. Electronic data exchange between Video Surveillance System and an Access Control System shall comply with SIA TVAC
7. Installation shall comply with FCC CFR 47 Part 15 Class A "Telecommunications, Radio Frequency, Digital Device Emission”
8. Installation shall comply with federal, state, and local codes and Authority Having Jurisdiction (AHJ)

1.4 CONTRACTOR REQUIERMENTS

A. The Contractor shall have a supporting office within (75) miles of the project location

B. Certifications: Technicians from the supporting office shall hold current certifications with the manufacturer

C. On-site maintenance and repair service shall be available locally and within (4) hours of notification of condition.

D. On-site Contractor personnel shall hold all required local, state, and federal licenses

E. On-site Contractor personnel shall hold current certifications with the manufacturer

1.5 QUALITY ASSURANCE

A. Installation shall comply with federal, state, and local codes and Authority Having Jurisdiction (AHJ).

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Install and program all software and hardware in accordance with manufacturer’s specifications.

D. All equipment shall be new, in current production, and the standard products of a manufacturer of ESS equipment.

E. Manufacturer shall guarantee availability of parts, for a minimum of (7) years from date of shipment.

F. On-site maintenance and repair service shall be available locally and within (4) hours of notification of condition.

G. Contractor shall review drawings and specifications.

H. Test and certify all software integration between all integrated systems for interoperability by the manufacturer of each system.

I. Software integration between the system, VMS, and all other integrated system components shall be tested and certified for interoperability by the manufacturers of each system.

1.6 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor.

1.7 SEQUENCING

A. Description: This implementation plan describes the general approach that shall be followed in order to minimize the time for the video surveillance system to be operational.

B. Approach: Contractor shall plan and schedule all work in such a sequence as to minimize the time before the system is operational. The following is a suggested work sequence:

1. Order all equipment needed and notify any subcontractors to schedule their participation.
2. Perform all system layout work.
3. Insure there are an adequate number of power receptacles available to operate all security equipment and coordinate with Owner as to where power is available.
4. Provide shop drawings to verify location of all equipment, conduit runs, power connections, etc. Submit shop drawings to Owner Project Manager.
5. Coordinate with Owner to provide space for the placement of all monitoring, control and recording equipment.
6. Prepare and pre-test all equipment to the greatest extent possible.
7. Install all equipment.
8. Test and inspect all systems.
9. Perform all other Work as required.
10. Provide as-built drawings.
11. Perform the Acceptance Test.
12. Provide training

1.8 SCHEDULING

A. The Contractor, immediately after being awarded the contract, shall prepare and submit an estimated progress schedule for the Work. The progress schedule shall be related to the entire project and shall indicate start and completion dates.

1.9 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to service, repair or replace system components as needed for proper system operation as specified herein.

B. Warranty Period: a 2-year warranty on hardware and a 1-year warranty on labor and software from date of date of Owner Acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

A. Contractor Responsibility

B. All products not provided by Owner shall be new and unused and shall be of manufacturer’s current and standard production. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.

C. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

D. Certain products specified may only be available through factory-authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

E. Approved manufacturers:

1. Avigilon
2. Cbord
3. Genetec
4. Lenel/S2
5. Open Options
6. Paxton Net2
7. RS2 Technologies
8. Salto

2.2 WIRE AND CABLE

A. Where doors are equipped with electronic hardware, provide all required system wiring to these devices as well as the card reader. In addition, provide complete integration of ADA operators where applicable.

2.3 FUNCTIONAL REQUIREMENTS

A. The system shall support Centralized Management enabling system operators and administrators to monitor and control multiple system controller installations simultaneously.

B. System Partitioning: The system administrator shall have the ability to divide the system into partitions, allowing subsets of the overall population and/or resources to be managed separately.

C. The system shall provide the following Access Control capabilities:

1. Login throttling, which can be enabled for the system to limit the number of login attempts from the same IP address for a selectable duration.
2. Integrated photo ID creation capability.
3. Photo ID and video verification during access control monitoring.
4. User interface secured access under encrypted password control.
5. System-wide timed anti-passback function.
6. Regional anti-passback with mustering and roll call functions.
7. Region occupancy counting and control.
8. “First-in-unlock” rule enforcement.
9. Multiple access levels and cards per person.
10. 128-bit card support for Wiegand card readers.
11. Detailed time specifications.
12. Simultaneous support for multiple card data formats.
13. Elevator control with or without floor selection tracking.
14. Access privileges variable by threat level.
15. Scheduled portal unlocks by time and threat level.
16. Card Format Decoder to quickly discover unknown card formats.
17. Card enrollment by reader or keyboard.
18. Compatibility with various input devices, including biometric readers.
19. Activation/expiration date/time by person with one-minute resolution.
20. Access level disable for immediate lockdown.
21. Use of Threat Levels to alter security system behavior globally.
22. Duress PINs, which can be enabled for the system to allow a valid user to raise an alarm if compelled under duress to use his or her credentials (card and PIN) to allow access for another person.
23. Multiple holiday schedules.
24. Timed unlock schedules.
25. Scheduled actions for arming inputs, activating outputs, and locking and unlocking portals.

26. Optional two-man access restriction for portals, requiring two valid card reads from two separate cardholders within a specified amount of time for portal entry.
27. Card enrollment reader support.
28. Dual-reader portal support.
29. Wiegand Reader support.
30. Magnetic-stripe reader support with cards using ABA Track 2 format for up to 200 bits.
31. Wiegand keypad PIN support for 4-digit or 6-digit PINs.
32. 8-bit and 4-bit burst keypad support for 4-digit or 6-digit PINs.
33. Integration with supported alarm panels.
34. Support for up to 200 DMP and 255 BOSCH intrusion panels with high-level TCP/IP integration.
35. Optional storage and recall of ID photos and personal/emergency data.
36. Unlimited person records.
37. Credentials are stored locally at the Field Panel. An unlimited number of credentials may be authenticated with the system Controller, caching the most frequently used credentials on the Field Panel. In an instance where the credential is not stored locally at the Field Panel, the Field Panel will attempt to confirm access by verifying the existence of the credential with the system Controller.
38. Unlimited number of scheduled actions, with the system Controller downloading up to 16 per Field Panel per day of the soonest-to-activate actions applying to that Field Panel, with any others that remain in the database as candidates for downloading later. Expired scheduled actions are removed automatically.
39. The system shall support tracing a person's activity in the current partition if the "Trace this person" check box is selected on the person record.
40. Search for person records using a credential scan.

D. The system shall provide the following Monitoring capabilities:

1. The Monitoring Home page shall allow users to view a full system summary, including the Activity Log, Auto-Monitor, and links to frequent User Tasks.
2. Common alarm panel integration for disarm on access, and arm on egress.
3. Support for the direct viewing of IP cameras.
4. Integrated real-time IP-based NVR systems and compatible third-party NVR systems with stored video replay for events.
5. Provides alarms on video loss, video motion detection, and video restore events.
6. Virtual inputs for video fail, camera normal, video motion, and building occupancy limits exceeded.
7. Provides alarms on communication loss and temperature variation.
8. Support for the creation of custom sets of alarm event actions.
9. Provides the ability to record video and link to video for alarm events based on access control activity.
10. Available video control and playback through the system user interface.
11. Provides the ability to assign threat levels to various alarm events according to severity.
12. Provides the ability to select up to 20 levels of priority for event actions.
13. Provides the ability to enter a duty log comment into the Activity Log, or to append a unique or preset comment to a particular log entry while viewing the Activity Log.

14. Support for the display of Activity Log entries that include both the time the event occurred on the Field Panel and the time it was reported to the SYSTEM Controller.
15. Support for electronic supervision of alarm inputs.
16. Support for the use of output relays for enabling circuits under alarm event control.
17. A monitoring desktop that integrates video, system Activity Logs, floorplans, ID photos, threat level control, and alarm notifications.
18. Support for the creation of unlimited customized monitoring layouts through the use of widgets, including layouts sized for the iPad or MacBook Air.
19. Graphic floorplans with active icons of security system resources.
20. System user permissions to grant whole or partial access to system resources, commands, and personal data.
21. Secure access to the user interface under encrypted password control.
22. Delivery of alerts via browsers, email, and text messages.
23. Remote Logging of system messages to remote host.
24. System health and maintenance:

    a. Provides the ability to manage system health alerts generated by the SYSTEM when it detects error conditions at applicable health monitoring points.
    b. For a given system, the health monitoring points may include the system license, disks, RAID drives, FTP, NAS, Backup, Archive, Disk Usage, and VMS.
    c. If a user configures notifications for a selected email group, group members shall receive a message whenever an error condition is detected at a health monitoring point. If the user has chosen to include a health summary, each notification shall include status information for all of the system's health monitoring points.

E. The system shall provide the following Video Management capabilities:

1. Real-time video monitoring displays, including multiple cameras simultaneously.
2. Pan, Tilt, and Zoom control of capable cameras.
3. Playback of video and access control event-related video.
4. Video switching and video widget pop-ups based on access activity or event activation.
5. Integrated alarm inputs from the Video Management System (VMS).
6. Digital playback of video events.
7. Linking of video and events based on triggers provided by the SYSTEM or VMS.
8. Support for multiple DVR and NVR systems.
9. Multiple pre-programmed supported cameras.
10. Recall of photo ID and real-time video feed for video verification and comparison of card holder.
11. Monitoring and control through a web browser interface.
12. System user permissions to grant whole or partial access to system cameras and video resources.
13. Full integrated operation with a Unified Management Client for live, recorded, forensic, and life safety notification over existing TV's and Monitors.
14. Ability to use the SYSTEM web interface to review the status of system and storage drives, and to adopt physical and virtual drives into an integrated NVR so it can begin using them for video storage.

F. The system shall provide the following Security Database capabilities:

1. Maintain data of system activity, personnel access control information, system user passwords and custom user role permissions for whole or partial access to system resources and data.
2. Partitions: It shall be possible to partition the system to create independent, virtual security management systems for multiple populations.
3. Support for the sharing of user privileges across partitions in a system.
4. Support for the grouping of multiple access levels across partitions in a system.
5. Built-in Open Database Connectivity (ODBC) compliant database for personal data.
6. LDAP, SLDAP, and Microsoft Active Directory integration for single-user logon authentication.
7. Microsoft Active Directory integration to allow the synchronization of cardholder data between Active Directory servers and the system.
8. Unlimited person records.
9. Network-secure API for external application integration.
10. Extensive and easy to use custom report generator.
11. User-defined data fields in personnel records.
12. Record recall by vehicle tag, name, or card.
13. An API for adding to, deleting from, and modifying the database.
14. Storage of system user passwords and permissions.
15. Storage and recall of ID photos and emergency personal information.
16. Pre-defined reports on system configuration, system activity history, and people.
17. A Used By feature for listing all correlations between specific card readers, keypads, inputs, and outputs, against groups, portals, elevators, access levels, access level groups, and other configured access control features. This feature may be useful for quickly determining I/O associations when editing and/or deleting system I/O points.
18. An Audit Trail report that shows changes made to the security database over a specified period of time.

    a. For each transaction listed in the report results, information is available on when the transaction occurred, who made the changes, the fields that were modified, and the original and new values.
    b. Search criteria can be applied to filter the report results, either by the person whose record was changed or by the area of the system configuration that was modified.

19. A Credential Audit report that shows all existing access cards by their current status settings and provides the ability to search for cards that have not been used for an operator-entered number of days. The report also shows for each card the name of the person to whom it was issued and the card number.
20. A Duty Log report shows duty log comments residing in the current security database, including archives.

    a. For each duty log comment included in the report results, information is available on when the comment was entered, who entered it, the date and time of the

logged event associated with the comment, the name of the logged event, and the specific comment text.

b. Search criteria can be applied to filter the report results, either by Operator (the user who entered the duty log comment) or by Event type.

21. Custom report writer interface that allows the interactive creation of custom reports. Reports may be saved for later reuse. No third party software (such as Crystal Reports) shall be necessary.
22. Custom report scheduling and distribution of report via email.
23. Selectable custom report output formats, including PDF, CSV, and HTML (default).
24. Custom report repository location. Users shall be able to review, cancel and delete reports from this data storage location.
25. Seamless search capability for access history reports. The reporting function shall search the database and archive simultaneously for matching report parameters.
26. Column sorting. Custom reports output shall be user configurable to sort individual columns in both ascending and descending order.
27. Periodic backup to on-board flash ROM and optional Network Attached Storage (NAS), or including FTP / SFTP servers.
28. Periodic archive creation for historical custom reporting and improved on-board database performance.
29. Email and text messaging alert notifications.
30. Custom Menu capabilities allowing a user to create a custom menu containing a specific set of options, which can be assigned to users and will then appear in their navigation palettes.

2.4 HARDWARE REQUIREMENTS

A. The system shall employ a modular hardware concept that enables simple system expansion and utilizes a three-tiered hardware hierarchy:

1. At the top tier is the system Controller, which shall contain the database engine, web server, application software, and configuration data. It is at this level that System Users, through a browser interface, shall interact with the system, set configurations, monitor activities, run reports, manage alarms, and manage cameras and video and storage.
2. At the second tier is the Field Panel, an intelligent device with native TCP/IP support, which shall make and manage access control decisions.
3. At the third tier are the application extension blades. Each of these blades shall connect to and manage a set of inputs, outputs, readers, or temperature monitoring points.
4. The system Controllers and Field Panels shall run on existing building TCP/IP networks and shall be configurable for access from separate subnets, through gateways and routers and from the Internet.
5. A PoE Plus powered Field Panel, which combines an Access Control blade and a CPU board, shall also be available.

B. The system Controller shall contain the operating system, database engine, web server, application software, and configuration data. The system Controller shall be available in configurations to support small to medium, large, and ultra-large systems.

C. An Entry-Level Controller shall contain a processor, flash memory, and a network switch. The Controller shall be supplied with 12V DC at a minimum of 5 amps. Internal battery backup shall supply sufficient power to provide for an orderly shutdown of the system in case of loss of external power. External battery backup shall be used to provide uninterrupted operation in the event of external power loss. The SYSTEM Controller is accompanied by a Field Panel. The Field Panel shall contain I^2C for communication with the Application Blades and a network interface port.

D. The Mid-Level Controller shall be available in wall-mount or 2RU rack-mount enclosure. It shall contain a motherboard with an Intel® Atom™ processor and solid-state disk drive. An Ethernet connector shall be provided for network connection.

E. The Enterprise Controller shall consist of a 1RU rack-mounted controller with additional processing power, memory and solid-state disk drive.

F. The Premium Enterprise Controller shall consist of a 1RU rack-mounted controller with additional processing power and memory, RAID-1 solid state disk drive array, serial port and network connections.

G. The Field Panel shall make and manage access control decisions with data provided by the Controller, and it shall manage the communication between the Controller and Application Blades connected to the system's inputs, outputs, and readers. The Field Panel shall be supplied with 120V AC at a minimum of 2.3 amps. The Field Panel can optionally be powered by 12V DC at a minimum of 7Ah. Internal SLA battery backup shall supply sufficient power to provide for an orderly shutdown of the system in case of loss of external power. External battery backup shall be used to provide uninterrupted operation in the event of external power loss. Each PoE Plus powered Field Panel shall support up to seven Application Blades. Communications between the Field Panel and the Controller shall be encrypted and authenticated using TLS digital certificates.

