

PROJECT MANUAL FOR

VIGO COUNTY PARKS AND RECREATION DEPARTMENT
GRIFFIN BIKE PARK CLUBHOUSE
10700 BONO ROAD, TERRE HAUTE, IN 47802



VIGO COUNTY
PARKS & RECREATION
DEPARTMENT

VIGO COUNTY PARKS AND RECREATION DEPARTMENT

ADAM GROSSMAN, SUPERINTENDENT



GRIFFIN BIKE PARK
RICH MOORE, MANAGER



PREPARED BY:
SANDERS AND ASSOCIATES INC.
AMANDA JUKES, AIA

November 12, 2024

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The bid packets items A-U and Appendix A, are available at Rapid Reproductions, Inc. 129 S. 11th St. Terre Haute, IN Phone: 812-238-1681 or at www.sandersandassocplanroom.com.

ITEMS V- EE are not included. These items are Standard AIA Documents (Most current editions) and may be examined at the Architect's office.

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Drawings: Refer to Drawing T-1 for an index to drawings.

INVITATION TO BID

The *Vigo County Parks and Recreation Department* will receive sealed bids for the construction of a clubhouse facility for Griffin Bike Park to be located at 10700 Bono Road, Terre Haute, Indiana until 10:00 AM on the 18th day of December 2024, at the office of the *Vigo County Auditor* located in the Vigo County Annex at 131 Oak Street, Terre Haute, Indiana at which time and place all bids will be publicly opened and read aloud.

Bids will be received on the basis of a single lump sum and alternates for complete construction as described in the Instructions to Bidders. The work is to include all labor, materials, equipment, tools and appliances, transportation, all applicable taxes, permits and everything required for the entire performance and completion of the work in every detail.

All work shall be in strict accordance with this Invitation to Bid and the bidding Contract Documents as prepared by Sanders & Associates, Inc. Any bids received after the above specified time and date will be returned to bidders unopened. Bids shall be accompanied by the General Contractor's Proposal Contents as stated in the specifications.

Bidding and Contract Documents including Drawings and Specifications may be examined in the office of the Architect, Sanders & Associates, Inc., 500 South 7th St., Terre Haute, Indiana, 47807, (812) 232-5256, or at www.Sandersandassocplanroom.com.

Plans and specifications will be available for distribution November 15th, 2024. The plans and specifications must be purchased directly from Rapid Reproductions, 129 S. 11th St., Terre Haute, IN 47807, with no deposit required, or online at www.Sandersandassocplanroom.com. No bids shall be withdrawn for a period of sixty-(60) calendar days after the bid opening without written consent of the Architect.

Do not include sales tax in the bid amount. The Owner is exempt from payment of Indiana Sales Tax and Use Tax. The Owner will furnish the contractor with the necessary exemption number upon request.

A certified check or bank draft, payable to the order of the *Vigo County Parks and Recreation Department* negotiable U.S. Government Bonds (at par value), or a satisfactory Bid Bond executed by the Bidder and acceptable surety, in an amount equal to five percent (5%) of the total amount of the bid shall be submitted with each bid.

Bid Guaranty will be returned to unsuccessful bidders upon selection of the successful bidder. Bid Guaranty of the successful bidder will be returned upon the signing of contracts. Bids may be held not to exceed sixty-(60) days from the date of Bid Opening for the purpose of reviewing the Bids and investigating the qualifications of the Bidders, prior to the award of a Contract.

Contractor receiving award shall furnish at the directive of the Owner, an approved Performance Bond, Labor and Material Payment Bond in an amount at least equal to 100% of the contract amount.

The bidders are requested to meet with the Owner and Architect for a pre-bid conference at the project location (10700 Bono Road, Terre Haute, IN) on Tuesday, December 3rd at 10:00 AM local time. Contractors shall be aware that this project is covered under the provisions of the Davis-Bacon Prevailing Wages Act. All laborers and mechanics shall be paid at a minimum according to the prevailing wages indicated in the Wage Decision.

The Contractor must ensure that all employees and applicants for employment are not discriminated against because of their race, religion, color, sex, national origin, or individuals with handicaps. Women and Minority Owned Businesses qualified to perform the work contemplated by this solicitation are encouraged to bid.

The time completion of the project shall be **365 days** after the notice to proceed. The *Vigo County Parks and Recreation Department* reserves the right to reject any or all bids or waive any informality in the bidding to the extent permitted by law.

Each bid must be enclosed in a sealed envelope marked:

Bid For: Griffin Bike Park Clubhouse
Bid opening December 18, 2024 at 10:00 AM
"Name and Address of Bidder"

Agent: Amanda Jukes, Architect
Sanders & Associates, Inc.
500 South 7th Street
Terre Haute, IN 47807
812-232-5256

Dated this 12th day of November

INSTRUCTIONS TO BIDDERS

1. SECURING DOCUMENTS

Copies of the proposed Contract Documents are on file at the following offices:

Architect:
Sanders & Associates, Inc.
500 South 7th Street
Terre Haute, IN 47807

The bid packets, plans and specifications are available online at www.sandersandassocplanroom.com, or at Rapid Reproductions, Inc. 129 S. 11th St., Terre Haute, IN (Phone # 812-238-1681)

Copies of the proposed Contract Documents may be obtained for bidding purposes upon the conditions set forth in the Invitation to Bid.

2. BID FORM

In order to receive consideration, make all bids in strict accordance with the following:

- 1) Make bids upon the forms provided therefore, with bids as shown properly executed and with all items filled out. Do not change the wording of the Bid Form, and do not add words to the wording of the Bid Form. Unauthorized conditions, limitations or provisions attached to the proposal shall be cause for rejection of the proposal. Alterations by erasure or interlineation must be explained or noted in the bid over the signature of the bidder.
- 2) No telegraphic bid or telegraphic modification of bid will be considered. No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the sender unopened.
- 3) Each bid shall be addressed to the Owner, and shall be delivered to the Owner at the address given on or before the day and hour set for opening of the bids. Each bid shall be enclosed in a sealed envelope bearing the title of the work, 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 his bid is received on time.

3. EXAMINATION OF DRAWINGS, SPECIFICATIONS, AND SITE OF WORK

Before submitting a bid, each bidder shall carefully examine the Drawings, READ the Specifications and all other proposed Contract Documents, and visit the site of the Work. Each bidder shall fully inform himself prior to bidding as to all existing conditions and limitations under which the Work is to be performed, and he shall include in his bid a sum to cover all costs of all items necessary to perform the work as set forth in the proposed Contract Documents. No allowances will be made to any bidder because of

lack of such examination or knowledge. The submission of a bid will be construed as conclusive evidence that the bidder has made such examination.

4. WITHDRAWAL OF BIDS

Any bidder may withdraw his bid, either personally or by written request, at any time prior to the scheduled time for opening bids. No bidder may withdraw his bid for a period of 60 days after the date set for opening thereof, and all bids shall be subject to acceptance by the Owner during this period.

5. AWARD OR REJECTION OF BIDS

The Contract will be awarded based on the low bid. The Owner also reserves the right to reject the Bid of any bidder who has previously failed to perform properly, or in a timely manner, or to complete an item, contracts of similar nature, who is not in a position to perform the Contract, or who has habitually and without just cause neglected the payment of bills or otherwise disregarded his obligations to subcontractors, materialmen, or employees. The Contract is intended to be awarded to the apparent and best low bidder. In the case of the acceptance of any alternates, it will be the lowest net or aggregate including the alternates that the Owner accepts. The Owner reserves the right to accept any bid and to waive any formalities.

6. EXECUTION OF AGREEMENT

The form of Agreement which the successful bidder, as Contractor, will be required to execute, is included in the Project Manual:

- 1) The bidder to whom the contract is awarded by the Owner shall, within 7 days after notice of award and receipt of Agreement form from the Owner, sign and deliver to the Architect all required copies.
- 2) At or prior to delivery of the signed Agreement, the Contractor shall deliver to the Architect the policies of insurance certificates as required by the Contract Documents. All bonds and policies of insurance shall be approved by the Owner before the successful bidder may proceed with the work.
- 3) Failure or refusal to furnish bonds or insurance policies or certificates in a form satisfactory to the Owner shall subject the bidder to loss of time from the allowable construction period equal to the time delay in furnishing the required material.

7. INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the proposed Contract Documents, or finds discrepancies in or omissions from any part of the proposed Contract Documents, he may submit to the Architect a written request for interpretation thereof not later than five days before bids will be opened.

- 1) The person submitting the request shall be responsible for its prompt delivery.
- 2) Interpretation or correction of proposed Contract Documents will be made only by Addendum, and will be mailed or delivered to each bidder of record. All Addenda will be a part of the Contract.
- 3) The Owner will not be responsible for any other explanations or interpretations of the proposed Documents.

8. CONSTRUCTION TIME AND LIQUIDATED DAMAGES

The Agreement will include a stipulation that work be completed in **365 days**. The Agreement will also include a stipulation that liquidated damages will be established in the amount of \$100.00 per calendar day after the completion date that the work is not fully completed and certificate of occupancy issued.

9. PERFORMANCE BOND

A performance and payment bond in a penal sum of 100 percent of the contract price; or as may be required or permitted by State law, or an irrevocable line of credit listing *Vigo County Parks and Recreation Department* as the sole beneficiary for 25% of the total construction contract. The line of credit must be issued for the entire construction period plus one (1) year following construction completion.

10. COMPLETION OF SPECIFICATIONS AND PLANS

Upon issue to prospective bidders the physical make-up and content of the plans, specifications and extra proposal forms are intended to be complete for preparing and submitting of proposals. However, the bidder will verify to his own satisfaction that all material issued him is complete. Should he discover that a page, sheet, etc., is missing, he shall notify the Architect in writing and it will be forwarded to him. After bids have been submitted, no claim of ignorance of the requirements of bidding or of construction due to such missing material will be recognized.

11. PROPOSAL CONTENTS

All bids shall include properly executed forms from the general contractor as follows:

- 1) Bid Security
 - 2) Bid Form & Attachment
 - 3) Non-Collusion Affidavits*
 - 4) EEO Certificates*
 - 5) Drug Free Work Place Certification*
 - 6) Anti-Lobbying Certificates*
 - 7) Non-Segregated Facilities*
 - 8) Proposed List of Subcontractors
- * All subcontractors shall submit these forms before the Notice to Proceed is issued.

12. WAGES

Attention of bidders is called to the fact that no less than minimum salaries and wages must be paid on this project.

13. PRE-BID MEETING

A Pre-Bid meeting will be at Griffin Bike Park, 10700 Bono Road, Terre Haute, IN on Tuesday, December 3, 2024 at 10:00 AM local time.

BID FORM ATTACHMENT

*VIGO COUNTY PARKS AND RECREATION DEPARTMENT
GRIFFIN BIKE PARK CLUBHOUSE
10700 BONO ROAD, TERRE HAUTE, IN 47802*

Bidding Contractors:

1. Pursuant to and in compliance with the invitation to bid and the proposed Contract Documents relating to Project, including any addenda, the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with the local conditions affecting the performance and costs of the work at the places where the work is to be completed, and having inspected the sites in all particulars, hereby purpuses and agrees to fully perform the work within the time stated and in strict accordance with the proposed Contract Documents, including furnishing any and all labor and materials, and to do all of the work required to construct and complete said work in accordance with the Contract Documents, for the following sum of money:
2. I understand that the Owner reserves the right to reject this bid, but that this bid shall remain open and not be withdrawn for a period of sixty days from the date prescribed for its opening.
3. If written notice of the acceptance of this bid is mailed or delivered to the undersigned within thirty days after the date set for the opening of this bid, or at any other time thereafter before it is withdrawn, the undersigned will execute and deliver the Contract Documents to the Architect in accordance with this bid as accepted, and will also furnish and deliver to the Architect, Proof of Insurance Coverage within seven days after personal delivery or after deposit in the mails of the notification of acceptance of this bid.
4. If awarded a contract under this proposal, the undersigned agrees to start work within seven (7) days of the contract signing, Notice of Acceptance, or request for additional information, may be addressed to the undersigned at the address set forth below:

ADDENDA CONFIRMATION

Bidder here with acknowledges receipt and has incorporated the provisions of the following addenda in this bid.

<u>Addendum Number</u>	<u>Date</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

BID FORM

BASE BID:

CONSTRUCTION OF GRIFFIN BIKE PARK CLUBHOUSE:

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

ALTERNATES:

1. OMIT BIKE STORAGE (ROOM 100)

_____ – (DEDUCT)

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

2. OMIT COVERED PORCH (ROOM 110)

_____ – (DEDUCT)

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

3. OMIT KITCHEN CABINETS & COUNTERTOPS

_____ – (DEDUCT)

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

4. ASPHALT SHINGLES IN LIEU OF METAL ROOF

_____ – (DEDUCT)

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

5. A.C.T. IN LIEU OF ACOUSTIC CEILING PANELS

_____ – (DEDUCT)

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

6. SEALED CONCRETE IN LIEU OF LVT FLOORING

_____ – (DEDUCT)

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

**UNIT PRICES:
SQUARE FOOT OF EXTERIOR CONCRETE
- (ADD)**

COMPLETE CONSTRUCTION BID (IN WRITING)

(IN FIGURES)

Date _____, 2024

(Firm Name)

Official Address:

_____ By: _____

_____ Title: _____

Phone: _____



CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R / 9-10) / Form 96 (Revised 2010)

Prescribed by State Board of Accounts

PART I

(To be completed for all bids. Please type or print)

Date (month, day, year): _____

1. Governmental Unit (Owner): _____

2. County : _____

3. Bidder (Firm): _____

Address: _____

City/State/ZIPcode: _____

4. Telephone Number: _____

5. Agent of Bidder (if applicable): _____

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of _____

(Governmental Unit) in accordance with plans and specifications prepared by _____

_____ and dated _____ for the sum of

_____ \$ _____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS

(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

ACCEPTANCE

The above bid is accepted this _____ day of _____, _____, subject to the following conditions: _____

Contracting Authority Members:

PART II

(For projects of \$100,000 or more – IC 36-1-12-4)

Governmental Unit: _____

Bidder (Firm) _____

Date (month, day, year): _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

- 1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

- 2. What public works projects are now in process of construction by your organization?

Contract Amount	Class of Work	Expected Completion Date	Name and Address of Owner

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

4. List references from private firms for which you have performed work.

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

SUPPLEMENTAL GENERAL CONDITIONS

1. *COPIES OF DOCUMENTS,*

2. *INSURANCE AND BONDS, ARTICLE 11, ADD THE FOLLOWING PARAGRAPHS:*

A. The Contractor shall not commence work under this contract until he has 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 and approved. 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 Contractor shall furnish the Owner with satisfactory evidence of the insurance required.

C. All policies and/or policy certificates shall contain the following clauses:

1. **Worker's Compensation Insurance:** The Contractor shall maintain during the life of this contract Worker's Compensation Insurance for all employees employed at the site of the project, and, in case any work is sublet, the Contractor must require the Subcontractor similarly to provide Worker's Compensation Insurance for all of his employees engaged in work under this contract at the site of the project. The Contractor shall provide insurance coverage equal to that provided under the Worker's Compensation Act, for the protection of his employees not otherwise protected. Employer's liability coverage must be maintained in amount not less than 100,000/500,000/100,000.
2. **Public Liability Property Damage:** The Contractor shall maintain during the life of this contract Commercial General Liability Insurance. Such coverage shall protect him and any Subcontractor performing work covered by this contract, from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which may arise from operations under this contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall be as follows:

Commercial General Liability Insurance in an amount not less than \$1,000,000 per occurrence for Bodily Injury, Property Damage, Personal and Advertising Injury with a \$1,000,000 general aggregate and a \$1,000,000 Products and Completed Operations aggregate.

The Contractor shall require all of its Subcontractors, if not protected under Contractor's insurance policies, to effect and maintain, at their own expense during the entire period of performance and until completion of the subcontract, Commercial General Liability Insurance with a company or companies to the satisfaction of the Owner as follows:

- a. Commercial General Liability Insurance in an amount not less than \$1,000,000 per occurrences for Bodily Injury, Property Damage, or accidental death with a \$1,000,000 general aggregate and a \$1,000,000 Products and Completed Operations aggregate.
 - b. Special hazards not covered under the Commercial General Liability Insurance must be covered on a policy within the amounts as required above.
3. Business Auto Insurance: The Contractor and all Subcontractors shall at all times during the life of this contract, and any other subcontracts, maintain at their own expense, respectively, business auto insurance covering all liability and claims arising from the use and operation, anywhere in the United States, in connection with the performance of the Contract of Subcontracts of automobiles, whether such are owner, hired, or non-owned by the Contractor or Subcontractors. 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: The Contractor and all Subcontractors shall maintain during the life of this contract, Umbrella Liability Insurance providing excess coverage over the above specified primary insurance in an amount not less than:
 - a. \$1,000,000 for contracts UNDER \$100,000.00
 - b. \$2,000,000 for contracts OVER \$100,000.00
5. Additional Insurance Requirements: The Contractor and all Subcontractors in connection with the above mentioned Worker's Compensation Insurance shall furnish to the Owner a Compensation Board showing that such insurance is in full force and effect.

With regard to the above mentioned General Liability Insurance, if in the event of any major change or cancellation of such policy, the Contractor and all Subcontractors shall give a 30 day advance notice to the Owner.

Also, the Contractor and all Subcontractors shall make the Owner, as stated in the "Instruction to Bidders", additional insured on their Business Auto and General Liability policies with regard to this Contract.

The Contractor and all Subcontractors shall be required to furnish to the Owner duly executed certificates of insurance showing that all insurance policies required under this contract have been issued and are in full force and effect at all times during the life of this contract and have named the Owner, as stated in the "Instruction to Bidders", additional Insured. These certificates are to include General Liability, including contractual coverage, Business Auto, and Umbrella Liability.

The “Contractor will name the Owner, and any other parties specified, as an “Additional Insured” under the Commercial General Liability Policy. This “Additional Insured” coverage shall be on Form CG2010, or its equivalent, including “completed operations” coverage. The “Additional Insured” coverage provided to the Owner shall be primary coverage, and non contributory as respects the Owners Liability policy.

6. Loss or Damage: The *Owner* will obtain all Builders Risk Insurance Policies for this project.
7. Indemnification: To the fullest extent permitted by law, the Subcontractor expressly agrees to defend (at Subcontractor’s expense and with counsel acceptable to the Contractor), indemnify, and hold harmless Owner, Contractor, Architect, Architect’s Consultants, Engineer, Construction Manager, Lender, and any other parties which Contractor has agreed to indemnify as named or referenced in the project contract documents as attached to and made a part of this Subcontract, and their respective Officers, Directors, Shareholders, Employees, Agents, Successors, Affiliates, and assigns from and against any and all claims, suits, losses, causes of action, damages, liabilities, fines, penalties and expenses of any kind whatsoever, including without limitation arbitration or court costs and attorney’s fees, arising on account of or in connection with injuries to or the death of any person, or any and all damages to property including loss of use, from or in any manner connected with the work performed by or for the Subcontractor under this Subcontract, caused in whole or in part by the presence of the person or property or the negligent acts or omissions of 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 paragraph. The defense and indemnification obligations under this Subcontract agreement shall not be restricted in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Subcontractor under workers’ compensation acts, disability benefits acts, or other employee benefits acts, and shall extend to and include any actions brought by or in the name of any employee of the Subcontractor or any third party to whom Subcontractor may subcontract a part or all of the work.

SUBCONTRACTORS:

- A. Prior to the awarding of the Contract, the contractor shall submit to the Owner, in writing, the names of the proposed Subcontractors and major material vendors, the Contractor shall furnish the Owner with full information concerning the proposed Subcontractor’s ability and qualifications at the time such Subcontractor is submitted for approval.
- B. The Contractor shall be responsible for the acts and omissions of his Subcontractors and of persons wither 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.

3. *TAXES, ARTICLE 3.6 ADD THE FOLLOWING PARAGRAPH:*

The Contractor shall pay all unemployment, social security, and other such taxes imposed by local, state, or federal government. The Owner is NOT subject to Indiana Retail Sales Tax and Federal Excise Tax, these taxes should Not be included in the Contractor's bid.

4. *PROTECTION AND SAFETY, ARTICLE 10*

OCCUPATIONAL SAFETY AND HEALTH ACTS:

The construction documents, and the joint and several phases of construction hereby contemplated are to be governed at all times by the applicable provisions of the state and federal laws included, but not limited to, the latest amendments of the following:

1. Indiana Occupational Safety and Health Act.
2. Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 81-596; Part 1910-Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations; Part 1518-Safety and Health Regulations for Construction, Chapter XVII of Title 29, Code of Federal Regulations.

The Contractor shall assume full responsibility for health and safety at the construction site, including, but not limited to, the above mentioned laws and regulations.

5. *PAYMENTS TO CONTRACTOR AND COMPLETION, ARTICLE 9, ADD THE FOLLOWING PARAGRAPH:*

Progress payments will be made monthly based on an approved Application for Payment, and will include work completed, as well as payment on material and equipment delivered and suitably stored at the site, less retainer of 10% of the amount of each, less the aggregate of previous payments in each case. Contractor must include with application, proof of purchase and delivery of material and equipment stored.

6. *SHOP DRAWINGS AND SAMPLES, ARTICLE 3.12, ADD THE FOLLOWING PARAGRAPHS:*

See Section 01300 Submittals and Section 01340 Shop Drawings, Product Data, & Samples for information on these items. No material shall be delivered to the project until final approved shop drawings are in the hands of the Owner and Architect and no shop drawings shall be used on the project that do not bear the Architect's stamp of approval.

7. *EQUAL EMPLOYMENT OPPORTUNITY:*

Attention of Bidders is particularly called to the requirement for ensuring that employees and applicants for employment are not discriminated against because of their race, creed, color, sex or national origin.

CONTRACTOR'S NON-COLLUSION AFFIDAVIT

The Bidder, by its officers and _____ agents or representatives present at the time of filling this bid, being duly sworn, on their oaths, say 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 offer of the State of Indiana whereby such affiant or affiants or either of them, has paid or is to pay such other bidder or public officer any sum of money, or has given or is to give such other bidder or public officer anything of value whatever, or such affiant or affiants 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 the letting of the contract sought for by the attached bids; that no inducement of any form or character other than that which appears up on 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.

FIRM NAME

*OWNER-PRESIDENT-PARTNER

PARTNER-VICE PRESIDENT AND/OR
SECRETARY/TREASURER

PARTNER

Subscribed and sworn to before me this ____ Day of _____ 20__

Public Notary (signature) _____

(print) _____

Commission expires: _____ Country of Residence: _____

This form **must be signed by the same person(s) who sign(s) the bid.*

SUBCONTRACTOR'S NON-COLLUSION AFFIDAVIT

State of _____
County of _____

_____, being first duly shown, deposes and says that:

- 1) He/She is _____ of _____.
Hereinafter referred to as the "Subcontractor";
- 2) He/She is fully informed respecting the preparation and contents of the subcontractor's Proposal submitted to the subcontractor to _____, the Contractor for certain work in connection with the _____ Contract pertaining to the Project in _____;
- 3) Such subcontractor's Proposal is genuine and is not a collusive or sham proposal;
- 4) Neither the subcontractor nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived, or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Proposal in connection with such contractor or to refrain from submitting a Proposal in connection with such contract, or has in any manner, directly or indirectly, sought by unlawful agreement or connivance with any other Bidder, firm or person to fix the price or prices in said subcontractor's Proposal, or to secure through collusion, conspiracy, connivance or unlawful agreement any advantage against the _____ and _____
- 5) The price or prices quoted in the subcontractor's Proposal are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owner, employees, or parties in interest, including this affiant.

SIGNATURE

Subscribed and sworn to before me this ____ Day of _____ 20__

Public Notary (signature) _____

(print) _____

Commission expires: _____

Country of Residence: _____

**REQUIRMENT FOR AFFIRMATIVE ACTION TO ENSURE
EQUAL EMPLOYMENT OPPORTUNITY**

Executive Order 11246

1. The Offeror's or Bidders' attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, and as follows:

Timetable	Goals for minority participation in each trade	Goals for female participation in each trade
Until Further Notice	3.1	6.9

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR part 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting for this solicitation. The notification shall list the name, address, and telephone number of the subcontractor, employer identification number of the subcontractor, estimated dollar amount of the subcontract, estimated starting and completion dates of the subcontract, and the geographical area in which the subcontract is to be performed.
4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is coextensive with the political jurisdiction of the City of Terre Haute, Indiana.