H. The Data Gathering Panel with embedded NVR shall make and manage access control decisions with data provided by the Controller, provide recording, live streaming and playback of IP cameras connected to it. The Data Gathering Panel with embedded NVR shall also manage the communication between the Controller and Application Blades connected to the system's inputs, outputs, and readers. The Unit shall be supplied with 120V AC at a minimum of 2.3 amps. The Field Panel can optionally be powered by a 12V 7Ah SLA battery. Internal SLA battery backup shall supply sufficient power to provide for an orderly shutdown of the system in case of loss of external power. External battery backup shall be used to provide uninterrupted operation in the event of external power loss. Each Field Panel with the embedded NVR shall support up to four Application Blades. Communications between the Field Panel and Controller shall be encrypted and authenticated using TLS digital certificates. Each Data Gathering Panel with embedded NVR shall contain a video management appliance that is designed to be integrated with a Controller. The integration provides a single user

interface for the access control and monitoring capabilities and the NVR video surveillance capabilities.

I. The Application Blades shall interface with the Controller through the Field Panel. The Application Blades shall be blade-style circuit cards. There shall be four types of Application Blades:

1. Access Control Blade - The access control blade shall receive power via the ribbon cable bus directly from the Field Panel. The access control blade shall supply up to 500 mA of power to one reader or 250 mA of power to each of two readers.
2. Supervised Input Blade - The input blade shall receive power via the ribbon cable bus directly from the Field Panel. It shall support a wide variety of input supervision types including normally open circuit and normally closed circuits, and zero, one or two resistor configurations.
3. Relay Output Blade - The output blade shall receive power via the ribbon cable bus directly from the Field Panel. Both normally open circuit and normally closed-circuit output devices shall be supported. The relay outputs shall support any output devices that operate on the following maximum electrical ratings: 30 Volts DC or AC, 2.5 Amps inductive or 5.0 Amps non-inductive.
4. Temperature blade - The temperature blade shall receive power via the ribbon cable bus directly from the Field Panel blade.

J. The PoE Plus powered Field Panel shall combine a CPU board and an Application Blade capability into a single enclosure. In addition, each PoE Plus powered Field Panel shall support one temperature input. The PoE Plus powered Panel may be supplied with 12VDC at 5 amps. With a 12VDC 5A power supply the total power available for all external output is 2000mA (24 watts). Alternatively, it shall also be possible to power the PoE Plus powered Field Panel from PoE switch that conforms to the IEEE 802.3af standard, or from PoE Plus switch which conforms to the IEEE 802.3at standard. With PoE (802.3af) as the power source the total power available for all external 12V output is 500mA (6 watts @12VDC). With PoE Plus (802.3at) as the power source the total power available for all external 12V output is 1000mA (12 watts @ 12VDC).

1. In addition, provide local battery backup at control panel to maintain operations for a minimum of one hour in the event of loss of power.

K. All wall-mount enclosures shall have a lock requiring a key, and a cabinet door tamper switch.

L. Intrusion Detection

1. The integration will allow the EAC system to monitor the intrusion panels and to control certain panel functionality, such as arming and disarming functions.
2. Bosch Remote Programming Software (RPS), a Windows-based account management and control panel programming utility is required. It should be installed before you add panels to the EAC.
3. Requires Bosch B or G Series control panels running with firmware version 3.03.014 or later.

4. The license for the Bosch panel integration must be enabled in the EAC software. In addition to the integration license, you must obtain a separate Bosch Panel license for each panel that will be connected to the EAC controller
5. Provide complete configuration of EAC/Intrusion Detection integration.
6. Control Panel

    a. Provides points to accommodate as shown on the Drawings.
    b. On-board Ethernet port.
    c. Integrates with EAC
    d. Provide Bosch B4500 series or approved equal.
    e. In addition, provide Bosch B920 2-line Alpha Numeric Keypad (SD12) where indicated.

7. Motion Detector

    a. TriTech. Passive infrared and microwave Doppler radar detection with First Step Processing.
    b. Cloak and Camouflage Detection Technology.
    c. Provide Bosch ISC-CDL1-W15G Motion detector or approved equal.

2.5 SOFTWARE REQUIREMENTS

A. Operating System and Application Software:

1. The embedded operating system for the system is Linux Ubuntu 16.04 LTS (long term support) as the operating platform. The operating system kernel shall be open-source and no operating system training or certification shall be necessary.
2. The application software shall be embedded in the system. The database shall be an embedded PostgreSQL relational database requiring a small footprint and provides high reliability. The web server shall be based on an embedded Apache™ web server enabling users to access and operate the system using a standard web browser.
3. The system shall support the following web browsers:

    a. Internet Explorer 11
    b. Chrome 70
    c. Firefox 63
    d. Safari 8, 9

B. Software Licensing:

1. Software licensing shall be based upon the number of portals, cameras, and select features for one Controller. Software license upgrades shall be available if system portal and camera capacity must be increased. The user license shall be valid in perpetuity and shall include one year of software updates from the date of shipment from the factory.
2. Licensing shall be controlled by a Product Key and an Activation Key. The Product Key contains the licensed system features and limits. To upgrade your system license to enable more cameras or more portals you will need a new Product Key. The Activation

Key contains the software support expiration date. The keys are locked to the system license number. The system license number shall be viewable on-screen on the About page

C. Software upgrades shall be possible from a browser on any network-connected PC by uploading a software update to the Controller. The Controller shall automatically upgrade all connected Field Panels. No client software installation shall be necessary.

D. Online Help and Documentation - The system shall be provided with complete embedded documentation. The online documentation shall include:

1. Context-sensitive online Help - (The Help displayed is specifically relevant to the current screen.) The online Help system shall provide explanations and procedures for all monitoring, administrative, and system configuration and maintenance functions. The Help system shall have linked table of contents, a linked index, and frequently asked questions pages. Each topic shall also have links to related topics. Each Help topic shall be printable.
2. Technical Support Notes - These documents shall be in PDF format, shall be printable, and shall be linked to from the Help system table of contents, index, and related topics.
3. Installation Guides - These documents shall be in PDF format, shall be printable, and shall be linked to from the Help system table of contents, index, and related topics.
4. Video Integration Guides - These documents shall be in PDF format, shall be printable, and shall be linked to from the Help system table of contents, index, and related topics.
5. End-User Task Guide - This document shall be in PDF format, shall be printable, and shall be linked to from the Help system table of contents, index, and related topics

E. Support Collaboration - It shall be possible, by the use of a network Support Collaboration Tool, for a technical support specialist to connect to the system and assist on-site technicians from remote network-connected locations. It shall only be possible for an on-site system administrator or technician to initiate this connection. There shall be no way to initiate this connection from outside of the secure network.

F. Language Support - The system shall be provided with multiple language support. The ability to switch from one language to another shall be accomplished through the user interface. Translation of the user interface, online help and documentation into other languages shall be available.

G. Date Formats - The system shall support global date formats.

H. Floorplans - The system shall provide graphic floorplan capability including graphic display of links to other floorplans, alarms and system resources such as portals, IP video cameras, inputs, outputs, and temperature monitoring points.

1. The Network Administrator holding at least a Setup user role shall be able to graphically configure device icons onto the floorplan images, and to upload additional floorplan images. JPEG images shall be supported, and the maximum size for a floorplan image shall be 256K.

2. It shall be possible to create floorplan groups for the purpose of assigning or withholding assignment of these groups to system user permissions known as custom user roles. If a floorplan group is assigned to a particular system user then the floorplans in that group shall be viewable by that system user.

I. Personnel Data - The system shall maintain person data relating to access control, system user privileges, photo identification, system activity, and contact information.

1. All person data in the system shall be integrated onto one tabbed page for viewing, editing, and deletion by system users.
2. A system user holding at least an Administrator user role shall be able to create, delete, and modify person records, including access levels and access level groups.
3. A system user holding at least a Setup user role shall be able to configure the display of person records. For example, the user shall be able to hide various tabs, and configure the User-defined tab by changing the tab label and customizing any of the 20 data fields that appear on the tab. The user shall be able to enter text, numbers, Boolean expressions, or user-defined list information into these data fields. The user shall also be able to define UDF value lists, which can be displayed as pre-entered drop-down lists for user-defined data fields.
4. The Person page shall contain a Journal tab, allowing the operator to enter and save a journal entry associated with the person.

J. Browser Based Data Import and Export - A Data Operations Tool shall be provided that supports, via an API, the import and export of personnel data. This tool shall make possible the pre-populating and ongoing populating, of cardholders into the system database. Data that shall be importable and exportable shall include:

1. Controller
2. Partition
3. FirstName
4. LastName
5. MiddleName
6. Deleted

7. Credentials [list]

    a. HotStampNum
    b. EncodedNum
    c. CardFormat
    d. Status
    e. ExpirationDate
    f. RemoteLockUserType
    g. Profile

8. AccessLevels [list]

    a. AccessLevelName

b. ActivationDate
c. ExpirationDate
d. AutoRemove

9. PersonID
10. PIN
11. ExemptFromPin
12. UDF1-20
13. Notes
14. ActivationDate
15. ExpirationDate
16. BadgeLayout
17. PictureFile
18. Phone
19. Email
20. Email2
21. Location
22. OtherContactName
23. OtherContactPhone1
24. OtherContactPhone2
25. Vehicles [list]

    a. Color
    b. Make
    c. Model
    d. State
    e. Licnum
    f. Tagnum

26. AntiPassBackPriv
27. ExemptFromNonUse
28. TracePerson
29. UseExtendedUnlock
30. LoginUserName
31. LoginUserPassword
32. LoginUserRole
33. LastModDateTime
34. LastModUser

K. Data Security:

1. Administrative access to the security management application and the personnel data shall be password protected and controlled by roles-based authorizations.
2. In addition, it shall be possible to enable secure communications between the Controller and web browsers, and between the Controller and Field Panels.
3. Communication between the Controller and browsers shall be secured using TLS digital certificates. The available options are:

a. Generate a self-signed certificate that is signed with your web server's own private key. This certificate shall provide encryption but not authentication.
b. Upload a certificate that is signed by a certificate authority (CA) to the SYSTEM Controller. This certificate shall provide both encryption and authentication.
c. Upload your organization's own certificate and matching key to the SYSTEM Controller.

4. Communication between the Controller and the Field Panels shall be encrypted and authentication/tamper detection shall be done using TLS digital certificates. Authentication will occur when the Field Panel connects to the SYSTEM Controller. The available options are:

a. Use a default self-signed certificate installed on the SYSTEM Controller and the Field Panel. The default built-in certificate for Field Panel communication shall use 2048-bit RSA key with SHA1 signature. The cipher mode to encrypt the data shall be AES256-GCM with SHA384 hash function.
b. Generate a self-signed self-signed certificate, which is signed with the Controller's private key. This certificate shall provide encryption but not authentication.
c. Generate an SSL certificate that is signed by a certificate authority (CA). This certificate shall provide both encryption and authentication.
d. Upload your organization's own SSL certificate and matching key to the Controller.

5. Communication between the Controller and other systems (when using the API) shall be secured using SSL and authentication/tamper detection shall be done using the SHA-1 algorithm.

L. Data Backups - It shall be possible to configure regular automatic database backups.

1. It shall be possible to back up a solid-state Entry-Level SYSTEM Controller or Mid-Level SYSTEM Controller to a built-in solid state hard drive.
2. It shall be possible to back up an Enterprise Controller or a Premium Enterprise SYSTEM Controller to a built-in solid state hard drive.
3. It shall be possible to save backups from any Controller to separate network attached storage (NAS) and file transfer protocol (FTP or SFTP) servers.
4. It shall also be possible to setup regular automatic creation of database archive files.

M. On-board Data Management - Each night the system shall truncate a sufficient number of the oldest records held on-board to reduce the database to its set limit, if required. This shall create the needed storage space for additional system activity records. Truncation will be performed on a First-in, First-out (FIFO) basis.

N. Partitions - It shall be possible to create multiple partitions for the management of multiple security systems or multiple populations.

1. It shall be possible to limit access to the data and resources of one partition to those with permissions for that partition.

2. It shall be possible for each partition to have its own population, resources, rules, events, video management, log data, reports and network resources.
3. It shall be possible to grant Monitor, Administrator and Setup privileges for multiple partitions to the same user. It shall also be possible to create custom user roles for each partition.
4. A Field Panel can reside in only one partition. It shall be possible to create partitions without Field Panels.

O. User Roles and Permissions - There shall be four pre-programmed levels of user roles, and custom user roles can be configured in the system with different permissions for each user:

1. Master Partition Monitor - These users may use the functions in the Monitor menu only within the Master (default) partition. Monitor functions shall include viewing the Activity Log, cameras, and floorplans.
2. Master Partition Administrator - These users may use the functions of both the Administration and Monitor menus only within the Master (default) partition. Administrative functions shall include adding and editing person information in the enrollment database, issuing and revoking cards, generating reports, and performing database backups.
3. Master Partition Setup - These users may use the functions of the Setup, Administration, and Monitor menus only within the Master (default) partition. Setup functions shall include defining access control, alarm event behavior, camera settings, floorplan images and configurations, holiday and time specifications. Setup functions shall also include: designation of network resources such as time and DNS servers, email and network storage settings; performance of system maintenance such as database backup and restore, software updates and file cleanups; designation of time zone, daily backup schedule and enrollment readers.
4. Full System Setup - These users may use the functions of all menus in all partitions.
5. Custom User Roles - In addition to the roles above the system shall also support the creation of detailed user permissions regarding which data operations, cameras, floorplans, elevators, events, access levels, access level groups, portals, reports, and personal data fields the system user may see, edit, delete, or control.

P. Alarm Panels - The system shall interface with alarm panels via wiring to an input point and an output point on each panel. This provides the ability to arm and disarm the panels, and to trigger events based upon alarm panel status.

Q. Intrusion Panels – The system shall integrate with the following intrusion panels:

1. BOSCH B and G Series control panels running with firmware version 3.03.014 or later.
2. Digital Monitoring Products (DMP) XR150, XR500 and XR550 Command Processor Panels.
3. Security administrators can use events on an intrusion panel, such as a zone going into an alarm state, to trigger events in the system. They can also use events in the system to control operations on an intrusion panel, such as the arming or disarming of an area.

4. Monitors can use the Intrusion Panel widget to view configuration and status information for an intrusion panel. They can also arm and disarm areas, bypass and reset zones, and activate and deactivate outputs associated with the panel.
5. The intrusion panels shall communicate their status to the system using port 6000-6063 (DMP), or port 7700 (BOSCH).
6. Intrusion panel system messages shall identify the panel that generated the message.
7. The system shall support at least 200 DMP panels and at least 255 BOSCH panels.
8. For DMP panels only: The system shall assign precedence to arm/disarm commands sent from the UI to the DMP panels.
9. Communication errors between DMP panels and the system shall be retried after one minute. Communication errors between BOSCH panels and the system shall be retried after two minutes, but this default retry time is configurable.
10. Bosch Remote Programming Software (RPS), a Windows-based account management and control panel programming utility is required. It should be installed before you add panels to the EAC.
11. The license for the Bosch panel integration must be enabled in the EAC software. In addition to the integration license, you must obtain a separate Bosch Panel license for each panel that will be connected to the EAC controller
12. Provide complete configuration of EAC/Intrusion Detection integration.

R. Alarm Events - The system shall manage alarm events.

1. It shall be possible to delay an input's change to the Alarm state by a specified number of seconds. The range of delay options shall be 0.5 seconds or from 1 to 120 seconds.
2. It shall be possible to associate specific actions with each alarm event. These actions may include, but are not limited to:

    a. Lock and Unlock portals.
    b. Activate and Deactivate relay outputs.
    c. Arm and Disarm input groups.
    d. Pulse outputs or output groups.
    e. Arm and Disarm alarm panels.
    f. Send emails and system messages.
    g. Move cameras to preset positions.
    h. Switch to a video monitor.
    i. Record video.
    j. Momentarily unlock portals.
    k. Change the threat level for a location, and (optionally) for its sub-locations.
    l. Make entries in the Activity Log.
    m. Play a digital sound file; it shall be possible to specify that it play in a loop until cleared or acknowledged.
    n. Display alarms in different colors.
    o. Set a priority for an alarm (one of 20 levels, with 1 being the highest).
    p. Require a duty log entry.
    q. Clear an alarm automatically or require an acknowledgement.
    r. Push a View to a Unified Management Client.
    s. Push a View to a group of Unified Management Clients.

t. Push an NVR camera stream to a Unified Management Client.
u. Push an NVR camera stream to a group of Unified Management Clients.

3. A system user holding at least a Setup user role shall be able to create, delete, and modify alarm system inputs, input groups, outputs, output groups, alarm panels, and events.
4. It shall be possible to trigger events based on system activity such as:

a. Failed login attempts.
b. Video motion detection.
c. Camera failure and camera restore events.
d. Valid or Invalid card reads.
e. Portals held or forced open.
f. Valid card reads with a specified access level.
g. Inputs entering an alarm state.
h. High and low temperature events.
i. Low batter voltage and low battery capacity events.
j. Alarm panel arming failures.
k. Alarm panel zone faults.
l. Tailgating and passback violations.
m. Occupancy limit exceeded
n. Region empty violations.
o. Field Panel power failure, communication failure, timeout, and tamper events.

5. It shall be possible to clone an event which creates an event with all attributes of the original, needing to change only the event's name and any attributes it will not have in common.

S. Activity Monitoring:

1. The system shall support a Monitoring Desktop that integrates video, system Activity Logs, floorplans, threat level control, ID photos, and alarm notifications.
2. Activity Log viewing includes one-click navigation to person records.
3. The system shall support a Widget Desktop that allows the creation of custom monitoring layouts. Within a custom layout, widgets display live video, system Activity Logs, alarm notifications, ID photos, floorplans, duty log entries, portal status displays, and intrusion panels.
4. The system shall support specific alarm events in the Events and Alarm Workflow widgets in one of the following three modes:

a. Activations do not display alarms – No alarm events shall be displayed in either widget when such events are configured in this mode. All settings shall be disabled in the Acknowledgements section of the page.
b. Multiple activations display a single alarm – Alarm events shall appear in both widgets each time the alarm input is triggered. Each subsequent trigger of the same input shall display a new alarm event which shall replace the previous one.

c. Multiple activations display multiple alarms – Alarm events shall appear in the Events widget as described in item b above. The Alarm Workflow widget shall simultaneously display a separate alarm event for each alarm trigger.

5. Many widgets support multiple partition viewing and filtering. For example, the Activity Log widget can display data from multiple partitions and data filtered by event type or reader group, and/or based on the text content of the event. Additionally, the system shall support the use of category filters, including Access Control, Alarms and Events, Threat Levels, System Admin, Devices, Field Panels, Access Granted, and Access Denied.
6. It shall also be possible to view cameras, Activity Logs, and floorplans on separate monitoring pages within the application.
7. The system shall support tracing a person's activity in the current partition if the "Trace this person" check box is selected in the person record.

    a. The traced activity is displayed in bold in the color selected for "Trace person log color" on the Controller page.
    b. In addition, if an event is selected for "Trace person event" on the Controller page, the event is triggered each time a traced person makes an access attempt. These event activations can be reported using a Trace people filter in a custom history report.
    c. When a user opens a person record in which "Trace this person" is enabled, a dialog box shall indicate that the person's activity is being traced.

8. The Activity Log shall be capable of displaying additional cardholder information, including "Hot Stamp", "Encoded Number", and "Company ID".
9. The system shall include a Photo Display Widget, which allows operators to display a current ID photo based on the most recent access request.
10. It shall be possible for a system user to place restrictions on the retention and tracking of access activity by setting options on the Controller page.

    a. The user can set an option to show Access Granted events in the Activity Log only when both a credential and PIN are used for access.
    b. The user can set an option to have the system retain Access Granted and Access Denied events only for a specific number of days. Once an Access activity record has been stored for the specified number of days, it shall be purged from the database. Access activity records shall not be included in archives.

T. Network-based Cameras and Video Surveillance - The system shall provide live IP video surveillance capability. The number of supported cameras shall be limited only by license. The system's video capabilities shall include video monitor switching based on access activity. The system shall provide monitoring, configuration, and administration of IP video. Cameras can be separately monitored or monitored in groups.

1. Presets - The system shall support the creation, deletion, and editing of camera preset positions in the system. It shall also be possible to save changes in preset positions directly to a camera.

2. Views - The system shall support the creation, deletion, and editing of multiple camera views, specifically Quad views (four cameras), NVR 2x2 view and NVR 1+7 views. The application shall provide a drop-down pick list for selecting current views or naming of new views.

U. Access Control:

1. The system shall be able to make access control decisions, define a variety of access levels and time specifications, write system activity into a log file, maintain a personnel enrollment database, receive signals from input devices such as door switch monitors, card readers and motion detectors, energize devices such as door locks and alarms via outputs.
2. Time Specifications: Each time specification must be assigned a unique alphanumeric name of up to 64 characters. The definition of a time specification shall require the assignment of both a start time and an end time.

    a. Each day of the week shall be individually assignable for inclusion in time specifications.
    b. Up to eight holiday groups per partition shall be assignable for inclusion in time specifications. If no holidays are assigned to a time specification then no holiday access shall be allowed. It shall be possible for users to change the default holiday group names (hol1 through hol8) to more meaningful names.
    c. Time specifications shall be assignable to access levels, output groups, portal groups, input groups, and alarm events.
    d. Time specifications shall function appropriately per Field Panel for the time zone specified for that Field Panel.

3. Card Formats - The system shall support the use of readers that use the Wiegand Reader Interface. The system shall support but not require the use of the card facility code. The system shall also support the use of the Magnetic Stripe ABA track 2 card data formats.

    a. It shall be possible to create new card formats, designate start bits and bit lengths for facility codes and card ID numbers, and designate parity bits. The system shall support up to 64 different card formats, and 32 formats can be enabled at a time. With compatible Mercury boards the system shall allow for up to 16 card formats to be designated as Mercury-supported. These Mercury-supported formats will be enabled on Mercury panels.
    b. It shall be possible to reverse the read order of the bits in the facility code and/or card ID portions of a card format.
    c. It shall be possible to view and change the default parity bit definitions for a card format.
    d. A card formats shall be disabled by default. Once enabled, the format appears in the card format dropdown within the credential section of a person record.
    e. The system shall support the use of a concatenated version of the FIPS 201 format (Federal Information Processing Standard Publication 201)
    f. FIPS 201 128-bit format. This system-owned credential format is based on Federal Information Processing Standard (FIPS) 201. It can be enabled and disabled, but it

cannot be modified. The credential number is a Federal Agency Smart Credential-Number (FASC-N) containing 32 characters, encoded as binary-coded decimal (BCD) digits. When issuing a credential using this format, a user can either enroll the credential via an enrollment reader or use a dialog box to enter a value for each of the fields that make up the 32 BCD string

g. Administrators shall be able to specify a specific number of days of non-use that will be allowed before unused cards will be disabled. Administrators shall be able to exempt individual users from this non-use rule.
h. The system shall support the Southwest Texas Regional Advisory Council (STRAC) UUID format of 128 bits displayed as 32 hexadecimal characters.

4. Access Levels - The system shall be capable of storing unlimited access levels in each partition.

   a. Each access level must be assigned a unique alphanumeric name of up to 64 characters.
   b. The definition of an access level shall require the assignment of a reader or reader group, and a time specification.
   c. It shall be possible to also assign an elevator floor group to an access level.
   d. It shall be possible to create a temporary access level by assigning an activation date and/or expiration date for any of a person's assigned access levels. It shall also be possible to have the system automatically remove a temporary access level once it has expired.

5. Access Level Groups – The system shall support the creation of access level groups, which will allow users to assign multiple access levels at once. Users with at least a Setup user role can create single-partition access level groups that can be viewed and assigned within the partition in which they were created. Users with the Full System Setup role can also create multi-partition access level groups, which can be viewed and assigned across partitions, and can contain access levels from multiple partitions, depending on the user's permissions.
6. First-in Unlock Rule: The system shall support the use of a First-in unlock rule. It shall be possible to use this rule to control the unlock behavior of portal groups with assigned unlock time specs.

   a. The First-in unlock rule shall require a card read of a specified access level. The portals in the group shall unlock only when the rule is satisfied and the unlock time spec is valid.
   b. There can be up to 64 First-in unlock rules in the system at a time.

7. Double Card Presentation - The system shall support the use of a Double Card Presentation mode. This mode shall allow the presentation of a card twice in quick succession at a designated reader. Such a "double read" shall change the locked portal to an unlocked state until a subsequent relock event or user-designated timeout occurs. The double card presentation mode shall be enabled on an individual portal basis and shall also require a designation on the access level assigned to the cardholder. The mode shall adhere to time spec and threat level restrictions.

8. Keypad timed unlock - It shall be possible to enable a timed unlock feature for a portal that has a combination reader/keypad device. Once this feature is enabled, any cardholder with valid access to the portal shall be able to specify how long the portal will remain unlocked.

    a. A cardholder presents his or her card and then enters the associated PIN, followed by the number sign (#) and the number of minutes (1-99) the portal should remain unlocked.
    b. The portal will remain unlocked for the specified number of minutes; unless it is closed before the timer expires. If the portal remains open after the timer has expired, a [Door Held Open] alarm will be activated.
    c. If reader/keypad devices are located on both sides of the portal, cardholders will be able to use either device to initiate a timed unlock.

9. Keypad Commands - For Field Panel connected access control keypads and combination card reader/keypads, users having the authorized access levels shall be capable of executing keypad initiated commands based on pre-defined two-digit number codes.

    a. Keypad commands shall be defined by mapping one or more two-digit codes to events defined in the system using the “Setup: Alarms: Keypad Commands” page.
    b. Keypad commands shall be assigned to specific keypads using the “Setup: Access Control: Readers/Keypads” page.
    c. Keypad commands shall be assigned to specific access levels using the “Setup: Access Control: Access Levels” page.

10. Holidays - The system shall support up to 30 holidays Field Panel. Each holiday must be assigned a unique alphanumeric name of up to 64 characters. The definition of a holiday shall require a start date and an end date. Holidays shall have the ability to span several days using only one holiday slot. Holiday definitions shall support the designation of a start time and an end time. If no start time is designated, then the system shall default to 00:00 (start-of-day). If no end time is designated, then the system shall default to 24:00 (end-of-day). Holidays shall require the use of 24-hour time format, e.g. 17:00 is 5:00PM.
11. Portals - A portal is a configurable object which can contain a reader or two readers, with or without keypads; a door status monitor (DSM); a request to exit (REX) device; and a lock. A system user with at least the Setup role shall be able to view current portal definitions, change portal definitions, delete portals, and create new portals. Creating a portal defines the access and alarm behavior of the access point. This can include:

    a. Card readers and keypads.
    b. Output for locking.
    c. Input for monitoring the door switch.
    d. Input for a Request-to-Exit function.
    e. Local alarm outputs and system alarm events.

12. Portal Groups - It shall be possible to create groups of portals and to assign an unlock time specification to the entire group. All the portals in the group shall remain unlocked during the time specified.

    a. It shall be possible to use portal groups for assigning or withholding assignment of these groups to system user permissions known as custom user roles. If a portal group is assigned to a system user then the portals in that group shall be viewable and unlockable by that system user.

13. Portal Alarm Conditions – Depending on the device type, system-wide events can be configured for up to seven portal alarm conditions. The seven alarm conditions are as follows:

    a. Forced: When a portal is opened and there has been no card read, nor request to exit.
    b. Held: When a portal is held open past the expiration of the shunt timer.
    c. Invalid: When the portal reader reads a card for which there is no entry in the database.
    d. Valid: When the portal reader reads a card for which there is a valid entry in the database.
    e. Duress: A card has been presented to the reader, followed by an entry of the cardholder's duress PIN into the keypad.
    f. Double Card Presentation: For a portal with Double Card Presentation enabled, a qualified user has performed a double read to unlock the portal.
    g. Unlock: The state of the portal’s RU (Remote Undog) exit device has changed from DNE (Dog On Next Exit) to Dogged (unsecured).

14. Two-man entry restriction: It shall be possible to require two valid card reads by different cardholders within a specified number of seconds for entry to a specific portal.
15. Escort Rule - The system shall support escorted access control rules by assigning one of the following two escort types to each cardholder:

    a. Escort - Cardholders with this access level shall enable access for persons requiring escorted access by presenting their credential at a card reader within 15 seconds after those requiring escorted access.
    b. Requires Escort - Cardholders with this access level shall be unable to access the portal unless a valid “Escort” cardholder presents their credential at the card reader within fifteen seconds after the “Requires Escort” credential has been presented. Otherwise, access will be denied, and the Activity Log shall display a message with the reason code {NO ESCORT}.

16. With compatible Mercury boards, the system shall support Facility Code Mode for reader/keypads, with the following available options.

    a. None (the default): The facility code is treated as part of the overall encoded credential number. A card matching only the facility code will not be granted access.

b. Configuration: Facility-code only checking is turned on only while the complete set of credentials is being downloaded to the Mercury panel. Once the credential download is complete, the behavior is the same as for the “None” setting.
c. Offline: Facility-code only checking is turned on only when the SIO is disconnected from its Mercury panel (via the RS-485 link). When the SIO is connected to the panel, the behavior is the same as for the “None” setting.
d. Configuration and Offline: Facility-code only checking is turned on both during the credential download and when the SIO is disconnected from its Mercury panel. At all other times, the behavior is the same as for the “None” setting.
e. Permanent: Facility-code only checking is always turned on.

17. Anti-passback - The system shall support both regional and timed anti-passback access control. For anti-passback functions, it shall be possible to configure regions, assign readers to those regions, and specify events for response to tailgate, passback, and occupancy limit violations. It shall also be possible to designate parent regions for hierarchical anti-passback.

    a. Grace: It shall be possible for a system Monitor or Administrator to Grace Card holders from passback and tailgate violations.
    b. It shall also be possible to set a specific time for all cardholders to be graced daily.
    c. The system shall be able to automatically place the cardholder in a predefined region upon the selection of the grace option.