CONTRACTOR
EQUAL EMPLOYMENT OPPORTUNITY

Executive Order 11246

(30 F.R. 12319-25)

Sec. 202. Except in contracts exempted in accordance with Section 204 of this order, all Government contracting agencies shall include in every Government contract hereafter entered into the following provisions:

“During the performance of this contract, the contractor agrees as follows:

- 1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination, rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in a conspicuous place, available to employees and applicants for employment, notices to be provided by the contracting offer setting forth the provision of this nondiscrimination clause.
- 2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
- 3) The contractor will send to each labor union or representative of workers with which he/she has collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union of workers’ representative of the contractors’ commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 4) The contractor will comply with all provisions of Executive Order No. 1124 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 5) The contract will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor for purposes of investigation to ascertain compliance with each rule, regulation and order.
- 6) In the event of the contractor’s non-compliance with the nondiscrimination clauses of the contract or with any such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or part, the contractor may be declared ineligible for Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7) The contract will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor pursuant to Section 202 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions including sanctions for non-compliance; Provided however, that in the event the contractor becomes involved in, or is threatened with, litigation with a sub-contractor or vendor as a result of such direction by the Department, the contractor may request the United States to enter into such litigation to protect the interest of the United States.

THIS COMPANY WILL COMPLY WITH THE PROVISIONS OF SECTIONS 202 OF EXECUTIVE ORDER 11246

Name of Firm: _____

Address: _____

Signature: _____

Printed: _____

Date: _____

SUBCONTRACTOR
EQUAL EMPLOYMENT OPPORTUNITY

Executive Order 11246

(30 F.R. 12319-25)

Sec. 202. Except in contracts exempted in accordance with Section 204 of this order, all Government contracting agencies shall include in every Government contract hereafter entered into the following provisions:

“During the performance of this contract, the contractor agrees as follows:

- 1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination, rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in a conspicuous place, available to employees and applicants for employment, notices to be provided by the contracting offer setting forth the provision of this nondiscrimination clause.
- 2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
- 3) The contractor will send to each labor union or representative of workers with which he/she has collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union of workers’ representative of the contractors’ commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 4) The contractor will comply with all provisions of Executive Order No. 1124 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 5) The contract will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor for purposes of investigation to ascertain compliance with each rule, regulation and order.
- 6) In the event of the contractor’s non-compliance with the nondiscrimination clauses of the contract or with any such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or part, the contractor may be declared ineligible for Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7) The contract will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor pursuant to Section 202 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions including sanctions for non-compliance; Provided however, that in the event the contractor becomes involved in, or is threatened with, litigation with a sub-contractor or vendor as a result of such direction by the Department, the contractor may request the United States to enter into such litigation to protect the interest of the United States.

THIS COMPANY WILL COMPLY WITH THE PROVISIONS OF SECTIONS 202 OF EXECUTIVE ORDER 11246

Name of Firm: _____

Address: _____

Signature: _____

Printed: _____

Date: _____

**CONTRACTOR'S CERTIFICATE REGARDING
DRUG-FREE WORK PLACE**

The Contractor certifies that it will provide a drug-free workplace by:

1. Publishing a Statement notifying employees that the unlawful manufacture, distribution, dispensing, possession; or use of a controlled substance is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violation of such prohibition.
2. Establishing an ongoing drug-free awareness program to inform employee about:
 - a. The dangers of drug abuse in the workplace
 - b. The Contractor's policy of maintaining a drug-free workplace
 - c. Any available drug counseling, rehabilitation, and employee assistance programs
 - d. The penalties that may be imposed upon employees for drug abuse violation occurring in the workplace
3. Giving each employee to be engaged in the performance of work on this contract a copy of the above required statement.
4. Notifying the employee in the required Statement that, as a condition of employment on this Contract, the employee will:
 - a. Abide by the terms of the Statement; and
 - b. Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.
5. Notifying the Contracting Officer in writing, within ten calendar days after receiving notice under subparagraph 4 (b) from an employee of otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every Contracting Officer or other designee on whose Contract activity the convicted employee was working. Notice shall include the identification number (s) of the Contract of funding Grant.
6. Taking one of the following actions, within 30 calendar days of receiving notice under paragraph 4 (b), with respect to any employee who is so convicted –
 - a. Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended, or
 - b. Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purpose by a Federal, State, or local health, law enforcement, or other appropriate agency.

DATE: _____

COMPANY: _____

SIGNATURE: _____

PRINTED: _____

SUBCONTRACTOR'S CERTIFICATE REGARDING
DRUG-FREE WORK PLACE

The subcontractor certifies that it will provide a drug-free workplace by:

1. Publishing a Statement notifying employees that the unlawful manufacture, distribution, dispensing, possession; or use of a controlled substance is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violation of such prohibition.
2. Establishing an ongoing drug-free awareness program to inform employee about:
 - a. The dangers of drug abuse in the workplace
 - b. The Contractor's policy of maintaining a drug-free workplace
 - c. Any available drug counseling, rehabilitation, and employee assistance programs
 - d. The penalties that may be imposed upon employees for drug abuse violation occurring in the workplace
3. Giving each employee to be engaged in the performance of work on this contract a copy of the above required statement.
4. Notifying the employee in the required Statement that, as a condition of employment on this Contract, the employee will:
 - a. Abide by the terms of the Statement; and
 - b. Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.
5. Notifying the Contracting Officer in writing, within ten calendar days after receiving notice under subparagraph 4 (b) from an employee of otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every Contracting Officer or other designee on whose Contract activity the convicted employee was working. Notice shall include the identification number (s) of the Contract of funding Grant.
6. Taking one of the following actions, within 30 calendar days of receiving notice under paragraph 4 (b), with respect to any employee who is so convicted –
 - a. Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended, or
 - b. Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purpose by a Federal, State, or local health, law enforcement, or other appropriate agency.

DATE: _____

SIGNATURE: _____

SIGNATURE: _____

**CONTRACTOR'S CERTIFICATE OF
ANTI-LOBBYING**

The Contractor certifies that to the best of his/her knowledge and belief that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the contractor, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the contractor shall complete and submit Standard Form LLL, 'Disclosure Form to Report Lobbying,' in accordance with its instructions.

3. The contractor shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all surecipients shall certify and disclose accordingly.

Date: _____

Name of Contractor

Official Address (Including Zip)

By: _____

Subscribed and sworn to before me this ____ Day of _____ 20__

Public Notary (signature)

(print)

Commission expires: _____

Country of Residence: _____

**SUBCONTRACTOR'S CERTIFICATE OF
ANTI-LOBBYING**

The subcontractor certifies that to the best of his/her knowledge and belief that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the contractor, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the contractor shall complete and submit Standard Form LLL, 'Disclosure Form to Report Lobbying,' in accordance with its instructions.
3. The subcontractor shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all surecipients shall certify and disclose accordingly.

Date: _____

Name of Subcontractor

Official Address (Including Zip)

By: _____

Subscribed and sworn to before me this ____ Day of _____ 20__

Public Notary (signature)

(print)

Commission expires: _____

Country of Residence: _____

CONTRACTOR'S CERTIFICATION OF NONSEGREGATED FACILITIES

The Bidder certifies that he/she does not maintain nor provide for his/her employees any segregated facilities at any of his/her establishments, and that he/she does not permit his/her employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The Bidder certifies further that he/she will not maintain or provide for his/her employees any segregated facilities at any of his/her establishments, and that he/she will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The Bidder agrees that a breach of the certificate will be in violation of the Equal Opportunity clause in any contract resulting from acceptance of his/her bid. As used in this certification, the term "segregated Facilities" mean any waiting rooms, work areas, restrooms, and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directives or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The Bidder agrees that he/she will obtain identical certification from proposed subcontractors prior to the award of subcontracts.

Date: _____

Name of Contractor

Official Address (Including Zip)

By: _____

Subscribed and sworn to before me this ____ Day of _____ 20__

Public Notary (signature)

(print)

Commission expires: _____

Country of Residence: _____

SUBCONTRACTOR'S CERTIFICATION OF NONSEGREGATED FACILITIES

The subcontractor certifies that he/she does not maintain nor provide for his/her employees any segregated facilities at any of his/her establishments, and that he/she does not permit his/her employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The subcontractor certifies further that he/she will not maintain or provide for his/her employees any segregated facilities at any of his/her establishments, and that he/she will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The subcontractor agrees that a breach of the certificate will be in violation of the Equal Opportunity clause in any contract resulting from acceptance of his/her bid. As used in this certification, the term "segregated Facilities" mean any waiting rooms, work areas, restrooms, and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directives or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The subcontractor agrees that he/she will obtain identical certification from proposed subcontractors prior to the award of subcontracts.

Date: _____
Name of Contractor _____

Official Address (Including Zip) _____
By: _____

Subscribed and sworn to before me this ____ Day of _____ 20__

Public Notary (signature) _____
(print) _____

Commission expires: _____ Country of Residence: _____

LIST OF SUBCONTRACTORS

Each bidder shall submit their Subcontractors List with their Bid.

After submission of this Schedule and after approval by the Owner and the Architect, it shall not be changed without prior approval by the Owner and the Architect.

SUBCONTRACTOR:

Name

Trade

Address

President, Owner, Partner, Etc.

City/State/Zip Code

Email

Telephone/Fax

Name

Trade

Address

President, Owner, Partner, Etc.

City/State/Zip Code

Email

Telephone/Fax

Name

Trade

Address

President, Owner, Partner, Etc.

City/State/Zip Code

Email

Telephone/Fax

Name

Trade

Address

President, Owner, Partner, Etc.

City/State/Zip Code

Email

Telephone/Fax

Name

Address

City/State/Zip Code

Telephone/Fax

Name

Address

City/State/Zip Code

Telephone/Fax

Name

Address

City/State/Zip Code

Telephone/Fax

Name

Address

City/State/Zip Code

Telephone/Fax

Name

Address

City/State/Zip Code

Telephone/Fax

Trade

President, Owner, Partner, Etc.

Email

Trade

President, Owner, Partner, Etc.

Email

Trade

President, Owner, Partner, Etc.

Email

Trade

President, Owner, Partner, Etc.

Email

Trade

President, Owner, Partner, Etc.

Email

Appendix A

Contract Provisions

All contracts, awarded by a recipient including small purchases shall contain the following provisions as applicable:

1. **Equal Employment Opportunity** – All contracts shall contain a provision requiring compliance with E.O. 11246, “Equal Employment Opportunity,” as amended by E.O. 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and as supplemented by regulations at 41 CFR Part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”
2. **Copeland “Anti-Kickback” Act (18 U.S.C. 874 and 40 U.S.C. 27c)** – All contracts and subgrants in excess of \$2,000 for construction or repair awarded by recipients and subrecipients shall include a provision for compliance with the Copeland “Anti-Kickback” Act (18 U.S.C. 874), as supplemented by Department of Labor regulations (29 CFR 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”). The Act provides that each contractor or subrecipient shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he is otherwise entitled. The recipient shall report all suspected or reported violations to the Federal awarding agency.
3. **Davis-Bacon Act**, as amended (40 U.S.C. 276a to a-7) – When required by Federal program legislation, all construction contracts awarded by the recipients and subrecipients of more than \$2,000 shall include a provision for compliance with the Davis-Bacon Act (40 U.S. C. 276a to a-7) and as supplemented by Department of Labor regulations (29 CFR Part 5, “Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction”). Under this Act, contracts shall be required to pay wages to laborers and mechanics at a rate not less than the minimum wages specified in a wage determination made by the Secretary of Labor. In addition, contractors shall be required to pay wages not less than once a week. The recipient shall place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation and the award of a contract shall be conditioned upon the acceptance of the wage determination. The recipient shall report suspected or reported violations to the Federal awarding agency.
4. **Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333)** – Where applicable, all contracts awarded by recipients in excess of \$2,000 for construction contracts and in excess of \$2,500 for other contracts that involved the employment of mechanics or laborers shall include a provision for compliance with Section 102 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), as supplemented by Department of Labor regulations (29 CFR Part 5). Under Section 102 of the Act, each contractor shall be required to compute the wages every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard

work week is permissible provided that the worker is compensated at a rate of not less than 1 ½ times the basic rate of pay for all hours worked in excess of 40 hours in the work week. Section 107 of the Act is applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

5. **Rights to Inventions Made Under a Contract or Agreement** – Contracts or agreements for the performance of experimental, developmental, or research work shall provide for the rights of the Federal Government and the recipient in any resulting invention in accordance with 37 CFR Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.
6. **Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.)**, as amended – Contracts and subgrants of amounts in excess of \$100,000 shall contain a provision that requires the recipient to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 et seq.). Violations shall be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).
7. **Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)** – Contractors who apply or bid for an award of \$100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient.
8. **Debarment and Suspension (E.O.s 12549 and 12689)** – No contract shall be made to parties listed on the General Services Administration’s List of Parties Excluded from Federal Procurement or Nonprocurement Programs in accordance with E.O.s 12549 and 12689, “Debarment and Suspension.” This list contains the names of parties debarred, suspended, or otherwise excluded by agencies, and the contractors declared ineligible under statutory or regulatory authority other than E.O. 12549. Contractors with awards that exceed the small purchase threshold shall provide the required certification regarding its exclusion status and that of its principal employees.