18. Mustering - To aid in evacuation management it shall be possible to designate a region or regions for mustering. It shall be possible to quickly get an occupancy count and occupant list for any region.
19. Scheduled Actions - It shall be possible to specify system actions to occur at scheduled times. When scheduling an action, it shall be possible to specify whether the time specifications for the scheduled action will be based on the time zone set for the local Field Panel or the time zone set for the SYSTEM Controller. Scheduled actions can include:

    a. Arming and disarming inputs and input groups.
    b. Activating and deactivating outputs and output groups.
    c. Locking and unlocking portals and portal groups.
    d. Locking and unlocking elevator floors and floor groups.

20. Floorplans - The system shall support displaying of active graphic floorplans and configuring each floorplan with icons representing system resources: cameras, portals, temperature points, and alarms. A network administrator holding at least a Setup user role shall be able to upload floorplan images and graphically configure device icons onto the floorplan images. Viewing floorplans will require the Adobe Flash Player plug-in for the browser.

    a. It shall be possible to create floorplan groups for assigning or withholding assignment of these groups to system user permissions known as custom user

roles. If a floorplan group is assigned to a system user then the floorplans in that group shall be viewable by that system user.

21. Elevator Control - The system shall be capable of controlling elevator access to floors. The system shall control up to 52 floor buttons per Field Panel, or up to 28 floors with floor selection tracking. With compatible Mercury boards, the system shall control up to 128 floor buttons per elevator cab, with or without floor selection tracking.

    a. It shall be possible to create, change, or delete floor groups, and to assign a free access time specification to a floor group. The floors in this group will be freely accessible during the times defined by the chosen time specification.
    b. It shall be possible to create elevator groups for assigning or withholding assignment of these groups to system user permissions known as custom user roles. If an elevator group is assigned to a system user then the elevators in that group shall be viewable by that system user.
    c. Users assigned to custom user roles for one or more elevator groups may be given Free Access privileges to manage access to the elevators in those groups by using the Scheduled Actions page or an Elevator Status widget to:

        1) Momentarily enable free access for an elevator floor button. This will allow persons to temporarily access one or more floors without the need for an access control transaction such as a card read.
        2) Schedule an extended period of free access to one or more floors. This will allow persons to access the floors without constraints for the duration of the free access schedule.

    d. Floor Tracking - Users may configure optional inputs on the system that shall change state when a corresponding floor selection button on an elevator is pushed, enabling the system to monitor the status of each floor selection button in relation to specific access credential transactions.
    e. The system shall support Elevator Floor Tracking

        1) The system shall support optional inputs that change state when the corresponding floor-select buttons are pushed, allowing the system to detect each button’s status.
        2) The system shall support an optional input that will change state and trigger an event, when the elevator’s duress/emergency button is pushed.

    f. Users may configure an optional input for each elevator and corresponding event on the system when the elevator’s duress/emergency button is pressed.

V. Threat Levels:

1. It shall be possible to configure up to eight threat levels per partition. It shall be possible to alter security system behavior using threat levels. Groups of threat levels may be created and assigned to portal groups, access levels, input groups, output groups, floor

groups, and event actions. The behavior of groups, access levels, and event actions with assigned threat level groups shall change based upon the current system threat level.

2. The system shall support 32 threat level groups.
3. It shall also be possible to change the system threat level in response to an alarm event.
4. The current system threat level shall display in the title bar of the security application interface and on floorplans.

W. Location-based threat levels - The system administrator shall have the ability to define locations. This allows for threat levels to be assigned to individual locations.

1. Within each parent location, sub-locations can be created, and additional sub-locations can be created within each of these, and so on. This creates a location hierarchy.
2. Locations shall contain portals.
3. Threat levels can be applied to any location within the hierarchy.

X. Appropriate Use banner - The system administrator shall have the ability to enter text (such as an appropriate use statement) to be displayed on the login page.

Y. Reports:

1. The system shall support a variety of predefined reports regarding software and security hardware configuration, event history, and the administration of people within the system.
2. It shall also be possible to produce reports directly from the system Controller based on data in archive files on FTP or SFTP servers, network attached storage, or the built-in hard drive.
3. The system shall support a graphic interface for interactively building custom reports from either historical or personnel data. These reports shall be savable for later reuse. Parameters can be inserted into reports to prompt for data input at report runtime. Report results can be printed, output to a PDF file or put into a spreadsheet.
4. It shall also be possible to group reports for assignment to custom user roles. Any reports not grouped and assigned to a custom user role shall not be viewable by that system user.
5. The system shall be capable of sorting users by various criteria, including email address, and allow for email groups to be selected for auto-distribution.
6. Report generation shall not affect the real-time operation of the system.
7. The specific reports provided shall include the following:

    a. Configuration Reports

        1) As Built - A graphical report that displays an image of each Application Blade in a Field Panel and the specific resources (inputs, outputs, readers, etc.) configured for that blade. The network settings for the Field Panel shall also be included. This report shall display an image of each Mercury panel being used and specific resources configured on those panels.
        2) Cameras - Displays all camera configuration information including control address, IP port, and camera type.

3) Camera Presets - Displays configured presets for each camera in the system.
4) Elevators - Displays elevator configuration information including Field Panel, reader, floor to output mappings, floor select, and duress/emergency inputs.
5) Floor Groups - Displays all configured floor groups for use in elevator control.
6) Holidays -Displays holiday specification information.
7) Portals - Displays portal definition information including reader, DSM input, REX input, alarm outputs, and events.
8) Portal Groups - Displays a list of all defined portal groups.
9) Reader Groups - Displays defined groups of readers.
10) Remote Locksets - Available if the Remote Locksets feature is licensed for the system. Displays the following information for each remote lockset: name, IP address, synchronization status, serial number, last completed update time, firmware version, battery voltage, assigned remote lockset profile, and number of stored cardholders. The report can be sorted by any of the columns.
11) Resources - Displays all configured system resources including readers, inputs, outputs, elevators, and temperature points.
12) Threat Level Groups - Displays all configured threat level groups and the threat levels assigned to them.
13) Threat Levels - Displays all configured threat levels including the description and color assignment.
14) Time Specs - Displays all configured time specs currently in the system. Time specs, which define allowed access times, are used as part of access level definitions.

b. History Reports

1) Access History - Displays access history based on an entered query. The system user can specify the query using either the keyboard or point-and-click selection. Access history reports shall include the ability to include elevator access requests.
2) Alarm Resolution – Provides a report that tracks alarm duration. This is the period between the activation of an alarm and its resolution. Alarms are individual activations of events defined in the system. For an alarm to be resolved, it must be acknowledged (if acknowledgement is required according to the associated event definition) and its underlying cause must be cleared.
3) Custom Report - Provides the capability to create custom reports of historical data. A graphic interface provides the user with the ability to interactively create and save reports for later use. Parameters can be inserted into reports to prompt for data input at report runtime. Custom report output shall be user selectable for HTML, PDF or CSV format. Custom report configuration shall include page size, orientation, and

column width and shall automatically notify the user if the selected configuration exceeds the selected page size.

4) General Event History - Displays time, type of activity, and activity details for a variety of event types. The system user can select the specific event types for the report.
5) Portal Access Count - Display how many times users have used a portal.
6) Audit Trail - Displays an audit trail of system changes and the name of the system user that made the changes. It shall be possible to specify the dates and times covered in the report.
7) Duty Log - Displays duty log comments residing in the current security database, including archives. For each duty log comment, the report shows the date and time the comment was entered, the person who entered the comment, the date and time of the logged event associated with the comment, and the Activity Log message followed by the specific comment text.

c. People Reports

1) Access Levels - Displays all access levels entered into the system including time specification, reader/reader group, and floor group.
2) Credential Audit - Lists existing credentials by their status settings (such as Active, Damaged, Lost, or Not Used). Before running the report, users can filter the data to see only credentials with a status setting, or only credentials that were not used with a specific number of days from the date they were issued.
3) Current Users - Displays a list of all security system users currently logged in to the security system website.
4) Custom Report - This provides the capability to create custom reports of personnel data. A graphic interface provides the user with the ability to interactively create and save reports for later use. Parameters can be inserted into reports to prompt for data input at report runtime. Custom report output shall be user selectable for HTML, PDF or CSV format. Custom report configuration shall include page size, orientation, column width, and shall automatically notify the user if the selected configuration exceeds the selected page size.
5) Occupancy - Displays a list of defined regions with the number of people currently occupying each region and the maximum number of occupants allowed, if a maximum has been specified.
6) Photo ID Gallery - Displays all the photo ID pictures in the system and the person's name.
7) Photo ID Requests -Displays all outstanding badge print requests and lists ID, name, badge layout, activation date, request date.
8) Portal Access - Lists people with access for a selected portal.
9) Roll Call - Allows you to select a defined Region from the drop-down and see a list of people currently in that region.
10) Roster - Displays every person entered into the system and it lists name, ID photo, expiration date, username, and access level.

Z. Administration - The system shall provide for the performance of system administration tasks from any network-connected computer with a browser. Most of the administrative, maintenance, and configuration utilities and functions shall require a SYSTEM user with at least a Setup user role. Information from the network administrator shall, in many cases, also be required. These administrative tasks shall include but not be limited to:

1. Generating reports:

    a. The system shall support a variety of predefined reports regarding software and security hardware configuration, event history, and the administration of people within the system.
    b. Alternatively, the system shall support a graphic interface for interactively building custom reports from either historical or personnel data. These reports shall be savable for later reuse. Parameters can be inserted into reports to prompt for data input at report runtime. Report results can be printed, output to a pdf file or put into a spreadsheet.
    c. It shall also be possible to group reports for assignment to custom user roles. Any reports not grouped and assigned to a custom user role shall not be viewable by that system user.
    d. A system user holding All Administration permissions, or permissions to view and edit specific types of reports, shall be able to view and create reports.

2. Database backups:

    a. The system shall create database, or full system data backups, each night at 00:15 hours. These backups shall be stored in ROM and written to the drive on the disk-based controller.
    b. It shall also be possible for system users to create such database backups at any time. Any database backups onboard the Controller may also be downloaded to off controller storage by the system user at any time.
    c. Backups shall also be written to network attached storage (NAS), or to an FTP or SFTP server if such storage has been configured in the system.
    d. A user with at least a Setup user role shall have the ability to schedule a time for the daily transfer of backups to NAS. The user can specify that the transfer will occur after the daily backup or at a specific time of day.

3. System restore:

    a. The system shall be able to restore its database, or the full system data, from a backup. Restoration of the system shall only be possible from a backup copy onboard the Controller. It shall, therefore, be possible to upload a copy of a database backup from any network attached storage.
    b. It shall be possible to review backups by date and description and select the desired backup for upload to the Controller or restoration as the current system database.

4. Software updates:

a. Software updates, upgrades and patches shall be provided from time to time. The system shall be able to update its software from these .upg files. Update of the application software shall only be possible from an update file onboard the Controller. It shall, therefore, be possible to upload a copy of the software update from any network attached storage or from any PC drive or desktop.
b. Software updates may involve the Controller only or may include updates for the Field Panel(s) also. The monitoring of the security system may be unavailable for several minutes during this process.

5. File upload - The system shall support uploads of files for use in and with the system. Supported files include:

a. Floorplans in .jpg format
b. Badge layouts
c. ID photos in .jpg format
d. Database backups
e. Software license files
f. Software updates
g. Threat level icons in .jpg format
h. Sound files (.wav) for use in event alerts

6. Setting system time, time zones, and time servers:

a. The system shall support the setting of time zones by selection of a drop-down pick list. Time zones shall be separately settable for the Controller and for each Field Panel in the system. An extensive list of world-wide time zones shall be provided. Adjustments for daylight saving time (summertime) shall be automatic.
b. The system shall support the use of network time servers. Up to three-time servers can be designated. Use of a network time server ensures that the Controller and its Field Panels are regularly synchronized with the exact time used by all other network resources.
c. It shall also be possible to manually set the system date and time.

7. Changing passwords:

a. Person data maintained in the system may also contain a username and password for logging on to the security application website as a system user. The system shall support the changing of administrator passwords. It shall be required to enter the password twice for verification purposes.
b. Administrators shall be able to specify a minimum number of characters that users must include in their login passwords.
c. Administrators shall be able to specify that users' login passwords must contain a combination of letters, numbers, and special characters.
d. Administrators shall be able to set a password expiration period in months (from 1 month to 12 months) for all passwords in the current partition. Whenever a user changes his or her password, it will remain in effect for the selected number of months.

e. It shall also be possible to integrate an LDAP or SLDAP server for single-user logon authentication. This will reference the LDAP-stored password for use by the system.

8. Issuing and revoking cards (credentials):

a. Access cards shall be assignable by the system user either by entering card data directly into the person record or by use of an enrollment reader. Access levels shall be assignable through the user interface by selection from the list.
b. Access cards shall be revocable at any time. A system user holding at least an Administrator user role may perform this action. Revoked cards shall stop functioning immediately.
c. A system user holding at least the Administrator role may also disable an access card by changing its Active status to Clear, Damaged, Disabled, Expired, Forgotten, Lost, Missing Active, Missing Disabled, Not Returned, Not Used Not Validated, Returned, Stolen, Suspended or Temporary Expired. The card will not function with any of these status settings (unless the setting has been customized, as described below). Running a Credential Audit report shall allow existing cards to be viewed by their status settings.
d. A system user holding at least the Administrator role may customize any of the following access card status settings: Clear, Damaged, Forgotten, Lost, Not Returned, Not Validated, Returned, Stolen or Suspended. The user can change the name and/or description of the status setting, and can specify that a card to which the setting is applied will continue to function.
e. A maximum number of active cards per person can be enabled for the system. Once a person has reached the system limit, a new card can be added for that person only if one of his or her active cards is revoked or disabled.
f. When “Enable credential profiles” is selected on the Controller page, it shall be possible to assign credential profiles to individual credentials to determine the number of days of non-use before they expire.
g. It shall be possible to set expiration dates for individual credentials in a person record. When a Controller encounters an expired person record during its nightly system check, it shall modify that person record from “Active” to “Expired”. Similarly, if an expired person record is set to “Temporary”, it shall be changed to “Temporary Expired”.

    1) To reactivate “Expired” and “Temporary Expired” credentials, a system user with appropriate user role permissions may edit the person record in the User Interface, and modify the expiration date to a future date/time. Once the record is saved, the person record status will be changed to “Active” or “Temporary”.

h. It shall be possible to specify that any credential not used within a specific number of days from the date it was issued will be disabled automatically.
i. To ensure that all new and modified credentials have expiration dates, a user with Setup privileges can enable a credential expiration requirement option for the system. When this option is enabled, users will be prevented from saving new and

modified credentials that do not have expiration dates. The API shall enforce this by requiring that a valid expiration date be passed when a command is issued to add or modify a credential.

j. The “First Name”, “Middle Initial”, and “Last Name” fields of each Person Record shall allow for up to 50 characters each.
k. The system shall provide for a workflow to be configured to facilitate processing of lost and/or forgotten credentials.
l. The system shall track credential status information and make it available for use in creating up-to-the-minute credential status reports.

9. Enrolling new people:

a. All person data entered into the system shall be held in the system database and shall be available only to system users holding at least an Administrator user role.
b. Person data can be added, deleted, and edited by users holding at least an Administrator user role.
c. The system shall support person record templates.

1) Each template defines values for specific fields, such as a default set of access levels.
2) These values will be filled in automatically in any person record created from the template.
3) When adding a person to the system, a user shall be able to use one of the available templates in the active partition to create the person record, or create it without a template.
4) Person Record Templates shall be available for use in custom People report definitions and in person search criteria.

10. Creating Photo IDs - The system shall include an integrated photo ID function. It shall be possible:

a. To design badge layouts.
b. To upload badge layouts for badge printing.
c. To capture ID photo images, print badges, and delete uploaded badge layouts.
d. For the system user to manage all photos ID functions entirely from within the browser.
e. To track the number of times a badge has been printed.
f. To print multiple badges at once using the Badge Print Workflow.
g. To enroll a person’s card number manually or through a reader and save the new credential from the Badge Print Workflow.
h. The system shall be capable of automatically generating auto-incremental encoded credential numbers. Each new encoded credential number shall be increased by one over the next highest number in the system.

11. Configuring network resources:

a. Remote Health Monitoring Service registration – The system shall support the registration of a system with the Remote Health Monitoring Service to support cloud-based monitoring and administration of the system from a single management dashboard.
b. Active Directory data synchronization – It shall be possible to configure a Microsoft Active Directory server for data synchronization:

    1) Each Controller shall support up to 10 Active Directory server connections.
    2) A user with the Full System Setup role shall have the ability to create up to 10 configurations for synchronizing data, with the same Active Directory server or with different Active Directory servers.
    3) Each configuration shall allow the synchronization of: (1) person attribute values stored on the Active Directory server with values displayed in person records on the Controller, and (2) security group assignments on the Active Directory server with access level assignments on the Controller.

c. Active Directory user authentication – It shall be possible to configure an Active Directory server for user authentication:

    1) The configuration shall provide single user-login capability.
    2) Password rules and authentication will be governed by the Active Directory server.

d. Domain Name Servers (DNS) - The system shall support setting IP addresses for up to two domain name servers.
e. Email settings - The system shall support the use of email notifications of alarm events.

    1) The system user must setup the email server IP address or DNS name and the email address of the SYSTEM Controller.
    2) A network administrator must setup the network mail server to relay email for the IP address of the Controller.
    3) When setting up an email relay, users shall be able to select a port number other than 25 to indicate that the system should attempt to use encrypted SSL connections for the outgoing messages. If an encrypted connection is not available, then the system will fall back to port 25 for an unencrypted connection.

f. File Transfer Protocol (FTP) - The system shall support the use of an FTP or SFTP Server for backups. Once configured, backups are automatically saved to the FTP server on a daily basis.
g. Network Attached Storage (NAS) - The system shall support the use of NAS for network storage of backups and Data Operations Import files. Once configured, the system data is saved to a network storage location on a daily basis.

    1) The network administrator must create a domain user account for the Controller and a password.

2) The system user must configure the network attached storage in the system, including the domain name, server IP address, share name, and the directory where the Controller may store data.
3) The system user can select a security protocol (ntlm, ntlmi, ntlmv2, ntlmv2i, ntlmssp, or ntlmsspi) to be used for authentication when communicating with the remote server.
4) The system user can also select the version of the Server Message Block (SMB) network file sharing protocol the NAS is set to use.

h. Time sever – It shall be possible for a system user to set up a primary Network Time Protocol (NTP) server and, optionally, secondary and tertiary NTP servers. The Controller's use of an NTP server will ensure the system will be synchronized regularly with the exact time used by all other network resources.
i. Remote logging – It shall be possible for a system user to set up remote logging. This will ensure that messages generated by the system will be forwarded to a remote host running the Rsyslog daemon.
j. A system user holding at least a Setup user role shall be able to configure network resources. Configuring an Active Directory server for data synchronization requires the Full System Setup user role.

12. Data Operations:

a. View – Users having the "Data Operations: View" user role permission shall be able to view the results of data operations. Depending on which other user permission roles assigned to them, they may also be able to add person records (including access level, credential, and user defined person record information) to the SYSTEM, and modify and delete existing person records.
b. Import File – Shall enable the user to manually upload (import) tab-separated or comma-separated (CSV) text files.
c. Export File – Shall enable the user to manually download (export) CSV text files.
d. Automatic Import – Shall enable the system to process an Import File at scheduled intervals from a pre-configured NAS location.
e. Automatic Backups – Shall support the use of network attached storage (NAS) devices for automatic backup of Data Operations Import files to a network storage location.
f. Person Record Management – Data Operations shall provide the user interface to import person record CSV data to the Controller. Data Operations shall also be the interface for exporting the complete set of current access level and credential configuration of existing person records from a Controller to an external target system.

2.6 VIDEO MANAGEMENT SYSTEM INTEGRATION

A. The system shall support the integration of Network Video Recorders (NVR). This integration shall allow the viewing of live streaming video and recorded video playback.

2.7 MERCURY AND MERCURY POWERED HARDWARE INTEGRATION

A. The system shall support the integration of access control hardware from Mercury Security Corp.

B. Mercury EP Series Devices: The following hardware components shall work with the SYSTEM Controller:

1. Supported Mercury EP-Series Panels:

a. EP2500: Intelligent Controller: 32MB RAM, Ethernet
b. EP1502: Intelligent Dual Reader Controller: 16MB RAM, Ethernet, 2 readers) 8 inputs, 4 relays
c. EP1501: Intelligent Single Door Controller: PoE, single door, 2 readers, 2 inputs, 2 outputs
d. Mercury firmware version 1.23.6 is supported on the above panels.

2. Supported Mercury Interface Boards (SIOs):

a. MR-50 Reader Interface Module (Series 2 and 3): 1 reader (magnetic stripe or Wiegand), 2 inputs, 2 relays
b. MR-52 Reader Interface Module (Series 2 and 3): 2 readers (magnetic stripe or Wiegand), 8 inputs, 6 relays
c. MR-16in Input Monitor Module (Series 2 and 3): 16 inputs (zones), 2 relays
d. MR-16out: Relay Output Control Module (Series 2 and 3): 16 relays

C. Mercury M5 Bridge Devices: The Mercury M5 Bridge hardware platform uses legacy Mercury Casi Micro/5 enclosures retrofitted with Mercury M5 and MR devices to replace existing Casi devices. The following Mercury hardware components shall work with the SYSTEM Controller:

1. Supported Mercury M5 Bridge Panel:

a. M5-IC - intelligent control device for the replacement of the Casi PX, PXN, and PXNplus CPU controllers

2. Supported Mercury Interface Boards (SIOs):

a. MR-50 Reader Interface Module (Series 2 and 3): 1 reader (magnetic stripe or Wiegand), 2 inputs, 2 relays
b. MR-52 Reader Interface Module (Series 2 and 3): 2 readers (magnetic stripe or Wiegand), 8 inputs, 6 relays
c. MR-16IN Input Monitor Module (Series 2 and 3): 16 inputs (zones), 2 relays
d. MR-16OUT: Relay Output Control Module (Series 2 and 3): 16 relays
e. M5-2K - multi-device interface panel for the replacement of the Casi M2000 reader controller
f. M5-2RP - multi-device interface panel for the replacement of the Casi 2RP reader control device

g. M5-2SRP - multi-device interface panel for the replacement of the Casi 2SRP reader control device
h. M5-8RP - multi-device interface panel for the replacement of the Casi 8RP reader control device
i. M5-16DO - multi-device interface panel for the replacement of the Casi 16DO output control device
j. M5-16DOR - multi-device interface panel for the replacement of the Casi 16DOR input control device
k. M5-20IN - multi-device interface panel for the replacement of the Casi 20DI input control device
l. MUX8 – multi-device interface panel for the replacement of the Casi M Series 8RP to a single communications port
m. CASI F2F readers and keypads shall be supported for Mercury M5 Bridge 2RP, 2SRP, and 8RP panels

3. Schlage Wireless Devices: Mercury connected Schlage AD-400 wireless locks and WRI400 wireless access point modules via PIM-400 module.
4. Honeywell PW-Series Devices: Mercury powered PW-Series devices controlled and connected to intelligent control module PW6K1IC.

D. Support for OSDP readers: When configuring readers for Mercury SIOs, users can enable the Open Supervised Device Protocol (OSDP). For readers that support AES 128-bit encryption, users shall be able to enable encryption as well. OSDP shall allow for tamper and disconnect actions, which can trigger events.

E. Support for alternate readers: When configuring a reader, a user shall be able to specify that it will be used only as an alternate reader for an elevator on a Mercury board. Although access to the elevator will be associated with the elevator's primary reader, cardholders will be able to request access at either of the elevator's readers.

2.8 THIRD PARTY SSL CERTIFICATE SUPPORT

A. It shall be possible to configure an SSL certificate that will provide encryption alone, or encryption plus authentication. The available options are:

1. Generating a self-signed SSL certificate, this is signed with the embedded web server's own private key. This certificate shall provide encryption but not authentication. Users will need to override their security warnings or accept the certificate as trustworthy into their browser key ring.
2. Generating an SSL certificate that is signed by a certificate authority (CA). This certificate shall provide both encryption and authentication.
3. Uploading your own SSL certificate and matching key to the SYSTEM Controller. Optionally, it shall be possible to upload a chain, or intermediate, file that links the certificate to a trusted root certificate. This provides both encryption and authentication.

2.9 PIVCHECK INTEGRATION (HID)

A. The system shall support the integration of HID's PIVCheck PIV/TWIC/CAC/FRAC. This integration allows for:

1. Support for FIPS-201 Credentials
2. Authentication of PIV, TWIC, CAC, and FRAC credentials.
3. Validation against a certificate revocation list.
4. Enrollment of information contained within the credential imported directly into the system database.

2.10 VISITOR MANAGEMENT SYSTEMS INTEGRATION

A. The system shall be able to integrate with a variety of industry leading visitor management products. The integration allows for visitor information to be shared with system, providing the ability to assign credentials to visitors as well as running reports on activity. There is no additional cost or license fee for integrating with these visitor management systems with the system application.

B. The following visitor management companies have written integrations to the system using the NBAPI:

1. Jolly - Lobby Track
2. HID - EasyLobby
3. STOPware - PassagePoint
4. Veristream – iVisitor
5. Angus
6. ProxyClick
7. Splan
8. Envoy

C. Fees associated with integration of third-party visitor management systems may be applicable, depending on the manufacturer.

2.11 API INTEGRATION

A. An application programming interface (API) is provided for the system. The API provides programmatic access to the network-connected components managed by the system.

1. Communication between the system and another application takes place through the TCP/IP networking protocol. The API is invoked by posting an HTTP message to the web server on the Controller.
2. The system database includes a table of "people" whose records act as container objects for attributes attached to people in real life. People are mapped to access levels, which specify access privileges—and to access cards, whose credentials are used for access control.

3. Access levels are created in the system using the normal web user interface for the system. People and credentials may be entered into the system either through the web user interface or through the API.
4. It shall be possible to assign a custom user role that will allow a user to log into the system only through the API.
5. The API supports commands for:

    a. Adding, modifying, removing, and retrieving data about a person, and retrieving information about one or more people based on various search criteria.
    b. Adding, modifying, and removing credentials, and retrieving a list of the names of defined card formats.
    c. Adding, modifying, and deleting access levels, and retrieving a list of the valid access levels in the system.
    d. Adding, modifying, and deleting access level groups, and retrieving a list of the valid access levels groups in the system.
    e. Pinging the system to determine its health, and retrieving the current version of the API from the server.
    f. Retrieving a history of access activity, either for all users or for a particular access card.
    g. Adding, modifying, and removing threat levels and threat level groups, and setting the threat level in the system.
    h. Retrieving a list of portals and associated card readers defined for the system.
    i. Adding, modifying, deleting, and retrieving time specifications and time specification groups.
    j. Adding, modifying, and deleting holidays, and returning a list of holiday keys or a specific holiday.
    k. Adding, modifying, and deleting readers and reader groups, and returning a list of reader group keys or information for a specific reader group.
    l. Adding, modifying, and deleting portals and portal groups, and retrieving information about a specific portal group.
    m. Requesting events from the Activity Log that occurred within a specified time period. These events are returned from the API in the CSV Export report format.
    n. Activate or Deactivate Output: Requests that the output specified by an output key value be activated or deactivated.
    o. Momentarily unlocking the portal specified by a portal key value.
    p. Locking or unlocking the portal specified by a portal key value.
    q. Support for credential IDs, which are aliases for actual credential numbers. As a security measure, credential IDs can be retrieved and stored in a client system in place of the encoded numbers and/or hot stamps.
    r. Adding, modifying, and deleting UDF value lists, and retrieving a list of the UDF value lists defined for the system.
    s. Recording Access Granted and Access Denied events in the Activity Log, and inserting a user-defined event that displays a text string in the Activity Log.

2.12 REMOTE MONITORING AND ADMINISTRATION

A. The system shall support cloud-based monitoring and administration of Controllers and video systems from a single management dashboard.

B. Remote Health Monitoring Service shall support the Entry-Level Controller, Converged Controller/NVR Unit, NVR, Centralized Management and Replication Server, and Unified Management Client.

C. Remote Health Monitoring Service shall support remote monitoring of the following:

1. The last communication with Remote Health Monitoring Service
2. Status of the CPU
3. Memory and network bandwidth usage

D. Remote Health Monitoring Service shall support the managing of system licenses, including:

1. OS version
2. Software version
3. SUSP expiration date
4. Detailed license information

E. Remote Health Monitoring Service shall support remote updating of the system's software

F. Remote Health Monitoring Service shall be accessible through an integrator portal

G. Remote Health Monitoring Service shall not require ports to be opened for communications from the Entry-Level Controller, Converged Controller/NVR Unit, NVR, Centralized Management and Replication Server, and Unified Management Client.

H. Remote Health Monitoring Service shall support the sending of email or text alerts to system users when a system has an error.

1. Alerts shall be able to be grouped together.

2.13 CARD READERS

A. Provide HID HID® Signo™ Keypad Reader 20K or approved equal where indicated.

2.14 VIDEOPHONE ENTRY SYSTEM

A. Provide Aiphone AX-084C Central Exchange or approved equal in the MDF.

B. Provide Aiphone AX-DV Video Door Station or approved equal where indicated at the main entrance.

C. Provide Aiphone AX-8MV Audio/Video Master or approved equal where indicated at the Reception desk. Master station shall provide programmable buttons to lockdown all entrances and allow entrance access by visitors.

2.15 UNINTERRUPTABLE POWER SUPPLY (UPS)

A. Provide true online UPS system for back-up power for all central components in case of power interruption, brown-out, or fluctuations for a minimum of 30 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine cable pathways including conduit, raceways, cable trays, and other pathway elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine rough-in for control cable and conduit systems to controllers, card readers, and other system components to verify conduit and back-box locations prior to installation of system devices

C. Examine available network capacity and support infrastructure. Consult with network administrator for compliance with network standards and capacity

D. Examine install location for compliance with space allocations, installation tolerance, hazards to safe system operation, and other conditions affecting installation

E. Examine roughing-in for LAN, WAN, and IP network before device installation

3.2 PREPARATION

A. Comply with SIA CP-01 Control Panel Standard.

B. Comply with ANSI/TIA-606-B Labelling Standard.

C. Prepare detailed project planning forms for programming and configuration of the SYSTEM. Fill in all data available from project plans and specifications and publish as project planning documents for review and approval. These may include (but are not limited to):

1. Define SYSTEM Partitions.
2. For each Location, record setup of controller features and access requirements.
3. Propose start and stop times for time zones and holidays, and match up access levels for doors.