Superseded General Decision Number: IN20230003

State: Indiana

Construction Type: Building

Counties: Clay, Gibson, Greene, Owen, Parke, Posey, Putnam, Sullivan, Vanderburgh, Vermillion, Vigo and Warrick Counties in Indiana.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	02/02/2024
2	03/01/2024
3	04/05/2024
4	04/19/2024
5	05/17/2024
6	05/31/2024
7	06/07/2024
8	07/05/2024
9	07/12/2024
10	07/19/2024
11	07/26/2024
12	08/09/2024
13	08/16/2024
14	08/30/2024
15	09/06/2024
16	09/13/2024
17	09/20/2024
18	09/27/2024
19	10/04/2024
20	10/18/2024

ASBE0018-003 06/01/2024

CLAY, GREENE, OWEN, PARKE, PUTNAM, VERMILLION AND VIGO COUNTIES

Rates Fringes

ASBESTOS WORKER/HEAT & FROST INSULATOR (includes application of all insulating materials protective coverings, coatings and finishes to all types of mechanical systems).....	\$ 38.55	23.53
HAZARDOUS MATERIAL HANDLER (includes preparation, wettings stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from		

mechanical systems).....\$ 23.00 14.40

ASBE0037-002 04/02/2023

GIBSON, POSEY, SULLIVAN, VANDERBURGH AND WARRICK COUNTIES

Rates Fringes

ASBESTOS WORKER/HEAT & FROST
INSULATOR (includes
application of all insulating
materials protective
coverings, coatings and
finishes to all types of
mechanical systems. Also
the application of
firestopping material
openings and penetrations in
walls, floors, ceilings,
curtain walls and all lead
abatement).....\$ 32.00 21.84

BOIL0374-002 01/01/2024

Rates Fringes

BOILERMAKER.....\$ 42.41 35.72

BRIN0001-001 06/01/2023

EVANSVILLE
POSEY, VANDERBURGH and WARRICK COUNTIES

Rates Fringes

Bricklayer, Stonemason.....\$ 34.17 20.14
Marble, Tile & Terrazzo
Finisher.....\$ 22.09 16.34
Marble, Tile & Terrazzo
Workers.....\$ 28.49 16.46

BRIN0004-012 06/01/2024

BLOOMINGTON
OWEN COUNTY

Rates Fringes

Bricklayer, Stonemason.....\$ 35.21 18.19
TERRAZZO FINISHER.....\$ 25.33 14.19
TERRAZZO WORKER/SETTER.....\$ 37.97 18.06
Tile & Marble Finisher.....\$ 25.33 14.19
Tile, Marble Setter.....\$ 37.22 18.05

BRIN0005-001 09/21/2023

TERRE HAUTE CLAY, GIBSON, REENE, PARKE, SULLIVAN, VERMILLION
and VIGO COUNTIES

Rates Fringes

BRICKLAYER
BRICKLAYER, STONE MASON
and POINTER/CLEANER/CAULKER.\$ 30.13 11.65
CEMENT MASON (GREENE and
SULLIVAN COUNTIES).....\$ 27.78 11.02
CEMENT MASON (REMAINING
COUNTIES).....\$ 27.93 11.02
TERRAZZO FINISHER.....\$ 23.38 13.15
TERRAZZO.....\$ 27.50 15.20
TILE and MARBLE FINISHER....\$ 19.83 6.32
TILE, MARBLE, MOSAIC.....\$ 35.63 17.23

CARP0088-001 06/01/2024

CLAY, OWEN, PARKE, PUTNAM, VERMILLION AND VIGO COUNTIES

Rates Fringes

Carpenters:
Carpenters, Drywall
Installers, Piledrivers....\$ 35.55 23.80
Millwright.....\$ 36.94 25.42
Soft Floor Layers.....\$ 33.47 20.07

CARP0224-004 04/01/2024

POSEY, VANDERBURGH AND WARRICK COUNTIES

Rates Fringes

CARPENTER
Carpenter.....\$ 31.49 25.46
Piledriver.....\$ 32.49 25.36

CARP0224-005 04/01/2024

GREENE, GIBSON and SULLIVAN COUNTIES

Rates Fringes

CARPENTER
Carpenter.....\$ 31.48 25.46
Piledriver.....\$ 28.71 22.45

CARP1080-002 04/01/2024

Rates Fringes

MILLWRIGHT

ZONE 1

POSEY, VANDERBURGH and
WARRICK COUNTIES.....\$ 34.40 27.61

ZONE 2

GIBSON, GREENE AND
SULLIVAN COUNTIES.....\$ 33.10 28.57

ELEC0016-004 04/01/2024

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

Rates Fringes

ELECTRICIAN.....\$ 43.51 20.92

ELEC0481-001 05/31/2024

PUTNAM COUNTY

Rates Fringes

ELECTRICIAN.....\$ 42.15 26.88

ELEC0538-002 06/01/2023

VERMILLION COUNTY

Rates Fringes

ELECTRICIAN.....\$ 39.09 24.37

ELEC0725-003 10/01/2022

CLAY, GREENE, OWEN, PARKE, SULLIVAN AND VIGO COUNTIES

Rates Fringes

ELECTRICIAN.....\$ 40.00 21.96

ELEC0725-010 06/01/2022

CLAY, GREENE, OWEN, PARKE, SULLIVAN AND VIGO COUNTIES

Rates Fringes

Communication Technician.....\$ 30.00 18.07

Includes the installation, operation, inspection, maintenance, repair and service of radio, television, recording, voice sound and vision production and reproduction apparatus, equipment and appliances used for domestic, commercial, education, entertainment and private telephone systems.

ELEV0003-002 01/01/2023

GIBSON, POSEY, VANDERBURGH and WARRICK COUNTIES

Rates Fringes

ELEVATOR MECHANIC.....\$ 57.69 37.335+a+b

FOOTNOTES:

a) Employer contributes as a vacation pay credit 8% basic hourly rate for more than 5 years of service and 6% basic hourly rate for less than 5 years of service.

b) Eight Paid Holidays: Thanksgiving Day; New Year's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day and Christmas Day.

ELEV0034-002 01/01/2024

CLAY, GREENE, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION and VIGO COUNTIES

Rates Fringes

ELEVATOR MECHANIC.....\$ 57.68 37.885+a+b

a) PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Vetern's Day, Thanksgiving Day, the Friday after Thanksgiving, and Christmas Day.

b) Employer contributes 8% of regular hourly rate to vacation pay credit for employee with more than 5 years of service; 6% for less than 5 years' service.

ENGI0181-013 04/01/2024

GIBSON, POSEY, VANDERBURGH, and WARRICK COUNTIES

Rates Fringes

Power equipment operators:
GROUP A.....\$ 41.28 19.72
GROUP B.....\$ 33.15 19.72

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP A: A-Frame Winch Truck, Articulating dump, autograde

(CMI), auto patrol, ballast regulator (RR), batcher plant (electrical control concrete), bending machine (pipe), bituminous plant (engineer), bituminous plant, bituminous mixer travel plant, bituminous paver, bituminous roller, boring machine, buck hoist, bull dozer, cable way, Chicago boom, chimney hoist, clamshell, concrete mixer (21 cu. ft. or over), concrete paver, concrete pump (crete), construction elevator (Allmac or similar) crane, craneman, crawler backhoe, crawler high-lift, crusher plant, derrick, derrick boat, dinkey, directional/boring machine, dope pots (pipeline), double drum tugger (electric or air), dragline, dredge operator, dredge engineer, drill operator, elevating grader, extendable boom forklift, formless paver, gantry crane, gator (or similar type tiller), gradeall, grader, grademan, greaser (on grease facility servicing heavy equipment), G.P.S System (on equipment with the classifications), grout pump, head greaser, helicopter crew, Hetherington paver, hoist (motorized, gas or diesel), hydraulic crane, hydro blaster, Industrial type forklift (over 9,000 lbs), laser concrete screed, laser or remote contrlled equipment (within the classifications), locomotive crane, locomotive, mechanic, mobile mixer, motor crane, mucking machine, multiple tamping machine (RR) overhead crane, pile driver, pulls, push dozer, push boats, roller (sheep foot), rough terrain crane, R.T. backhoe, R.T. endloader, Ross carrier, scoop, shovel, side boom, skidstter loader (obcat or similar type), swing crane, tail boom, tar machine (pipeline), tower crane, trench machine, welder (heavey duty), truck mounted concrete pump, truck-mounted drill, vacuum truck, well point whirleys.

GROUP B: Air Compressor (1 or more, 600 cfm and over), air compressor with throttle valve, bituminous distrubtor, brakeman, bullfloat, cement gun, concrete mixer, concrete mixer, concrete saw, concrete spreader or puddlers, conveyor, deck hand oiler, deck engine, drill helper, earth roller, electric vibrator compactor (earth or rock), elevator (in-plant, automatic), finishing machine, fireman, form grader, generator, guard-rail driver, heater, oiler, Industrial type forklift (9,000 lbs and under), material pump, motor boats, paving joint machine, post hole digger, power broom, power traffic signals, rock roller, rock spreader, Roller (earth or rock), spike machine (RR), steam jenny, sub grader, tamping machine, truck crane oiler, truck mounted drill oiler, Tugger (one-drum, air or electric) vibrator, vibro-piling hammer-hydraulic hammer or auger, water pump, widener (apsco or similar type) welding machine, JLG lifts and scissor lifts or similar machine.

 ENGI0841-001 04/01/2023

REMAINING COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1.....	\$ 33.90	23.00
GROUP 2.....	\$ 26.75	23.00

GROUP 1: Power Cranes, Draglines, Derricks, Shovels, Gradalls, Mechanics, Tractor Highlift, Tournadozer, Concrete Mixers with Skip, Tournamixer, Two-Drum Machine, One-Drum Hoist with Tower or Boom, Cableways, Tower Machines, Motor Patrol, Boom Tractor, Boom or Winch Truck, Winch or Hydraulic Boom Truck, Truck Crane, Tournapull, Tractor Operating Scoops, Bulldozer, Push Tractor, Asphalt Planer, Finishing Machine on Asphalt, Large Rollers on Earth, Rollers on Asphalt Mix, Ross Carrier or Similar Machine, Gravel Processing Machine, Asphalt Plant Engineer, Paver Operator, Farm Tractor with Half Yard Bucket and/or Backhoe Attachments, Dredge Engineer, or Dredge Operator, Central Mix Plant Engineer, CMI or Similar Type Machine, Truck or Skid Mounted Concrete Pump, Tower Crane, Engine or Rock Crusher Plant, Concrete Plant Engineer, Ditching Machine with Dual Attachment, Tractor Mounted Loaders, Cherry Picker, Hydro Crane, Standard or Dinkey Locomotives, Scoopmobiles, Euclid Loader, Soil Cement Machine, Back Filler, Elevating Machine, Power Blade, Drilling Machines Including Well Testing, Caissons, Shaft or Any Similar Type Drilling Machines, Motor Driven Paint Machine, Pipe Cleaning Machine, Pipe Wrapping Machine, Pipe Bending Machine, Apsco Paver, Boring Machine, (Equipment Greased), Barber-Greene Loaders, Formless Paver, (Well Point System), Concrete Spreader, Hydra Ax, Span Saw and Similar Types, Marine Scoops, Brush Mulcher, Brush Burner, Mesh Placer, Tree Mover, Helicopter Crew (3), Piledriver - Skid or Crawler, Stump Remover, Root Rake, Tug Boat Operator, Refrigerating Machine, Freezing Operator, Chair Cart-Self Propelled, Hydra Seeder, Straw Blower Power Sub Grader, Bull Float, Finishing Machine, Self-Propelled Pavement Breaker (Backhoe Attached), Lull (or Similar Type Machine), Two Air Compressors, Compressors Hooked in Maifold, Overhead Crane, Chip Spreader, Mud Cat, Sull-Air Fork Lifts (Except When Used For Landscaping Work), Soil Stabilizer (Seaman Tiller, Bo Mag, Rago Gator and Similar Types or Equipment), Tube Float, Spray Machine, Curing Machine, Concrete or Asphalt Milling Machine, Snooper Truck Operator.

GROUP 2: Concrete Mixers Without Skips, Rock Crusher, Ditching Machine Under 6', Curbing Machine, One Drum Machines without Tower or Boom, Air Tugger, Self-Propelled Concrete Saw, Machine-Mounted Post Hole Digger, Two to Four Generators, Water Pumps, or Welding Machines within 400 ft., Air Compressor 600 cu. ft. and Under, Rollers on Aggregate and Seal Coat Surfaces, Fork Lifts (When Used For Landscaping Work, Concrete and Blacktop Curb Machine, Farm Tractor with less than Half Yard Bucket, One Water Pump, Iolers, Air Valves or Steam Valves, One Welding Machine,

Truck Jack, Mud Jack, Gunnite Machine, House Elevators when used for Hoisting Material, Engine Tenders, Wagon Drill, Flex Plane, Conveyor, Siphons and Pulsometer, Switchman, Fireman on Paint Pots, Fireman on Asphalt Plants, Distributor Operators on Trucks, Tampers, Self-Propelled Power Broom, Striping Machine (Motor Driven), Form Tamper, Bulk Cement Plan Equipment Greaser, Deck Hands, Truck Crane Oiler Driver, Cement Blimps, Form Grader, Temporary Heat, Throttle Valve, Farm Tractor, Super Sucker (And Similar Type of Equipment).

FOOTNOTE: Employees operating booms from 149 ft. to 199 ft. including jib, shall receive an additional seventy five cents (.75) per hour above the rate. Employees operating booms over 199 ft. including jib, shall receive an additional one dollar and twenty five cents (\$1.25) per hour above the regular rate.

 IRON022-003 06/01/2024

CLAY, DAVIESS, GREENE, KNOX, LAWRENCE, MARTIN, MONROE, MONTGOMERY, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION AND VIGO COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 36.70	25.69

The following holidays shall be observed: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day. Any holiday which occurs on a Sunday shall be observed the following Monday, unless the legal observance of these holidays is changed by law.

 IRON0103-003 04/01/2023

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 31.99	25.55

 LAB00204-002 06/01/2024

CLAY, GREENE, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION, and VIGO COUNTIES

	Rates	Fringes
Laborers:		
Caisson and Tunnel Work in		
Compressed and Free Air		
GROUP 1.....	\$ 23.18	16.00
GROUP 2.....	\$ 23.93	16.00
GROUP 3.....	\$ 24.18	16.00
GROUP 4.....	\$ 24.18	16.00
LABORERS		
GROUP 1.....	\$ 26.93	18.00
GROUP 2.....	\$ 27.68	18.00
GROUP 3.....	\$ 28.43	18.00

LABORER CLASSIFICATIONS

GROUP1: Building and construction laborers; Scaffold builders (other than for masons or plasterers); Mechanic tenders; Flag & signal person; Window washers & cleaners; Waterboys & toolhousemen; Railroad workers; Masonry wall washers (interior & exterior); Curing compound; All portable water pumps with discharge up to 3 inches; Waterproofing; Handling of creosote lumber or like treated material (excluding railroad material); Asphalt rakers & lutemen; Kettleman; Air tool operators and all pneumatic tool operators; Air & electric vibrators & chipping hammer operators; Earth compactors; Jackmen & sheet men working ditches deeper than 6 ft. in depth; Laborers working ditches 6 ft. in depth or deeper; Assembly of uncrete pump; Tile layers (sewer or field) & sewer pipe layer (metallic or non-metallic); Motor-driven wheelbarrows & concrete buggies; Hyster operators; Pumpcrete assemblers; Core drill operator; Cement, lime or silia clay handlers (bulk or bag); Handling of toxic materials damaging to clothing; Pneumatic spikers; Deck engine & winch operators; Water main & cable ducking (metallic/non-metallic); Screed man or screw operator on asphalt paver; Chain saw and demolition saw operators; Concrete conveyor assemblers; Asbestos removal; Hazardous waste removal.

GROUP 2: Plasterers' tenders; Mortar mixers; Welders (acetylene or electric); Cutting torch or burner; Cement nozzle laborers; Cement gun operators; Scaffold builders when working for plasterers and for masons; Water blast machine operators.

GROUP 3: Dynamite men; Mason Tenders; Drillers-air track or wagon drilling for explosives

LABORERS CLASSIFICATIONS For CAISSON And TUNNEL WORK In COMPRESSED And FREE AIR

GROUP 1: Cage Tenders, Dump Men, Flagman, Signalman, Top Laborers, Rod Men

GROUP 2: Concrete Repairmen, Lock Tenders (pressure side),

Motor men, Muckers, Grout Machine, Track Layers, Air Hoist, Key Board, Agitator Car, Car Pushers, Concrete Laborers, Grout Laborers, Lock Tenders (free air side), Steel Setters, Tuggers, Tuggers, Switchmen.

GROUP 3: Mucking Machine, Laser Beam, Liner Plate & Ring Setter, Shield Drivers, Power Knife, Welders Burners, Pipe Jacking Machine, Skinners, Maintenance Technician, Miner, Bricklayer Tenders, Concrete Blowers, Drillers, Erectors, Form Men, Jackhammermen, Mining Machine.

GROUP 4: Dynamite Men, Drillers air track or wagon drilling for explosives.

LAB00561-005 04/01/2023

GIBSON, POSEY, VANDERBURGH and WARRICK COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.12	18.10
GROUP 2.....	\$ 27.42	18.10
GROUP 3.....	\$ 28.62	18.10
GROUP 4.....	\$ 28.87	18.10

LABORER CLASSIFICATIONS

GROUP 1: Building & Construction Laborers; Scaffold Builders (other than for Masons or Plasterers); Ironworker Tender; Mechanic Tender; Civil Engineer Tender; Rodmen and Chainmen; Signalmen and Flagman, Window Washer & Cleaner; Waterboy and Toolhouseman; Roofer Tender; Railroad Worker; Masonry Wall Washer (Interior & Exterior); Cement Finisher Tender; Carpenter Tender; All Other Tenders not listed; Portable Water Pump with discharge up to 3"; Wiremesh; Fire Prevention; Fire Watch; Fire Stop Tender

GROUP 2: Waterproofing; Handling of creosote Lumber or like treated material (Excluding Railroad Material); Asphalt Raker & Luteman; Kettleman; handling and removal Hazardous materials damaging to clothing; Air Tool Operator; Vibrator; Chipping Hammer Operator and all pneumatic tool operator and earth compactor; Jack Man & Sheeting Man Working in Ditches 6 Feet in depth or deeper; Laborers working ditches six (6) feet in depth or deeper; Assembly of Unicrete Pump; Chain Saw Operator; Water line layers, five (5) feet outside the building foundation; Tile layers (Sewer or Field); Sewer Pipe Layer (Metallic and Non-metallic) five (5) feet outside the building; Motor Driven Wheelbarrow & Concrete Buggy; Hyster Operator; Grout pump operator; Pump crete Assembler; Conveyor Assembler; Core Drill Operator; Cement/Lime/Silica Clay Handler (Bulk or Bar); Pneumatic Spiker; Deck/Engine/Winch Operator; Water Main & Cable Decking (Metallic or Non-metallic); Remote Controlled Compactor

GROUP 3: Plasterer Tender; Mason Tender; Mortar Mixer; Welder (Acetylene or Electric); Cutting Torch or Burner; Cement Gun Operator; Scaffold Builder (When working for Plasterer or Mason)

GROUP 4: Dynamite Man

PAIN0156-002 04/01/2024

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
Painters:		
BRUSH & ROLLER.....	\$ 29.62	18.32
DRYWALL FINISHERS.....	\$ 30.37	19.32
SPRAY, SANDBLAST, POWER TOOLS, WATERBLAST & STEAM CLEANING.....	\$ 30.62	19.32

FOOTNOTE A:

All Structures over 40? \$0.75/ hour above base wage
All Structures over 75? \$1.50/ hour above base wage
All Structures over 100? \$2.50/ hour above base wage

PAIN0197-002 06/01/2024

CLAY, GREENE, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION AND VIGO COUNTIES:

	Rates	Fringes
Painters:		
Brush & Roller.....	\$ 30.25	15.50
Drywall & Paper hangers (with tools).....	\$ 31.25	15.50
Sandblasting.....	\$ 32.25	15.50
Spray & Pot Man.....	\$ 30.75	15.50

FOOTNOTE A: \$1.00 premium for work on structures over 40 ft. above floor/ground level
\$2.00 premium for work on structures over 100 ft above floor/ground level

PAIN1165-007 06/01/2024

GIBSON, POSEY, VANDERBURGH, WARRICK COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 32.86	19.34

PAIN1165-012 01/01/2024

CLAY; GREENE; OWEN; PARKE; PUTNAM; SULLIVAN; VERMILLION and VIGO COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 34.03	20.05

PLAS0075-001 06/01/2017

CLAY, OWEN, PARKE, PUTNAM, VERMILLION AND VIGO COUNTIES:

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.75	13.50

PLAS0075-002 06/01/2017

GREENE and SULLIVAN COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 28.50	13.50

PLAS0566-001 04/01/2018

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 26.30	16.91

PLAS0692-001 06/01/2024

AREA #46

CLAY, GIBSON, GREENE, OWEN, PARKE, POSEY, PUTNAM, SULLIVAN, VANDERBURGH, VERMILLION, VIGO and WARRICK COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 30.50	17.62

PLUM0136-002 04/01/2024

REMAINING COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 43.67	21.35

PLUM0157-001 07/01/2024

CLAY, GREENE, PARKE, PUTNAM (Part), SULLIVAN, VERMILLION and VIGO COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 44.45	22.50

PLUM0440-001 06/04/2024

PUTNAM COUNTY (EAST OF ROAD 43 EXCEPT TERRITORY ON A EAST MILE RADIUS FROM THE COURT HOUSE)

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 46.50	19.89

ROOF0106-001 04/01/2023

REMAINING COUNTIES:

	Rates	Fringes
Roofers:		
COMPOSITION.....	\$ 31.60	19.43
SLATE & TILE.....	\$ 31.60	19.43

* ROOF0119-001 09/01/2024

PUTNAM COUNTY

	Rates	Fringes
Roofers:.....	\$ 31.00	14.21

ROOF0150-002 07/01/2024

CLAY, GREENE, OWEN, PARKE, SULLIVAN, VERMILLION AND VIGO COUNTIES

	Rates	Fringes
ROOFER.....	\$ 30.00	18.30

SFIN0669-002 04/01/2024

	Rates	Fringes
SPRINKLER FITTER.....	\$ 45.40	27.29

SHEE0020-018 07/01/2023

CLAY, GREENE, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION, and VIGO COUNTIES

	Rates	Fringes
Sheet metal worker.....	\$ 39.53	22.92
HVAC Duct Work		

SHEE0020-019 07/01/2023

GIBSON, POSEY, VANDERBURGH, and WARRICK COUNTIES

	Rates	Fringes
Sheet metal worker.....	\$ 34.58	29.98
HVAC Duct Work		

TEAM0135-006 04/01/2024

CLAY, GREENE OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION, and VIGO COUNTIES

	Rates	Fringes
Truck drivers:		
GROUP 1.....	\$ 32.10	.42+a+b
GROUP 2.....	\$ 32.60	.42+a+b
GROUP 3.....	\$ 32.80	.42+a+b
GROUP 4.....	\$ 32.95	.42+a+b
GROUP 5.....	\$ 33.45	.42+a+b

A: \$36.40 PER DAY & 450.00 PER WEEK.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1: Single Axle Trucks seven (7) cu.yds. or less than ten and one-half (10 1/2) tons, dumpsters, scoop-mobiles five (5) cu. yds. and under or less than seven and one-half (7 1/2) tons, mixer trucks three (3) cu.yds. and under, air compressors and welding machines, including those pulled by separate units, batch trucks-wet or dry-2"34-E batches or less, truck driver helpers, warehousemen, mechanic's helpers, greasers and tiremen, all pick-up trucks and other vehicles. Drivers on dumpsters or similar dumpsters, mounted on four (4) wheel truck rated two (2) cu.yds. or less, and small pallet type fork-lift operator and drivers on pallet jacks or similar type equipment.