4. Set up groups, facility codes, software triggers, and list inputs and outputs for each SYSTEM Controller.
5. Assign action message names and compose messages.
6. Set up alarms. Establish trigger actions between events and video surveillance features.
7. Prepare and install alarm graphic maps.
8. Develop user-defined fields.
9. Develop screen layout formats.
10. Discuss badge layout options; design badges.
11. Complete system diagnostics and operation verification.
12. Prepare a specific plan for system testing, startup, and demonstration.
13. Develop acceptance test concept and, on approval, develop specifics of the test.
14. Develop cable and asset-management system details; input data from construction documents. Include system schematics and technical drawings in electronic format.

D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final programming and configuration documents. Use final documents to program and configure software.

3.3 WIRE AND CABLE

A. ANSI/TIA 568 Category 6A Compliant horizontal structured cabling system with a fiber backbone is currently being installed under Division 27. Connect system components to this cabling system utilizing required patch cables. Provide patch cables as necessary for system connectivity plus ten percent spare. Provide patch cable color and lengths as directed by Owner.

B. Where doors are equipped with electronic hardware as follows: Door Position Switch, Latch Retraction, Latchbolt Monitoring, Request-To-Exit, Electronic Power Transfer, and/or Power Supply above door, provide all required system wiring to these devises as well as the card reader. In addition, provide complete integration of ADA operators.

C. Comply with NECA 1, "Good Workmanship in Electrical Construction".

D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 6A rating of components and fiber-optic rating of components, and that ensure Category 6A performance of completed and linked signal paths, end to end.

F. Junction boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with tamper resistant fasteners and/or tamper detection switches. In addition, hinged enclosure doors shall be equipped with locking hardware. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the controller or panel location.

H. Card Readers and Keypads and Peripheral Devices:

1. Install number of conductor pairs recommended by device manufacturer for the functions specified.
2. Follow device manufacturer's installation requirements for maximum cable distances and sizes.

3.4 IDENTIFICATION

A. Label, in plain English, each end of each cable, Field Panel, patch panel, network switch, or cabinet

1. Each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the device as shown

B. At completion, cable and asset management documentation shall reflect as-built conditions.

3.5 SEQUENCE OF OPERATIONS

A. Open hours unlocked doors:

1. Upon entering the main entry, the door can be opened manually, or the operator paddle activates the operator to open the door and the card reader has no functional use because the doors are unlocked.
2. Upon entering the main entry vestibule, the inner door can be manually opened or activated by the paddle for the inner door operator once the outer door operator has closed the door (see operator coordination). The main entry vestibule shall contain a paddle for each door or a dual paddle to active each door.

B. Closed hours locked doors:

1. Upon entering the main entry, the operator paddle does not activate the operator, but the card reader does activate the operator to open the inner and outer vestibule doors.
2. Upon entering the main entry vestibule, the inner door can be manually opened or activated by the paddle for the inner door operator once the outer door operator has closed the door (see operator coordination).

C. Exiting during all hours:

1. Upon exiting the main entry panics shall have request to exit.
2. Upon exiting the main entry door operators shall always be activated by the paddles controlling each door.

D. Operator coordination:

1. Operators shall be delayed allowing the first activated operator to open then close and seal the door completely before the next operator is activated in order to maintain the airlock in the main entry vestibule. This applies to ingress or egress.

E. Other notes:

1. All exterior door and latch positions are always monitored.
2. Mechanical keys should be provided at the Knox Box entry for the fire department.
3. All other exterior doors to be typically locked.
4. All exterior doors shall always be accessible via card reader where card readers are indicated.

3.6 SYSTEM SOFTWARE AND HARDWARE

A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved.

B. Assign the software license(s) to Owner.

C. All default password shall be changed to those selected by the owner

1. The contractor shall retain no records of passwords for the project

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspection: Confirm that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Configure and pretest system components, wiring, and functions to confirm that they comply with specified requirements.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements.
4. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
5. Operational Tests: Perform operational system tests to confirm that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

B. The system is considered defective and the project incomplete if it does not pass tests and inspections

C. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

B. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.9 ADJUSTMENTS

A. Occupancy Adjustments: When requested within 30 days of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections
2. Confirm system configuration and adjust settings needed
3. Recommend changes to the system to improve Owner's use
4. Provide a written report of adjustments and recommendations

3.10 DEMONSTRATION

A. The training of all personnel shall be performed on-site by a manufacture certified trainer.

B. Provide a training tutorial and all handout material.

C. Provide a minimum of 24 hours training

D. Develop and provide separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials, monitor the system, and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

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SECTION 28 31 11.10 – ADDRESSABLE FIRE ALARM WITH ADDRESSABLE SPEAKER/VISUAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.

C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Fire alarm and detection operations.

2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.

3. One-way supervised automatic voice alarm operations.

1.02 ACCEPTABLE MANUFACTURERS

A. Manufacturers: The equipment and service described in this specification are those supplied and supported by Johnson Control Fire Protection, LP (Simplex).

B. No Substitutions allowed; must match the Campus fire alarm network systems.

1.03 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:

1. Division 26: applicable sections apply

C. The system and all associated operations shall be in accordance with the following Guidelines of the following Building Code: UBC IBC

1. NFPA 72, National Fire Alarm Code
2. NFPA 70, National Electrical Code
3. NFPA 101, Life Safety Code
4. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
5. Other applicable NFPA standards
6. Local Jurisdictional Adopted Codes and Standards
7. ADA Accessibility Guidelines

1.04 SYSTEM DESCRIPTION

A. Based on Simplex 4100ES

B. General: Provide a complete, non-coded, addressable/conventional, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

E. Wiring/Signal Transmission:

1. Transmission shall be hard-wired, using appropriate communications or power wiring for the devices connected. Wiring shall be low voltage power limited and as specified by the system Manufacturer.

2. System connections to all devices shall be as directed by the Manufacturer

3. System Trouble Supervision: System “Troubles” shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

4. All system events shall be transmitted to the Owner’s Simplex Tru-Site monitoring system.

F. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions.

a. Exception: If an Emergency Notification message is received it shall supersede the fire alarm signal while the Emergency Notification message is playing.

2. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first.

G. Annunciate all events regardless of priority or order received.

1. Noninterfering: An event on one addressable device does not prevent the receipt of alarm signals from any other addressable device. All fire alarm and priority 2 alarms are manually resettable from the FACP after the initiating device or devices are restored to normal.

H. Transmission to Remote Monitoring Stations shall be over the Owner’s Simplex Fire Alarm Network on Owner supplied fiber optic cables.

I. Annunciation: Operation of alarm, priority 2 or supervisory initiating devices shall be

annunciated at the FACP indicating the location and type of device.

J. General Alarm: Unless otherwise noted all building fire alarms are general alarms. A system general alarm shall include the following to occur:

1. Indication of alarm condition at the FACP.
2. Identification of the device or monitor zone that is the source of the alarm at the FACP.
3. Operation of audible and visible notification devices throughout the building until silenced at FACP.
4. Closing doors normally held open by magnetic door holders.
5. Unlocking designated doors.
6. Shutting down supply and return fans serving the area where alarm is initiated.
7. Closing smoke dampers on system serving the area where alarm is initiated.
8. Initiation of smoke control sequence through the building temperature control system.
9. Notifying the ISU Public Safety Dispatch Center and ISU Department of Facilities Management.

K. Priority 2 Operations: Upon activation of a Priority 2 device such as a security panel or panic alarm the system shall operate as follows:

1. Activate the system Priority 2 audible signal and illuminate the LED at the control unit.
2. Pressing the Priority 2 Acknowledge Key will silence the Priority 2 audible signal while maintaining the Priority 2 LED "on" indicating off-normal condition.
3. Record the event in the FACP historical log.
4. Transmission of Priority 2 signal to the ISU Public Safety Dispatch Center.
5. Restoring the condition and performing a Priority 2 reset shall cause the Priority 2 LED to clear and restore the system to normal.

L. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:

1. Activate the system supervisory service audible signal and illuminate the LED at the control unit.
2. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
3. Record the event in the FACP historical log.
4. Transmission of supervisory signal to the ISU Public Safety Dispatch Center.
5. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

M. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.

N. System Reset

1. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
2. Should an alarm condition continue, the system will remain in an alarmed state.

O. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.

P. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

1. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
2. Control relay functions associated to one of the 8 testing groups shall be bypassed.
3. The control unit shall indicate a trouble condition.
4. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a [voice announcement] [code] to identify the device or zone.
5. The unit shall automatically reset itself after signaling is complete.
6. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to voice announce the trouble condition.

Q. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning.
    a. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of

reporting are provided.

b. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system.

c. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the ISU Public Safety Dispatch Office The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor.

d. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.

6. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.

R. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

S. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

T. Audible Alarm Notification:

1. By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.

2. Automatic Voice Evacuation Sequence:

a. The audio alarm signal shall consist of a high-low alarm tone that shall sound continuously until the "Alarm Silence" switch is activated.

3. The system shall also include the standard ISU tornado warning and all clear message.

4. All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

U. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.

2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.

3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

V. Manual Voice Paging

1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
3. Facility for total building paging shall be accomplished by the means of an "All Speaker Talk" switch.

W. Fire Suppression Monitoring:

1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating monitor device. Activation of either device shall distinctly report which device is in alarm on the FACP.

X. Power Requirements

1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.
5. The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.05 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 01 Specification Sections.

1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.
3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of IMS graphic screens.
4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor, and auxiliary control circuits
6. Operating instructions for FACP.
7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
9. Record of field tests of system.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

C. Exception: Notification Appliance Devices by COOPER Notification (Wheelock) are acceptable.

1.07 MAINTENANCE SERVICE

A. Maintenance Service Contract: Provide maintenance of fire alarm systems and peripheral equipment for a period of 12 months after substantial completion, using factory-authorized service representatives. Maintenance shall be on a 24/7/365 basis with a guaranteed 4 hour response if the problem is deemed by the Owner to be serious enough to require this level of response. The Owner is knowledgeable of fire alarm system operation and what constitutes a problem serious enough to require the 4-hour response. Adjust and replace defective parts and

components with original manufacturer's replacement parts, components, and supplies.

1. If the Owner replaces a defective peripheral device from their peripheral device stock the replaced peripheral device shall be provided to the Owner at no additional cost for the Owner's stock replacement provided the peripheral device was not damaged due to misuse or vandalism. The Owner will provide the defective peripheral device that was replaced to the Manufacturer upon request. The Owner's labor costs for the peripheral device replacement will **not** be billed to the Manufacturer.

B. System Inspection: Prior to the end of the one-year warranty the Manufacturer shall provide a complete **panel** inspection, including battery testing, and correct any problems found with the panel and any peripheral equipment showing on the panel as being defective at the time of the panel inspection as a part of the system warranty.

C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

1.08 EXTRA MATERIALS

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

1. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.

2. Addressable Manual Stations: Furnish quantity equal to 5 percent of the number of units installed, but not less than one.

3. Addressable speaker/strobe and strobe only units: Furnish quantity equal to 5 percent of the number of units installed, but not less than one.

4. Smoke Sensors, Heat Sensors and Flame Detectors: Furnish quantity equal to 5 percent of the number of units of each type installed but not less than one of each type used.

5. Addressable Sensor Bases: Furnish quantity equal to 5 percent of the number of units of each type installed but not less than one of each type.

1.09 SYSTEM PROGRAMMING

A. Provide three (3) years of system reprogramming including FACP, Network Nodes as required and the Tru-Site Computers

B. The three (3) year period starts on date of final acceptance of the completed system by the Owner.

PART 2 - PRODUCTS

2.01 FIRE ALARM CONTROL PANEL (FACP)

A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

B. The following FACP hardware shall be provided:

1. Power Limited base panel with beige cabinet and flat door, 120 VAC input power.

2. 2,000-point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node
4. 2,000 points of annunciation where one (1) point of annunciation equals:
    a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
    b. 1 LED on panel or 1 switch on panel.
5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
6. One Auxiliary Relay, SPDT 2A @32VDC, programmable as an alarm relay, trouble relay, either as normally energized or de-energized, or as an auxiliary control.
7. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
8. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
9. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
10. The FACP shall support (6) RS-232-C ports and one service port.
11. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
12. Programmable DACT for either Common Event Reporting or per Point Reporting.
13. Service Port Modem for dial in passcode access to all fire control panel information.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80-character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:

1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface.
2. All announcements are made over dedicated, supervised communication lines. All risers shall support addressable wiring for each audio channel and addressable speakers.

3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
4. Status annunciator indicating the status of the various voice alarm speaker zones and the status of fire fighter telephone two-way communication zones.

F. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 7 (Class A) supervised serial communications channel (SLC):

1. Amplifiers, voice and telephone control circuits
2. Addressable Signaling Line Circuits
3. Initiating Device Circuits
4. Notification Appliance Circuits
5. Auxiliary Control Circuits
6. Graphic Annunciator LED/Switch Control Modules

2.02 EMERGENCY POWER SUPPLY

A. General: Components include battery, charger, and an automatic transfer switch.

B. Battery: Sealed lead-acid. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.03 TRUEALARM SENSOR BASES

A. TrueAlarm sensor bases contain integral addressable electronics that constantly monitor the status of the detachable photoelectric or heat sensors. Each sensor's output is digitized and transmitted to the system fire alarm control panel every four seconds.

B. Since TrueAlarm sensors use the same base, different sensor types can be easily interchanged to meet specific location requirements. This feature also allows intentional sensor substitution during building construction. When conditions are temporarily dusty, instead of covering the smoke sensors (causing them to be disabled), heat sensors may be installed without reprogramming the control panel. Although the control panel will indicate an incorrect sensor type, the heat sensor will operate at a default sensitivity providing heat detection for building protection at that location.

C. Base mounted address selection:

1. Address remains with its programmed location
2. Accessible from front (DIP switch under sensor)

D. General features:

1. Automatic identification provides default sensitivity when substituting sensor types
2. Integral red LED for power-on (pulsing), or alarm or trouble (steady on)
3. Locking anti-tamper design mounts on standard outlet box

4. Magnetically operated functional test

E. Supervised relay and remote LED Indicator options are available.

2.04 ADDRESSABLE MANUAL PULL STATIONS

A. Description: Addressable single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

B. Protective Shield: Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.05 TRUEALARM SENSORS

A. Smoke Sensors (Photoelectric)

1. TrueAlarm photoelectric sensors use a stable, pulsed infrared LED light source and a silicon photodiode receiver to provide consistent and accurate low power smoke sensing. Seven levels of sensitivity are available for each individual sensor, ranging from 0.2% to 3.7% per foot of smoke obscuration. Sensitivities of 0.2%, 0.5%, and 1% are for special applications in clean areas. Standard sensitivities are 1.5%, 2.0%, 2.5%, 3.0%, and 3.7%. Application type and sensitivity are selected and then monitored at the fire alarm control panel.
2. The sensor head design provides 360° smoke entry for optimum response to smoke from any direction. Due to its photoelectric operation, air velocity is not normally a factor, except for impact on area smoke flow.
3. Built-in insect screens

B. Heat Sensors

1. TrueAlarm heat sensors are self-restoring and provide rate compensated, fixed temperature sensing, selectable with or without rate-of-rise temperature sensing. Due to its small thermal mass, the sensor accurately and quickly measures the local temperature for analysis at the fire alarm control panel.
2. Rate-of-rise temperature detection is selectable at the control panel for either 15° F (8.3° C) or 20° F (11.1° C) per minute. Fixed temperature sensing is independent of rate-of-rise sensing and programmable to operate at 135° F (57.2° C) or 155° F (68° C). In a slow developing fire, the temperature may not increase rapidly enough to operate the rate-of-rise feature. However, an alarm will be initiated when the temperature reaches its rated fixed temperature setting.
3. TrueAlarm heat sensors can be programmed as a utility device to monitor for temperature extremes in the range from 32° F to 155° F (0° C to 68° C). This feature can provide freeze warnings or alert to HVAC system problems.

C. Duct Smoke Sensor:

1. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
2. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
3. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
4. Duct Housing shall provide a relay control trouble indicator Yellow LED.
5. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
6. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
7. Duct Housing shall provide a magnetic test area and Red sensor status LED.
8. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
9. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.

2.06 ADDRESSABLE CIRCUIT INTERFACE MODULES

A. Individual addressable modules (IAMs)

1. Both power and communications from a two-wire MAPNET II or IDNet circuit. They provide location specific addressability to a single initiating device (such as single station smoke detector alarm contacts or heat detector contacts) or multiple devices at the same location by monitoring normally open dry contacts and the wiring to an end-of-line resistor.
   a. Total wiring distance from IAM to supervision resistor(s) of up to 500 ft (152 m)
   b. Monitored connection is compatible with Simplex® 2081-9044 Overvoltage Protectors for outdoor wiring or electrically noisy applications
   c. For use in indoor locations up to 158° F (70° C) such as attic spaces or similar applications.
2. Model 4090-9001 is packaged in a thermoplastic housing and provides screw terminal connections and a status indicating LED. (***ISU Standard choice***)
   a. Enclosed design minimizes dust infiltration
   b. Mounts in standard single gang electrical box
   c. Screw terminals for wiring connections
   d. Visible LED flashes to indicate communications
   e. Optional covers are available to allow LED to be viewed after installation (requires mounting bracket, ordered separately)

3. Model 4090-9051 is an encapsulated package with wire leads. It does not provide a status indicating LED.
4. IDNet communications provides current limited monitoring:
    a. Provides monitoring of tamper switch (supervisory) and waterflow switch (alarm) on same circuit using one point
    b. Available with IDNet communications only
5. Multiple operation modes are available and are selectable at the control panel:
    a. Contact closure status can be tracked.
    b. Momentary contact closure conditions can be selected at the panel to be latched or tracked.

B. Individual Addressable Relay Module (Relay IAM)

1. IDNet Relay IAMs allow fire alarm control panels to control a remotely located Form “C” contact using IDNet addressable communications for both data and module power. Typical applications would be for switching local power for control functions such as elevator capture, or control of HVAC components, pressurization fans, dampers, etc. Relay status is also communicated requiring only one device address.
    a. A single addressable point provides control and status tracking of a Form “C” contact.
    b. Contact Rating
        1) Power Limited 2A @ 24VDC resistive
        2) Power Limited 1A @ 24VDC inductive
        3) Non-power limited 0.5A @ 120VAC resistive.
    c. Low power latching relay design allows IDNet communications to supply both data and module power.
    d. Relay is set to OFF on initial power up and upon loss of IDNet communications.
    e. Enclosed design minimizes dust infiltration.
    f. Mounts in standard 4” (102 mm) square electrical box, optional adapter bracket is available to mount in a 4 11⁄16” (119 mm) square electrical box.
    g. Screw terminals for wiring connections.
    h. Visible LED flashes to indicate communications.
    i. Optional covers are available to allow LED to be viewed after installation.

C. Dual Contact Relay IAM (Individual Addressable Module)

1. Same as Addressable Relay Module (Relay IAM), item B above, except with two form C contacts on common relay.

2.07 MAGNETIC DOOR HOLDERS

A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.

B. Material and Finish: Match door hardware.

2.08 EMERGENCY NOTIFICATION SYSTEM INTERFACE

A. A Valcom VE8001AR unit shall be provided for interface of Owner's Emergency Notification System with the building Addressable Alarm Notification devices.

B. The Owner will provide campus network connection to the Valcom unit.

C. Contractor/Simplex will provide interconnection from Valcom unit to the FACP Addressable Alarm Notification control.

D. Coordinate testing with ISU Public Safety Department.

2.09 ADDRESSABLE ALARM NOTIFICATION APPLIANCES

A. Alarm notification appliances shall be by Simplex.

B. General Requirements

1. Wall mounted units are to be red and ceiling mounted units are to be white unless noted otherwise.
2. Input voltage: 25 or 70.7Vrms
3. Speaker Wattage output: ¼, ½, 1, 2 watts
4. Frequency 400-4000Hz (S/V), 200-10,000Hz (H/F), General Signaling 125 Hz to 12 kHz
5. Strobe candela: 15, 30, 75, 110, 135, 185 cd

C. Wall mount Addressable Speaker Visible (S/V) Notification Appliances

1. Are individually powered, addressed, and controlled from a Simplex fire alarm control panel IDNAC Signaling Line Circuit (SLC). S/V notification appliances use a multi-tapped speaker for audio/tone notification and a multi-candela strobe with synchronized 1 Hz flash rate (63 synchronized strobes maximum per NAC) and selectable candela rating.
2. Wiring supervision is electronically monitored and allows audio wiring to be T-tapped for class B wiring, reducing wiring costs and wiring distances.
3. Wall mount S/V appliances are available in a 400-4000 Hz model and high fidelity H/F) model capable of operating between 200-10000 Hz.
4. Separate appliance and cover selection greatly simplifies the ordering and installation process. A colored lens kit is available to customize the light output.

D. Ceiling Mounted Addressable Speaker Visible (S/V) Notification Appliances

1. Are individually powered, addressed, and controlled from a Simplex fire alarm control panel IDNAC Signaling Line Circuit (SLC). S/V notification appliances use a multi-tapped speaker for audio/tone notification and a multi-candela strobe with synchronized 1 Hz flash rate (63 synchronized strobes maximum per NAC) and selectable candela rating.
2. Wiring supervision is electronically monitored and allows audio wiring to be T-tapped for class B wiring, reducing wiring costs and wiring distances.
3. Ceiling mount speaker visible appliances are available in 400 - 4000 Hz models and high fidelity models capable of operating between 200 – 10000 Hz.

4. Separate appliance and cover selection greatly simplifies the ordering and installation process.

E. Addressable Visual (Strobe) Only Notification Appliances (Wall and Ceiling Mounted)

1. TrueAlert ES addressable strobes are individually addressed visible notification appliances that receive power, supervision, and control signals from a Simplex fire alarm control panel providing IDNAC Signaling Line Circuits (SLCs).
2. Individually addressed and controlled multi-candela TrueAlert ES V/O (visible only) notification appliances provide:
3. Multi-candela xenon strobe with synchronized 1 Hz flash rate and with intensity *programmable from the control panel* or jumper selected as 15, 30, 75, 110, 135, or 185cd
4. Advanced addressable notification controlled by *IDNAC SLCs* providing *regulated 29 VDC* allowing strobes to operate with lower current even under battery backup
5. Wiring supervision to each appliance allowing “T-tapped” connections for Class B circuits to simplify wiring (Class A circuits require in/out wiring)
6. *Self-Test Mode* allows an on-board sensor to detect the strobe output and then report its status to the control panel

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. A pre-installation meeting shall be held prior to any installation work beginning. The meeting shall be held on-site. Coordinate with the Owner for a location. This meeting shall be conducted by the manufacturer’s installation service technician assigned to the job. The Contractor’s installation personnel shall be in attendance. The Owner’s personnel may choose to attend at their own discretion.

B. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

C. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:

1. Factory trained and certified personnel.
2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
3. Personnel licensed or certified by state or local authority.

3.02 WIRING AND RACEWAY INSTALLATION

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AH and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm

System Manufacturer.

C. Fire Alarm cable above suspended ceilings may be ran exposed but all cable shall be plenum rated. Cable shall be adequately supported to the building structure. Attachment to ceiling support wire or piping is not permitted.

D. Paint fire alarm system junction boxes covers red in concealed locations, e.g. above ceilings, and where exposed in mechanical/electrical spaces.

E. Where raceway is installed exposed in finished spaces it shall be painted to match the installation surface or as directed by the A/E/D or Owner.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:

1. Factory trained and certified.
2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
3. International Municipal Signal Association (IMSA) fire alarm certified.
4. Certified by a state or local authority.
5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pre-testing: Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

H. Final Test, Certificate of Completion, and Certificate of Occupancy:

I. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.04 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.05 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

B. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.

C. Schedule training with the Owner at least seven days in advance.

END OF SECTION 28 31 11.10

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SECTION 28 80 00 – VIDEO SECURITY SYSTEMS

PART 1 – GENERAL

1.01 SCOPE

A. This Section details the hardware and software to be used for the installation of a video security camera system on the Campus of Indiana State University and any remote properties owned or operated by Indiana State University. System shall be a fully installed and fully functional system. Indiana State University is currently standardized on Meraki cloud-based cameras in all buildings.

B. Contractor shall confirm video security plan with owner and designer at the start of each project.

C. Complete installation shall be to established industry standards and applicable Codes.

1.02 RELATED SECTIONS

A. Division 00 Bidding Requirements

B. Division 01 General Requirements

C. Division 26 Electrical

D. Division 27 Communications

1.03 SUBSTITUTIONS

A. There are no substitutions permitted for the Products listed here-in as these represent the ISU Campus Standard.

1.04 INSTALLER QUALIFICATIONS

A. A firm with at least five (5) years of successful installation experience on projects with video security system work similar to this project.

1.05 SUBMITTALS

A. Provide submittals of all hardware and software proposed for use on this Project.

B. All submittals shall be submitted electronically in PDF format.

1.06 WARRANTY

A. All hardware on this Project shall be fully warranted for a period of three (3) years for all parts and labor.

B. Warranty shall commence after start-up and Owner acceptance.

PART 2 – PRODUCTS

2.01 CAMERAS

A. All cameras, mounting hardware, and software licensing will be purchased by the owner and provided to the Contractor for installation.

B. On some projects the Owner and project design firm may work with camera manufacturers to specify other model numbers due to design considerations. Make sure to review the bid documents and drawings carefully before installing any cameras.

2.02 MOUNTS

1. Interior camera mounts as required shall be the camera brand mounts designed for the specific camera and mounting task required.
2. Exterior camera mounts, domes, heaters, and dehumidifiers as required shall be the camera brand designed for the specific camera, mounting task, and expected year around Indiana weather.
3. Camera mount arms will be provided by the owner as required.

2.03 CABLE/FIBER LENGTH REQUIREMENTS

A. If a camera is specified and cameras cable length will be over 300 feet Transition Networks E-TBT-FRL-05 Fiber Optic Media Converters for multi-mode fiber with ST connectors must be installed on fiber optic cable to the building data wiring center

2.04 CABLE

A. Camera cables and connectors shall all be the brands and models specified in Division 27 for data communications.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The Contractor shall install all cameras in their intended location and confirm proper functionality with the owner.

B. The Owner reserves the right to relocate camera locations up to 15’ before installation at no additional cost to the Owner.

C. All cable/wiring shall be properly labeled on both ends of each run as specified in Division 27 for data communications.

3.02 START-UP

A. The Contractor shall demonstrate to the Owner’s satisfaction the proper operation of every component of the installation.

3.03 PROJECT CONTACT

A. If you have any questions concerning these specifications, please contact:

Justin Hart
Unified Communications Services Assistant Director
Indiana State University
(812) 237-8067 | Justin.Hart@indstate.edu
Gillum Hall G006B
217 N. 6th Street
Terre Haute, IN 47809

END OF SECTION 28 80 00

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing site utilities and abandoning site utilities in place.
8. Temporary erosion and sedimentation control.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by owner.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities. Communicate all utility disconnections with Architect and Owner prior to shut off.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than seven days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated on Drawings in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones.
   3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove pavers and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 321726 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering and wear.
b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
1. Material: Cast-fiber-reinforced polymer concrete tile.
2. Color: Red brick.
3. Shapes and Sizes:

a. Rectangular panel, 24 by 24 inches.
b. Radius panel, nominal 24 inches deep by 6-foot outside radius.

4. Dome Spacing and Configuration: 1.67-inch spacing, in manufacturer's standard pattern.
5. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.4 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Cold milling of existing asphalt pavement.
4. Hot-mix asphalt patching.

B. Related Requirements:

1. Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.3 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Herbicide.
2. Paving geotextile.
3. Joint sealant.

B. Hot-Mix Asphalt Designs:

1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.

2. For each hot-mix asphalt design proposed for the Work.

C. Sustainable Design Submittals:
1. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 20 percent or more than 50 percent by weight.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer.

B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

1. Aggregates.
2. Asphalt binder.
3. Asphalt cement.
4. Cutback prime coat.
5. Emulsified asphalt prime coat.
6. Tack coat.
7. Fog seal.
8. Undersealing asphalt.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by INDOT.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the local municipality and INDOT for asphalt paving work.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D3910.

4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 binder designation PG 64-22.

B. Cutback Prime Coat: ASTM D2027/D2027M, medium-curing cutback asphalt, MC-30 or MC-70.

C. Emulsified Asphalt Prime Coat: ASTM D977 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires asphalt shingles or glass from sources and

gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.

C. Joint Sealant: ASTM D6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 10 percent or more than 50 percent by weight.

1. Surface Course Limit: Recycled content no more than 10 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods"; and complying with the following requirements:

1. Provide mixes meeting INDOT requirements with a history of satisfactory performance in geographical area where Project is located.
2. Aggregate Sub-Base: No. 53 Coarse Aggregate, INDOT Section 504.
3. Bituminous Base Course: #5D crushed stone in bituminous plant mix, INDOT Section 402.04 (b)(2).
4. Binder Course: No. 8 or 9 crushed stone in bituminous plant mix, INDOT Section 402.04 (b)(2).
5. Surface Course: No. 11 Crushed stone in bituminous plant mix, INDOT Section 402.04 (b)(2).

C. Emulsified-Asphalt Slurry: ASTM D3910, Type 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 1-1/2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
7. Handle milled asphalt material in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Single-Course Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

D. Placing Two-Course Patch Material: Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted layer of hot-mix asphalt surface course, finished flush with adjacent surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.11 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes Concrete Paving Including the Following:
   1. Curbs and gutters.
   2. Walks.

B. Related Requirements:
   1. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   2. Section 321713 "Parking Bumpers."
   3. Section 321723 "Pavement Markings."
   4. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Environmental Product Declaration: For each product.
   2. Health Product Declaration: For each product.
   3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
   4. Laboratory Test Reports: For concrete paving mixtures, documentation indicating that cured concrete complies with Solar Reflectance Index requirements.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from galvanized-steel wire into flat sheets.

C. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

D. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

E. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, Grade 60 deformed bars.

F. Plain-Steel Wire: ASTM A1064/A1064M, galvanized.

G. Deformed-Steel Wire: ASTM A1064/A1064M.

H. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

I. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

J. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

K. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

L. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 miles (160 km) of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, gray portland cement Type I/II.
2. Fly Ash: ASTM C618, Class C or Class F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M,, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water: Potable and complying with ASTM C94/C94M.