GROUP 2: Drivers on tandem axle eighteen (18) cu.yds.or twenty- four (24) tons gross, six (6) wheel trucks, Koehring or similar dumpsters, tract trucks, Euclids, hug bottom dumps, tournapulls, tournatrailers, tournarockers, or similar equipment when used for transportation purposes under nine (9) cu.yds. or less than thirteen and one-half (13 1/2) tons, tandems and semi-trailer service trucks, mixer trucks over three (3) cu. yds. and including six and one-half (6 1/2) cu.yds., fork lift, four (4) wheel A frame trucks when used for transportation purposes, four (4) wheel winch trucks, pavement breakers, batch trucks - wet or dry - over 2 up to and including 4-"34-E" batches two (2) men oil distributors, fork-lift under four (4) ton and vacuum trucks.

GROUP 3: Koehring or similar dumpsters, tract trucks, semi-trailer water trucks, Euclids, hug bottom dumps, tournapulls, tournatrailers, tournarockers, tractor trailers, tandems Q frame winch trucks, hydrolift trucks or similar equipment when used for transportation purposes, mixer trucks over six and one-half (6 1/2) cu.yds. batch trucks wet or dry over 4-"34-E" batches single axle low boy trailers, and Contractor's mechanics when working on equipment operated by employees within this Bargaining Unit. Six (6) wheel pole trailers and one (1) man oil distributors, fork- lift over four (4) ton and mobile mixers.

GROUP 4: Drivers on heavy equipment over sixteen (16) cu.yds. or twenty-four ton, such as Koehring or similar dumpsters, tract trucks, Euclids, hug bottom dumps, tournapulls, tournarockers or similar equipment wen used for transportation purposes, pole trailers over six (6) wheels, water pulls, low-boy trailers tandem axles, quad axle or more no-weight limitation, diesel and/or heavy equipment mechanics when working on equipment operated by employees with this Bargaining Unit.

GROUP 5: Mechanic furnishing his own tools.

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GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES:

	Rates	Fringes
Truck drivers:		
GROUP 1.....	\$ 27.08	21.45
GROUP 2.....	\$ 27.54	21.45
GROUP 3.....	\$ 27.76	21.45

GROUP 1 - Pickup Trucks, Winch Trucks, Warehouseman, Mechanic, Street sweepers, Single axle trucks

GROUP 2 - Tandem Trucks or Dump Trucks; Farm Tractor Pulling trailer; Bituminous Distributors, Pavement Breakers

GROUP 3 - Mixer Trucks, all types; Lowboys, all types; Semi-trucks, all types; All Tri-axle Dump Trucks; Articulated End Dumps; End Dumps; Heavy Equipment Type Water Wagons; Hazardous Waste Warehouseman; Hazardous Waste Driver; and Drivers on equipment when not self-loaded or pusher loaded, such as Koehring or similar dumpsters, track trucks, Euclid bottom dump and hug bottom dump, Tournatrailers, Tournarockers or similar equipment.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage

determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

State Adopted Rate Identifiers

Classifications listed under the "SA" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the SA identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

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283100 – Detection and Alarm

Drawings: Refer to Drawing T-1 for an index to drawings.

Section 01070

CUTTING AND PATCHING

PART ONE - GENERAL

1.01 DESCRIPTION

A. Work included: This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the Work required to:

- (1) Make the several parts fit properly.
- (2) Uncover Work to provide for installation, inspection, or both, of ill-timed Work.
- (3) Remove and replace Work not conforming to requirements of the Contract Documents.
- (4) Remove and replace defective Work.

B. Related work described elsewhere:

- (1) In addition to other requirements specified, upon the Architect's request, uncover Work to provide for inspection by the Architect of covered Work, and remove samples of installed materials for testing.
- (2) Do no cut or alter work performed under separate contract without the Architect's written permission.

1.02 QUALITY ASSURANCE

A. Perform all cutting and patching in strict accordance with pertinent requirements of these Specifications and, in the event no such requirements are determined in conformance with the Architect's written direction.

1.03 SUBMITTALS

A. Request for the Architect's consent:

- (1) Prior to cutting which affects structural safety, submit written request to the Architect for permission to proceed with cutting.
- (2) Should conditions of the Work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Architect and secure his written permission prior to proceeding.

B. Notices to the Architect:

- (1) Prior to cutting and patching performed pursuant to the Architect's instructions, submit cost estimate to the Architect. Secure the Architect's approval of cost estimates and type of cost reimbursement before proceeding with cutting and patching.
- (2) Submit written notice to the Architect designating time the Work will be uncovered, to provide for the Architect's observation.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. For replacement of Work removed, use materials which comply with the pertinent Sections of these Specifications.

2.02 PAYMENT FOR COSTS

- A. The Owner will reimburse the Contractor for cutting and patching performed pursuant to the Architect's written request after claim for such reimbursement is submitted by the Contractor. Perform all other cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

PART THREE - EXECUTION

3.01 CONDITIONS

A. Inspection:

- (1) Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, backfilling, and patching.
- (2) After uncovering the Work, inspect conditions affecting installation of new Work.

B. Discrepancies:

- (1) If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions.
- (2) Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION PRIOR TO CUTTING

- A. Provide all required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.

3.03 PERFORMANCE

- A. Perform all required excavating and backfilling as required under pertinent Sections of these Specifications. Perform cutting and demolition by methods which will prevent damage to other portions of the Work and will provide proper surfaces to receive installation of repair and new work. Perform fitting and adjustment of products to provide finished installation complying with the specified tolerance and finishes.

END OF SECTION

Section 01085

APPLICABLE STANDARDS

PART ONE – GENERAL

1.01 DESCRIPTION

A. Work included:

- 1) Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
- 2) Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named code or standard.
- 3) It is also the Contractor's responsibility, when so required by the Contract Documents or by written request from the Architect, to deliver to the Architect all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Architect, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Architect.

B. Related work described elsewhere: Specific naming of codes and standards occurs on the Drawings and in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

- A. Familiarity with pertinent codes and standards: In procuring all items used in this Work, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this Work meet or exceed the specified requirements.
- B. Rejection of non-complying items: The Architect reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements. The Architect further reserves the right, and without prejudice to other recourse the Architect may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Architect and the Owner.
- C. Applicable standards listed in these Specifications include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

- 1) AASHTO = American Association of State Highway and Transportation Officials, 341 National Press Building, Washington, DC 20004
- 2) ACI = American Concrete Institute, Box 19150, Redford Station, Detroit, Michigan 48129
- 3) AISC = American Institute of Steel Construction, Inc., 1221 Avenue of the Americas, New York, New York 10020
- 4) ANSI = American National Standards Institute (successor to USASI and ASA), 1430 Broadway, New York, New York 10018
- 5) ASTM = American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103
- 6) AWS = American Welding Society, Inc., 2501 N. W. 7th Street, Miami, Florida 33125
- 7) AWWA = American Water Works Association, Inc., 6666 West Quincy Avenue, Denver, Colorado 80235
- 8) CRSI = Concrete Reinforcing Steel Institute, 228 North LaSalle Street, Chicago, Illinois 60610
- 9) CS = Commercial Standard of NBS, U. S. Department of Commerce, Government Printing Office, Washington D.C. 20402
- 10) FGMA = Flat Glass Marketing Association, 3310 Harrison, Topeka, Kansas 66611
- 11) I.B.C. = International Building Code
- 12) NAAMM = National Association of Architectural Metal Manufacturers, 1033 South Boulevard, Oak Park, Illinois 60302
- 13) NEC = National Electrical Code (see NFPA)
- 14) NEMA = National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017
- 15) NFPA = National Fire Protection Association, 740 Atlantic Avenue, Boston, Massachusetts 02210
- 16) SDI = Steel Deck Institute, 135 Addison Avenue, Elmhurst, Illinois 60125
- 17) SSPC = Steel Structures Painting Council, 4400 5th Avenue, Pittsburgh, Pennsylvania 15213

- 18) TCA = Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540
- 19) UL = Underwriters' Laboratories, Inc. 207 East Ohio Street, Chicago, Illinois 60611
- 20) Fed Specs and Fed Standards: Specifications Sales (3 FRI), Bldg. 197, Washington Navy Yard, General Services Administration, Washington, DC 20407
- 21) MIL-SPECS: Military Specifications, Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402
- 22) UBC = Uniform Building Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, California 90601

END OF SECTION

Section 01300

SUBMITTALS AND SUBSTITUTIONS

PART ONE - GENERAL

1.01 DESCRIPTION

A. Work included:

- (1) Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, reference to recognized industry and government standards, or description of required attributes and performance.
- (2) To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for their review by the Architect.
- (3) Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related work described elsewhere: Individual requirements for submittals are described in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Coordination of submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the Contract Documents. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.

B. Certificates of compliance:

- (1) Certify that all materials used in the Work comply with all specified provisions thereof. Certification shall not be construed as relieving the contractor from furnishing satisfactory materials if, after tests are performed on selected samples, the material is found to not meet specified requirements.
- (2) Show on each certification the name and location of the Work, name and address of Contractor, quantity and date or dates of shipment or delivery to which the certificates applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.

- (3) In addition to the above information, all laboratory test reports submitted with Certificates of Compliance shall show the date or dates of testing, the specified requirements for which testing was performed, and results of the test or tests.

1.03 SUBMITTALS

- A. Submittal schedule: Within 15 days after award of Contract, and before any items are submitted for approval, submit to the Architect two copies of the schedule described in Article 2.01 of this Section.
- B. Certificates of Compliance: Upon completion of the Work, and as a condition of its acceptance, submit to the Architect all Certificates of Compliance.
- C. Procedures: Make submittals in strict accordance with the provision of this Section.

PART TWO - PRODUCTS

2.01 SUBMITTAL SCHEDULE

- A. General: Compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the Work. Include a list of each type of item for which Contractor's drawings, Shop Drawings, Certificates of Compliance, material samples, guarantees, or other types of submittals are required. Upon approval by the Architect this schedule will become part of the Contract and the Contractor will be required to adhere to the schedule except when specifically otherwise permitted.
- B. Coordination: Coordinate the schedule with all necessary subcontractors and material suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as described in Paragraph 3.02 below.
- C. Revisions: Revise and update the schedule on a monthly basis as necessary to reflect conditions and sequences. Promptly submit revised schedule to the Architect for review and comment.

2.02 SHOP DRAWINGS AND COORDINATION DRAWINGS

- A. Shop Drawings:
 - (1) Scale and measurements: Make all Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.

- (2) Type of prints required: Submit all Shop Drawings by hard copy to the office of the Architect. Digital PDF or CAD files may also be accepted. Shop Drawings should be reviewed by Contractor prior to submittal with a stamp indicating approval from Contractor's office.
- (3) Reproduction of review Shop Drawings: Printing and distribution of review Shop Drawings for the Architect's use will be by the Architect. All review comments of the Architect will be shown on the Shop Drawings when it is returned to the Contractor. The Contractor shall make and distribute all copies required for his purposes.

2.03 MANUFACTURERS' LITERATURE

- A. General: Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly indicate which portion of the contents is being submitted for review.
- B. Number of copies required: Submit the number of copies which are required to be returned plus one copy which will be retained by the Architect. Information may also be transmitted digitally via email to the Architect in PDF or other electronic format.

2.04 SAMPLES

- A. Accuracy of samples: Samples shall be of the precise article proposed to be furnished.
- B. Number of samples required: Unless otherwise specified, submit all Samples in the quantity which is required to be returned plus one which will be retained by the Architect.
- C. Reuse of samples: In situations specifically so approved by the Architect, the Architect's retained Sample may be used in the construction as one of the installed items.

2.05 COLORS AND PATTERNS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts to the Architect for review and selection.

2.06 SUBSTITUTIONS

- A. Approval required:
 - (1) The Contract is based upon the standards of quality established in the contract Documents.

- (2) All products proposed for use, including those specified by required attributes and performance, shall require approval by the Architect before being incorporated into the Work. Any proposed substitutions shall be labeled "alternate" on the submittal.
- (3) Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Architect.

B. "Or equal":

- (1) Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that materials, equipment, or methods will be approved as equal or as equivalent unless the item has been specifically approved for this work by the Architect.
- (2) The decision of the Architect shall be final.

2.07 PROJECT RECORD DOCUMENTS

- A. Submit project record documents for Section 01720 of the Specifications.

PART THREE - EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

- A. General: Consecutively number all submittals. Accompany each submittal with a letter of transmittal containing all pertinent information required for identification and checking of submittals.
- B. Internal identification: On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicate the submittal number in which the item was included.
- C. Resubmittals: When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new submittal number.
- D. Submittal log: Maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals at all times. Make the submittal log available for the Architect's review upon request.

3.02 COORDINATION OF SUBMITTALS

- A. General: Prior to submittal for approval, use all means necessary to fully coordinate all material including but not necessarily limited to:
- (1) Determine and verify all interface conditions, catalog numbers, and similar data.