2.5 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.7 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

2.8 DETECTABLE WARNING MATERIALS

A. Detectable Warning Materials: see “321726 – Tactile Warning Surfacing” for requirements.

2.9 PARKING BUMPERS

A. Precast Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete; 4000-psi minimum compressive strength; 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
   1. Source Limitations: Obtain wheel stops from single source from single manufacturer.
   2. Surface Appearance: Smooth, free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.

3. Surface Sealer: Manufacturer's standard salt-resistant, clear sealer, applied at precasting location.
4. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 14-inch minimum length, hardware as standard with wheel-stop manufacturer.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 6 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

   1. Use water-reducing admixture high-range, water-reducing admixture high-range, water-reducing and retarding admixture plasticizing and retarding admixture in concrete as required for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd..

G. Concrete Mixtures: Normal-weight concrete.

   1. Compressive Strength (28 Days): 3500 psi.
   2. Maximum W/C Ratio at Point of Placement: 0.50.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
   4. Solar Reflectance (SR): Three-year-aged SR value of at least 0.28 or initial SR of at least 0.33.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 30 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints in Sand Matrix Finish areas where indicated: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
    b. In Sand Matrix finish areas provide 1/8-inch wide joint with 45 degree bevels on each side of joint totaling ¼” width.
    c. Contraction joints shall extend down face of curbs.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 SPECIAL FINISHES

A. Sand Matrix Finish

1. Where indicated, provide a light to medium sand textured finish utilizing chemical surface retarder power wash and acid etch per industry standards to achieve desired finish to match approved mock-up. Saw cut joints in concrete with an edging tool to a 1/4-inch (6-mm) 45° bevel.

2. Prepare surfaces according to manufacturer's written instructions and as follows:
   a. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   b. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
   c. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by acid etching. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
   d. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff. Waterborne stains are pH sensitive. Revise pH value or test method in subparagraph below
   e. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.

3.9 DETECTABLE WARNING INSTALLATION

A. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

3.10 WHEEL STOP INSTALLATION

A. Install wheel stops in accordance with manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring to substrate.

C. Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.12 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.14 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crafco Inc.
b. Pecora Corporation.
c. The Dow Chemical Company.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.

1.3 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.
1. Parking Lot Pavement-marking paint, latex.

B. Shop Drawings:

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of INDOT for pavement-marking work.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers for Parking Lot Markings: Subject to compliance with requirements, provide products by one of the following:

1. Aexcel Inc.
2. Benjamin Moore & Co.
3. Color Wheel Paints & Coatings.
4. Columbia Paint & Coatings.
5. Conco Paints.
6. Coronado Paint; Division of INSL-X Products Corporation.
7. Diamond Vogel Paints.
8. Dunn-Edwards Corporation.
9. Ennis Traffic Safety Solutions, Inc.
10. Frazee Paint.
11. General Paint.
12. Kwal Paint.
13. M.A.B. Paints.
14. McCormick Paints.
15. Miller Paint.
16. Parker Paint Mfg. Co. Inc.
17. PPG Industries.
18. Pratt & Lambert.
19. Rodda Paint Co.
20. Rohm and Haas Company; a subsidiary of The Dow Chemical Company.
21. Scott Paint Company.
22. Sherwin-Williams Company (The).

B. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.

1. Color: White for crosswalks, stop bars, pavement markings, and general parking lot striping, and Blue for ADA spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 321726 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering and wear.
b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
1. Material: Cast-fiber-reinforced polymer concrete tile.
2. Color: Red brick.
3. Shapes and Sizes:

a. Rectangular panel, 24 by 24 inches.
b. Radius panel, nominal 24 inches deep by 6-foot outside radius.

4. Dome Spacing and Configuration: 1.67-inch spacing, in manufacturer's standard pattern.
5. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.4 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 321816.13 - PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Unitary, seamless surfacing.
2. Organic loose-fill surfacing.

1.3 DEFINITIONS

A. Definitions in ASTM F2223 apply to Work of this Section.

B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."

C. SBR: Styrene-butadiene rubber.

D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of protective surfacing.

1. Include plans, sections, placement and penetration details, and attachment to substrates.
2. Include accessories and edge terminations.
3. Include patterns made by varying colors of surfacing.

4. Include fall heights and use zones for equipment and structures specified in Section 116800 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of accessories involving color selection.
2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches
3. Loose-Fill Surfacing: Minimum 1 quart
4. Drainage/Separation Geotextile: Minimum 12 by 12 inches

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each type of loose-fill surfacing.

C. Product Certificates: For each type of unitary surfacing product.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Reduction in impact attenuation as measured by reduction of critical fall height.
b. Deterioration of protective surfacing and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain protective surfacing materials, including loose-fill accessories, from single source from single manufacturer.

1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: Critical fall height tested according to ASTM F1292.

B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.3 UNITARY, SINGLE-DENSITY, SEAMLESS SURFACING

A. Description: Manufacturer's standard, site-mixed and applied, single-layer material in thickness as required, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GameTime; a PlayCore Company.
b. Playsafe Surfacing LLC.
c. SynLawn.
d. Approved Equal

2. Composition: Blend of SBR and EPDM rubber, particles and binder, forming a wearing and cushioning product.
3. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
4. Critical Height: As indicated on Drawings.
5. Overall Thickness: Not less than as required for critical height indicated or minimum 1-1/2 inches.
6. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
7. Color(s): As selected by Architect from manufacturer's full range.

2.4 ORGANIC LOOSE-FILL SURFACING

A. Engineered Wood Fiber: ASTM F2075; containing no bark, leaves, twigs, or foreign or toxic materials; tested for accessibility according to ASTM F1951.
   1. Uncompressed Material Depth: Not less than as required for critical height indicated or minimum 9 inches.

2.5 GEOSYNTHETIC ACCESSORIES

A. Drainage/Separation Geotextiles: Comply with Section 312000 "Earth Moving."

B. Weed-Control Barrier: Composite fabric geotextile consisting of woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, weighing not less than 4.8 oz./sq. yd.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
   1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
B. Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

3.3 INSTALLATION OF GEOSYNTHETIC ACCESSORIES

A. Install geosynthetic accessories before edging and according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions and in a manner that cannot become a tripping hazard.

3.4 INSTALLATION OF SEAMLESS SURFACING

A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
   1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
   2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
   3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
   4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with a minimum of cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
      a. Design: Where colored pattern is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
   5. Edge Treatment: Flush. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.5 INSTALLATION OF LOOSE-FILL SURFACING

A. Apply components of loose-fill surfacing according to manufacturer's written instructions to produce a uniform surface.
B. Loose Fill: Place loose-fill materials to required depth after installation of playground equipment support posts and foundations. Include manufacturer's recommended amount of additional material to offset natural compaction over time.
C. Grading: Uniformly grade loose fill to an even surface free from irregularities.
D. Compaction: After initial grading, mechanically compact loose fill before finish grading.
E. Finish Grading: Hand rake to a uniformly smooth finished surface and to required elevations.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests with the assistance of a factory-authorized service representative:
   1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
B. Playground protective surfacing will be considered defective if it does not pass tests.
C. Prepare test reports.

3.7 PROTECTION

A. Prevent traffic over surfacing for not less than 48 hours after installation.

END OF SECTION 321816.13

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.
3. Horizontal-slide gates

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate.

B. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of gate operators and controls.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

1. Design Wind Load: .
a. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.148 inch.

    a. Mesh Size: 2 inches.
    b. Zinc-Coated Fabric: ASTM A392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before weaving, where indicated.
    c. Polymer-Coated Fabric: ASTM F668, Class 1 or Class 2a over zinc-coated steel wire, where indicated.
        1) Color: Black, according to ASTM F934.
    d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Twisted top and knuckled bottom.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Light-Industrial-Strength Material: Group IC-L, round steel pipe, electric-resistance-welded pipe.

    a. Line Post: 2.375 inches in diameter.
    b. End, Corner, and Pull Posts: 4.0 inches.

3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F1043.

    a. Top Rail: 1.66 inches in diameter.

4. Brace Rails: ASTM F1043.
5. Metallic Coating for Steel Framework:

    a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. zinc coating according to ASTM A653/A653M.
    b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.

c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
e. Coatings: Any coating above.

6. Polymer coating over metallic coating.

a. Color: Match fence fabric, Galvanized or Black, according to ASTM F934.

2.4 TENSION WIRE

A. Polymer-Coated Steel Wire: 0.148-inch- diameter, tension wire according to ASTM F1664, Class 1 or Class 2a over zinc-coated steel wire.

1. Color: Match fence fabric, Galvanized or Black, according to ASTM F934.

2.5 SWING GATES

A. General: ASTM F900 for gate posts and single and double swing gate types.

1. Gate Leaf Width: As indicated on drawings.
2. Framework Member Sizes and Strength: Based on gate fabric height as indicated on drawings.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.6 FITTINGS

A. Provide fittings according to ASTM F626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish: match fence fabric as indicated.

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

a. Polymer coating over metallic coating.

b. Zinc coated galvanized fencing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 96 inches o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install

tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along bottom of fence fabric. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.6 TOP RAIL COVER

A. Install top rail cover to fences and gates where indicated on drawings per manufacturer's instructions.

END OF SECTION 323113

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Decorative aluminum fences.
   2. Swing gates

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for concrete and post concrete fill.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each fence material and for each color specified.

   1. Provide Samples 12 inches in length for linear materials.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For decorative metallic-coated-steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE ALUMINUM FENCES

A. Decorative Aluminum Fences: Fences made from aluminum extrusions.

1. Basis of Design Product: Ameristar, Echelon Plus with Majestic top rail, or approved equal.

B. Posts: Square extruded tubes.

1. Line Posts: 3 by 3 inches with 0.120-inch wall thickness.
2. End and Corner Posts: 3 by 3 inches with 0.120-inch wall thickness.

C. Post Caps: Aluminum castings that project at least 1/4 inch beyond posts.

D. Rails: Extruded-aluminum channels, 1-3/4 by 1-3/4 inches, with 0.070-inch-thick sidewalls and 0.062-inch-thick top.

E. Pickets: Extruded-aluminum tubes, 1 inch square, with 0.062-inch wall thickness.

1. Terminate tops of pickets at top rail for flush top appearance equal to bases of design product.
2. Picket Spacing: 4 inches clear, maximum.

F. Fasteners: Manufacturer's standard concealed fastening system.

G. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers.

H. Fabrication: Assemble fences into sections by welding or fastening pickets to rails.

1. Fabricate sections with clips welded to rails for field fastening to posts.
2. Drill clips for fasteners before finishing.

I. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

J. Finish: Baked enamel or powder coating.

2.3 SWING GATES

A. Basis of Design Product: Ameristar, Echelon Plus with Majestic top rail, or approved equal.

B. Gate Configuration: As indicated

C. Gate Frame Height: As indicated

D. Gate Opening Width: As indicated

E. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 2 by 2 inches with 0.250-inch wall thickness

F. Frame Corner Construction: Welded

G. Additional Rails: Provide as indicated, complying with requirements for fence rails.

H. Infill: Comply with requirements for adjacent fence.

I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

J. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops for pairs of gates. Fabricate latches with integral eye openings for padlocking; Padlock accessible from both sides of gate.

2.4 ALUMINUM

A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.

B. Extrusions: ASTM B 221, Alloy 6063-T5.

C. Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

D. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

E. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

F. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Black, per manufacturer’s standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Space posts uniformly at 6 feet o.c.

3.4 GATE INTSALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 323119

SECTION 329113 - SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes planting soils specified by composition of the mixes.

B. Related Requirements:
   1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
   2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
   3. Section 329300 "Plants" for placing planting soil for plantings.

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.
b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Health Product Declaration: For each product.
3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.7 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.8 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

    a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
    b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.

9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inchdepth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inchdepth of soil.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Regional Materials: Imported soil manufactured planting soil and soil amendments and fertilizers shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Planting-Soil Type: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in quantities recommended by soils testing reports to produce suitable planting soil for long term health of lawns and plants.

C. Planting-Soil Type: Imported, naturally formed soil from off-site sources and consisting of sandy loam or silt loam soil according to USDA textures; and modified to produce viable planting soil.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 6 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
3. Unacceptable Properties: Clean soil of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

4. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in quantities recommended by soils testing reports to produce suitable planting soil for long term health of lawns and plants.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
3. Form: Provide lime in form of ground dolomitic limestone or calcitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

E. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Feedstock: Limited to leaves and may include animal waste.
2. Reaction: pH of 5.5 to 8.
3. Soluble-Salt Concentration: Less than 4 dS/m.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 50 to 60 percent of dry weight.
6. Particle Size: Minimum of 98 percent passing through a 1-inch sieve.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.5 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth indicated on Drawings, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

a. Mix lime and sulfur with dry soil before mixing fertilizer.
b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698 and tested in-place.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of of 12 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime and sulfur with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Application: Apply compost component of planting-soil mix minimum of 2 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Construction Manager may engage a qualified testing agency to perform tests and inspections.

B. Soil will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.7 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.8 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Turf renovation.
3. Erosion-control material(s).

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:

a. Landscape Industry Certified Technician - Exterior.
b. Landscape Industry Certified Lawn Care Manager.
c. Landscape Industry Certified Lawn Care Technician.

5. Pesticide Applicator: State licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.7 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15 to May 30.

2. Fall Planting: September 1 to October 15.

3. Seeding shall not take place between June 1 and September 1 or between October 16 and March 14 without prior written approval.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
1. Quality: Seed of grass species as listed below for solar exposure, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

2. Sun and Partial Shade: Proportioned by weight as follows:
   a. 85% Turf Type Tall Fescue, blend of equal quantities of 3 premium varieties.
   b. 15% Bluegrass, premium variety.

2.2 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

   1. Organic Matter Content: 50 to 60 percent of dry weight.
   2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.4 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 4-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade, blend planting soil in place.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft..

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 TURF RENOVATION

A. Renovate existing turf where indicated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.7 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow turf to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Landscape edgings.

B. Related Requirements:
1. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

B. Samples for Verification: For each of the following:
1. Organic Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
2. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
3. Weed Control Barrier: 12 by 12 inches.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Interior.
    c. Landscape Industry Certified Horticultural Technician.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not

bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during periods appropriate for plant species and per standard nursery practices. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization and edgings.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of Substantial Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram or 10-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 2 inches maximum, 1/2 inch minimum Insert dimensions.
3. Color: Natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.4 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
7. Maintain supervision of excavations during working hours.
8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: with Planting soil..
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Two per plant or Three for each caliper inch of plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Two per plant or Three for each caliper inch of plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.8 PLANTING AREA MULCHING

A. Install weed-control barriers in all areas to receive mineral mulch only. Install before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.
3. Mineral Mulch in Planting Areas: Apply 3-inch average thickness of mineral mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.9 EDGING INSTALLATION

A. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch-deep, shovel-cut edge as indicated on Drawings.

3.10 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.12 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
2. Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
3. Species of Replacement Trees: Species selected by Architect.

3.13 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.14 MAINTENANCE SERVICE

A. Maintenance Service for Trees, Shrubs and Groundcovers: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 329300