- (2) Coordinate with other trades as required.
 - (3) Clearly indicate all deviations from requirements of the Contract Documents.
- B. Grouping of submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

3.03 TIMING OF SUBMITTALS

- A. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.
- B. Architect's review time: In scheduling allow at least **10 calendar days** for review by the Architect following his receipt of the submittal.
- C. Delays: Delays caused by tardiness in receipt of submittals returned to the contractor will not be an acceptable basis for extension of the Contract completion date.

3.04 ARCHITECT'S REVIEW

- A. General: Review by the Architect shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the Contractor from responsibility for errors which may exist.
- B. Authority to proceed: The notation "Reviewed, no exceptions noted" or "Review, exceptions noted" authorize the Contractor to proceed with fabrication, purchase, or both, of the items so noted, subject to the revisions, if any, required by the Architect's review comments.
- C. Revisions: Make all revisions required by the Architect. If the Contractor considers any required revision to be a change, he shall so notify the Architect as provided for under "Changes" in the General Conditions. Show each drawing revision by number, date, and subject in a revision block on the drawing. Make only those revisions directed or approved by the Architect.
- D. Revisions after approval: When a submittal has been reviewed by the Architect, re-submittal for substitution of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary.

END OF SECTION

Section 01485

TEMPORARY FACILITIES AND CONTROLS

PART ONE-GENERAL

1.01 DESCRIPTION

A. Work included: Temporary facilities and controls required for the work include but are not limited to:

1. Temporary utilities such as heat, water, electricity, and telephone.
2. Field offices and sheds
3. Sanitary facilities
4. Enclosures such as tarpaulins, barricades, and canopies
5. Fencing of the construction area
6. Haul roads

B. Related work described elsewhere:

1. Except that all equipment furnished by the subcontractors shall comply with all requirements of pertinent safety regulations, the ladders, planks, hoists, and similar items normally furnished by the individual trades in execution of their own portions of the work are not part of this Section.
2. Permanent installation and hook-up of the various utility lines are described in the pertinent other Section of these Specifications.

1.02 PRODUCT HANDLING

A. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout progress of the work.

1.03 JOB CONDITIONS

A. Make all required conditions to existing utility systems with minimum disruption to services in the existing utility systems. When disruption of the existing service is required, do not proceed without the Architect's approval and when required, provide alternate temporary service.

PART TWO-PRODUCTS

2.01 UTILITIES

A. General: All temporary facilities shall be subject to the Architect's approval. The cost of all temporary facilities such as water and electric is to be paid by the Contractor.

B. Water:

1. Furnish and install all necessary temporary water lines and water supply and upon completion of the work, remove all such temporary facilities.
2. The Contractor will furnish all water needed for construction at no cost to the Owner.

C. Electricity:

1. Furnish and install necessary temporary wiring and upon completion of the work, remove all such temporary facilities.
2. The Contractor will furnish all electricity needed for construction at no cost to the Owner.

D. Telephone: Make all necessary arrangements and pay all costs of operation and installation of telephone service to the Contractor's office at the site. A job site telephone is not required.

E. Utilities for testing: Normal quantities required to make final tests of completely permanent systems will be furnished at no cost to the Contractor.

F. Sanitary Facilities: The Contractor shall provide facilities.

2.02 FIELD OFFICES AND SHEDS

A. Contractor's facilities:

1. Provide a field office building and sheds adequate in size and accommodation for all Contractor's offices, supply and storage.
2. The entire facility, including furniture, will remain the property of the Contractor and shall be removed from the site after completion of the work.

2.03 ENCLOSURES

A. Furnish, install and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all safety and other regulations.

2.04 HAUL ROADS

A. Provide and maintain all required access to the work from paved areas and other routes, in strict accordance with all regulations governing the Contractor's use of the site.

PART THREE-EXECUTION

3.01 MAINTENANCE AND REMOVAL

- A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the work. Remove all such temporary facilities and controls as rapidly as progress of the work will permit, or as directed by the Architect.

3.02 CONTRACTOR'S OFFICE LOCATION

- A. The location of the Contractor's office and storage area shall be on the site in any location chosen by the Contractor and approved by the Architect.

END OF SECTION

Section 01710

CLEANING

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this Section.
- B. Related work described elsewhere: In addition to standards described in this Section, comply with all requirements for cleaning up as described in various other Sections of these Specifications.

1.02 QUALITY ASSURANCE

- A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.
- B. Codes and standards: In addition to the standards described in this Section, comply with all pertinent requirements of government agencies having jurisdiction.

PART TWO - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

- A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

- A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Architect.

PART THREE - EXECUTION

3.01 PROGRESS CLEANING

- A. General:
 - (1) Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.

- (2) Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
- (3) At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
- (4) Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

B. Site:

- (1) Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material, including roofing scraps and nails, etc. Removal all such items to the place designated for their storage.
- (2) Weekly, and more often if necessary, inspect all arrangements of materials stored on the site; restack, tidy, or otherwise service all arrangements to meet the requirements of subparagraph A (1) above.
- (3) Maintain the site in a neat and orderly condition at all times.

C. Structures:

- (1) Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
- (2) Weekly, and more often if necessary, sweep all interior spaces clean. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
- (3) As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
- (4) Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space of which finish materials have been installed. "Clean" for the purpose of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

3.02 FINAL CLEANING

- A. Definition: Except as otherwise specifically provided, "clean" (for the purpose of this Article) shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.
- B. General: Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.01 above.
- C. Site: Unless otherwise specifically directed by the Architect, broom clean all paved areas on the site and all public paved areas directly adjacent to the site. Completely remove all resultant debris.
- D. Structures:
 - (1) Exterior: Visually inspect all exterior surfaces and remove all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
 - (2) Interior: Visually inspect all interior surfaces and removal all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only the specified cleaning materials and equipment.
 - (3) Glass: Clean all glass inside and outside.
 - (4) Polished surfaces: To all surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished.
- E. Timing: Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean project.

3.03 CLEANING DURING OWNER'S OCCUPANCY

- A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be as determined by the Architect in accordance with the General Conditions of the Contract.

END OF SECTION

01710 - 3

Section 01720

PROJECT RECORD DOCUMENTS

PART ONE - GENERAL

1.01 DESCRIPTION

A. Work included:

- (1) Throughout the progress of the work of this contract, maintain an accurate record of all changes in the Contract Documents, as described in Article 3.01 below.
- (2) Upon completion of the Work of this Contract, transfer the recorded changes to a set of Record Documents, as described in Article 3.02 below.

B. Related work described elsewhere: Submittals - Section 01300

1.02 QUALITY ASSURANCE

A. General: Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved in advance by the Architect.

B. Accuracy of records: Thoroughly coordinate all changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to properly show the change. Accuracy of records shall be such that future searches for items shown in the Contract Documents may reasonably rely on information obtained from the approved Record Documents.

C. Timing of entries: Make all entries within 24 hours after receipt of information.

1.03 SUBMITTALS

A. General: The Architect's approval of the current status of Record Documents will be a prerequisite to the Architect's approval of requests for progress payment and request for final payment under the Contract.

B. Progress submittals: Prior to submitting each request for progress payment, secure the Architect's approval of the Record Documents as currently maintained.

C. Final submittal: Prior to submitting request for final payment, submit the final Record Documents to the Architect and secure his approval.

1.04 PRODUCT HANDLING

- A. Use all means necessary to maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of the recorded data to the final Record Documents. In the event of loss of recorded data, use all means necessary to secure the data to the Architect's approval; such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials and, in such case, all replacements shall be to the standards originally specified in the Contract Documents.

PART TWO - PRODUCTS

2.01 RECORD DOCUMENTS

- A. Job set: Near the completion of the Project, the Contractor shall provide the Architect a marked set of Drawings with all changes noted to be used in the creation of the Final Record Documents.

PART THREE - EXECUTION

3.01 MAINTENANCE OF JOB SET

- A. Identification: Immediately upon receipt of the job set described in Paragraph 2.01 A, above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".
- B. Preservation:
 - (1) Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect.
 - (2) Do not use the job set for any purpose except entry of new data and for review by the Architect, until start of transfer of data to final Record Documents.
 - (3) Maintain the job set at the site of work as that site is designated by the Architect.
- C. Making entries on drawings: Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by note and by graphic line, as required. Date all entries. Call attention to the entry by a "cloud" around the area or areas affected. In the event of overlapping changes, different colors may be used for each of the changes.

D. Making entries on other documents:

- (1) Where changes are caused by directives issued by the Architect, clearly indicate the change by note in ink, colored pencil, or rubber stamp.
- (2) Where changes are caused by Contractor-originated proposals by the Architect, including inadvertent errors by the Contractor which have been accepted by the Architect, clearly indicate the change by note in erasable colored pencil.
- (3) Make entries in the pertinent Documents as approved by the Architect.

E. Conversion of schematic layouts:

- (1) In most cases on the Drawings, arrangement of conduits and circuits, piping, ducts, and other similar items, is shown schematically and is not intended to portray precise physical layout. Final physical arrangement is as determined by the Contractor, subject to the Architect's approval. However, design of future modifications of the facility may require accurate information as to the final physical arrangements of items which are shown only schematically on the Drawings.
- (2) Show on the job set of Record Drawings, by dimension accurate to within 25 mm (1") the centerline of each run of items such as are described in Paragraph E (1) above. Clearly identify the item by accurate note such as "cast iron drain" "galv. water", etc. Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum", "exposed", etc.). Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
- (3) The Architect may waive the requirements for conversion of schematic data where, in the Architect's judgment, such conversion serves no beneficial purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect.
- (4) Time of entries: Be alert to changes in the Work from how it is shown in the Contract Documents. Promptly, and in no case later than 24 hours after the change has occurred and been made known to the Contractor, make the entry or entries required.
- (5) Accuracy of entries: Use all means necessary, including the proper tools for measurement, to determine actual location of the installed items.

3.02 FINAL RECORD DOCUMENTS

- A. General: The purpose of the Final Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of

design to proceed without lengthy and expensive site measurement, investigation, and examination.

- B. Review and approval: Submit the completed total set of Record Documents to the Architect. Participate in review meeting or meetings as required by the Architect, make all required changes in the Record Documents, and promptly deliver the Final Record Documents to the Architect.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

- A. The Contractor shall have no responsibility for recording changes in the Work subsequent to acceptance of the Work by the Owner, except for changes resulting from replacements, repairs, and alterations made by the Contractor as part of his guarantee.

END OF SECTION

Section 02200

EXCAVATING, FILLING AND GRADING

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Excavating, filling, and grading for this work includes, but is not necessarily limited to:
- (1) Excavating for footings and foundations, and the site work;
 - (2) Filling and backfilling to attain indicated grades;
 - (3) Trenching and trench backfilling;
 - (4) Rough and finish grading of the site;
 - (5) Compaction of all fill materials;
 - (6) Boring or other utility excavation;
 - (7) Miscellaneous site work and earthwork necessary for a complete installation of all features specific or shown on drawings.

1.02 JOB CONDITIONS

- A. Dust control:
- (1) Use all means necessary to control dust on and near the work and on and nearly all off-site borrow areas if such dust is caused by the Contractor's operations during performance of the work or if resulting from the condition in which the Contractor leaves the site.
 - (2) Thoroughly moisten all surfaces as required to prevent being a nuisance to the public, neighbors, and concurrent performance of other work on the site.
- B. Protection:
- (1) Use all means necessary to protect all materials of this Section before, during, and after installation and to protect all objects designated to remain.

- (2) In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no cost to the Owner. Operations shall be conducted so that material outside of the limits of the project will not be disturbed.

1.03 CLASSIFICATION OF EARTHWORK

A. Excavation: All excavation and fill will be classified as hereinafter described.

- (1) Topsoil: All excavation work shall include the stripping and stockpiling of existing topsoil prior to excavation of the underlying materials.
- (2) Unclassified excavation; shall consist of the excavation and disposal of all materials of whatever character encountered in the work.

B. Borrow:

- (1) This site may not contain sufficient quantities of proper fill material, therefore, the Contractor shall obtain extra material from an approved source or commercial borrow area in close proximity to the site.
- (2) Borrow shall consist of approved material required for the construction of embankments or for other portions of the work and shall be obtained from approved locations and sources outside the project limits. Unless otherwise designated in the contract, the Contractor shall make his own arrangements for obtaining borrow and shall pay all costs involved.

1.04 QUALITY ASSURANCE

A. Compacted fill: Unless otherwise specified, all fill, except rock, shall be compacted to its maximum dry density.

B. Method of making density tests: The percent of compaction shall be based on maximum dry density unless otherwise specified or directed that it be based on maximum wet density.

- (1) Laboratory: The procedure for determining maximum dry densities for compaction control shall be outlined in AASHTO T180.
- (2) Field-Density determination; shall be made in accordance with AASHTO T191 or T205 except if the percent of compaction is to be based on maximum wet densities, it will not be necessary to determine the moisture content and dry density of the soils. All references to soils in these methods of tests shall be interpreted to mean either or both cohesive and granular materials.
- (3) If particles larger than those that can pass through a No. 4 sieve for soil and 3/4 inch sieve for granular material are encountered, corrections shall be made so that the density

obtained will be for the minus No. 4 or 3/4 inch only. After the densities are determined, the degree of compaction shall be computed by the following formula;

$$\text{Degree of Compaction} = \frac{\text{In Place Density (lbs./cu/ft.)}}{\text{Maximum Density (lbs./cu/ft.)}} \times 100$$

- (4) Other approved types of field density tests may be used for control purposes after density values corresponding to those obtained by either of the methods set out above have been established.

PART TWO - PRODUCTS

2.01 FILL MATERIAL, GENERAL

- A. Approval required: All fill material shall be subject to the approval of the Architect. In general, all structural fill shall be well graded, predominantly granular material containing only sufficient fines to bind the mass during compaction.
- B. Notification: For approval of fill material, notify the Architect at least four working days in advance of intention to import material, designate the proposed borrow area, and permit the Architect sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

2.02 ON-SITE FILL MATERIAL

- A. All on-site fill material shall be soil mixture which is free from organic matter and other deleterious substance. It shall contain no rocks or lumps over six inches in greatest dimension, and not more than 15% of the rocks or lumps shall be larger than 2 1/2 inches in greatest dimension. Subsoil of high silt content shall not be placed in structural fill but may be mixed with clean granular material, in proportions specifically approved by the Architect, to produce structural or other fill materials.

2.03 IMPORTED FILL MATERIAL

- A. All imported fill material shall meet the requirements of Article 2.02 above and, in addition, shall be predominately granular with a maximum particle size of two inches and a plasticity index of 12 or less.

2.04 FILL BENEATH FOUNDATIONS

- A. All fill material placed within two feet of the base of foundations and/or slabs shall be a plasticity index of 15 or less and shall be approved by the Architect prior to placement.

2.05 GRANULAR MATERIAL UNDER CONCRETE (SLABS AND WALKS)

A. Granular material under concrete slabs shall be clean mineral aggregate with particle size grading within the following limits:

- (1) Passing the one inch mesh: 100%
- (2) Passing the number four sieve: Not more than 5%
- (3) Passing the number 200 sieve: Not more than 1%

Note: Pea gravel is not an acceptable fill material.

2.06 TRENCH AND STRUCTURAL BACKFILL

A. On-site fill material used for trench and structural backfill shall meet the requirements of Article 2.02 above.

B. Imported cohesion-less material used for trench and structural backfill shall be free of organic substance and other deleterious matter, shall be subject to the approval of the Architect, and shall be in particle size grading within the following limits:

- (1) Passing the number four sieve 100%
- (2) Passing the number 200 sieve 3% Maximum

2.07 LIMESTONE FILL

A. Limestone fill shall be crushed quarry stone. The material shall be uniformly coarse graded with a maximum size of 1.5 inches with less than 8% passing the No. 4 sieve.

2.08 FINAL GRADE FILL

A. Material for lawn or seeded areas shall be good topsoil suitable for either seeding or sodding.

2.09 OTHER MATERIAL

A. All other material, not specifically described but required for a complete and proper installation, shall be as selected by the Contractor subject to the approval of the Architect.

PART THREE - EXECUTION

3.01 GENERAL

A. Familiarization: Prior to all work of this section, become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section. Verify that all work to proceed such as demolition, clearing, grubbing and survey work is satisfactorily completed.

B. Backfilling prior to approvals:

- (1) Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to all required inspections, test, and approvals.
- (2) Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Owner.
- (3) After the work has been completely tested, inspected, and approved, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering all at no additional cost to the Owner.

3.02 FINISH ELEVATIONS AND LINES

- A. For setting and establishing finish elevations and lines see the drawings. All existing benchmarks and monuments are to be protected.

3.03 EXCAVATING

- A. Depressions: Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, open the depression to equipment working width and remove all debris and soft material as directed by the Architect.
- B. Other areas: Excavate to grades shown on the Drawings. Where excavation grades are not shown on the Drawings, excavate as required to accommodate the installation.
- C. Overexcavation: Backfill and compact all overexcavated areas as specified for fill below, and at no additional cost to the Owner.
- D. Removal of unsuitable materials:
- (1) Topsoil: Topsoil shall be stripped from the areas to be excavated and on which fill or pavement is to be placed, to the depth of the sod or that depth comprising mostly humus, organic or other deleterious materials.
 - (2) Topsoil shall be stockpiled in an approved area to be later spread on those areas which are to be seeded or sodded. Topsoil which is to be composted shall be fertilized with a high nitrogen chemical fertilizer immediately prior to stripping. Fertilizer shall be evenly applied to the topsoil surface at a rate which will provide 100 pounds of available nitrogen per acre.
 - (3) Peat, Muck, Marl, Etc.: All such unsuitable foundation materials shall be excavated from beneath all paved areas, embankments and structures which could be adversely affected by settlement; and properly disposed of as approved by the Architect.

3.04 PREPARATION OF SUBGRADE

- A. Scarifying: After the site has been cleared, stripped, and excavated to within six inches of the specified depths for re-compaction, scarify the exposed surface to a minimum depth of six inches, moisten as required to condition, and compact to the requirements specified for fill below.
- B. Leveling: Remove all ruts, hummocks, and other uneven surfaces by surface grading prior to placement of fill.

3.05 EXCESS WATER CONTROL

- A. Unfavorable weather: Do not place, spread, or roll and fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the Architect.
- B. Flooding: Provide berms or channels to prevent flooding of sub-grade. Promptly remove all water collecting in depressions.
- C. Softened sub-grade: Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and re-compact as specified for fill and compaction below, at no additional cost to the Owner.
- D. Dewatering:
 - (1) Provide and maintain at all time during construction, ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the work.
 - (2) Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations.

3.06 FILL AND COMPACTION

- A. Filling: After sub-grade compaction has been approved by the Architect, spread approved fill material in layers not exceeding eight inches in uncompacted thickness.
- B. Moisture control:
 - (1) The moisture content of fill and sub-grade materials at the time of compaction shall be within the limits specified. Where not otherwise specified, the moisture content shall be within plus or minus two (2) percentage points of optimum moisture content.

- (2) Wherever possible, the moisture shall be controlled in the area being excavated by:
 - (a) Sprinkling water on the surface to increase moisture content.
 - (b) Tilling the soil to aerate it to reduce the moisture content.
- C. Compaction, general: Compact each soil layer to the specified minimum degree. Repeat compaction process until plan grade is attained.
- D. Placing compacted fill:
 - (1) Where compaction is permitted by the use of sheep's foot rollers, pneumatic-tire rollers, three-wheel rollers or other power-rollers, the fill material, before rolling, shall be spread in horizontal layers having a uniform thickness not exceeding 8 inches, loose measure. Where a tamping (sheep's foot) roller is used, the loose depth of lift shall not exceed the length of the tamper feet.
 - (2) Where compaction is required by the use of mechanical or vibrator tamps, filled material shall be spread in horizontal layers having a uniform thickness not exceeding 4 inches, loose measure. The rate at which fill materials are placed and spread shall, at times, be regulated such that the tamping and/or rolling equipment can obtain thorough and uniform compaction of each layer to the density as hereinafter specified.
 - (3) Each fill layer or lift shall extend transversely over the entire area and shall be kept smooth. If a dragline, bulldozer or similar equipment deposits material in piles, the material so cast shall be moved from its place of deposit and spread out in layers as specified herein for uniform layers.
 - (4) The surface of the fill area shall be sloped or crowned to drain at all times.
 - (5) When the material is so granular it is not practical to make compaction tests, the contractor may, if approved by the Architect, compact such material with crawler-tread tractor which has a bearing of at least 6 pounds per square inch of tread, or with approved vibrator equipment, or both. The material shall be placed in lifts not to exceed 6 inches, loose measurement, and each lift thoroughly compacted by successive trips back and forth with the tread areas overlapping enough on each trip so that all portions will be compacted uniformly.
- E. Degrees of compaction requirements:
 - (1) Structural fill: Densify all structural fill, including re-compacted existing fill and backfill, to a minimum degree of compaction of 95% of maximum dry density.
 - (2) Pavement areas: Compact the upper six inches of fill in pavement areas to a minimum degree of compaction of 90% of maximum dry density.

(3) Trenches in building and pavement areas:

- (a) Building and pavement areas are defined, for the purpose of this paragraph, as extending a minimum of five feet beyond the building and/or pavement.
- (b) Compact cohesive backfill material to a minimum degree of compaction of 90% of maximum dry density.
- (c) Compact the upper six inches of backfill in pavement areas to a minimum degree of compaction of 90% of maximum dry density.
- (d) Densify cohesionless backfill material to a minimum relative density of 70% as determined by ASTM D2049.
- (e) Compact materials of a questionable cohesion to either a minimum degree of compaction of 90% or a minimum relative density of 70%, whichever results in the greater dry density.

F. Jetting; will not be permitted unless specifically authorized by the Architect for densification of cohesion-less material.

3.07 GRADING

A. General: Except as otherwise directed by the Architect, perform all rough and finish grading required to attain the elevations shown on the Drawings, or as required to complete construction and insure proper drainage.

B. Grading tolerances:

(1) Rough grade:

- (a) Building: Plus or minus 0.1 foot

(2) Finish grade:

- (a) Granular cushion under concrete slabs: Plus or minus 0.05 foot
- (b) Parking areas: As specified elsewhere.
- (c) Landscaped areas: As specified elsewhere.

C. Treatment after completion of grading:

- (1) After grading is completed and the Architect has finished his inspection, permit no further excavating, filling, or grading except with the approval of and inspection of the Architect.

- (2) Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.08 EXCAVATING FOR FOOTINGS

A. Preparation:

- (1) To minimize differential settlement, it is essential that earth surfaces upon which footings will be placed be compacted to the approval of the Architect and in accordance with the compaction requirements established in this Section of these Specifications.
- (2) Verify that all footing sub-grade compaction is complete and approved prior to forming (where applicable) and pouring footings.

- B. Excavating: Excavate to the established lines and grades. Cut off bottom of trenches level, and remove all loose soil. Where soft spots are encountered, remove all defective material and replace with lean concrete at no additional cost to the Owner.

3.09 PLACING GRANULAR MATERIAL

- A. Carefully place the specified granular under-slab material concrete slabs on grade, uniformly attaining the thickness indicated on the Drawings, and providing all required transition planes.

3.10 TRENCHING

A. General:

- (1) Perform all trenching required for the installation of items where the trenching is not specifically described in other Sections of these Specifications.
- (2) Make all trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting.

- B. Depth: Trench as required to provide the elevations shown on the Drawings. Where elevations are not shown on the drawings, trench to sufficient depth to give a minimum of 18 inches of fill above the top of the pipe, measured from the adjacent finished grade.

- C. Correction of faulty grades: Where trench excavation is in-advertently carried below proper elevations, backfill with granular material approved by the Architect, and then compact to provide a firm and unyielding sub-grade and/or foundation to the approval of the Architect and at no additional cost to the Owner.

D. Trench bracing:

- (1) Properly support all trenches in strict accordance with all pertinent Federal, State and Local safety rules and regulations.
- (2) Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing adjacent improvements of every kind, whether on public or private property, will be fully protected from damage.
- (3) In the event of damage to such adjacent improvements, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
- (4) Arrange bracing, sheeting, and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.

E. Removal of trench bracing: Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.

F. Grading and stockpiling trenched material: Control the stockpiling of trenched material in a manner to prevent water running into the excavations. Do not obstruct surface drainage, but provide means whereby storm and waste waters are diverted into existing gutters, other surface drains, or temporary drains.

3.11 FOUNDATION FOR PIPES

A. General: Grade the trench bottoms to provide a smooth, firm, and stable foundation free from rock points throughout the length of the pipe.

B. Foundation material: Place a minimum of six inches of the specified cohesion-less material in the bottom of the trench, clean sand may be used.

C. Subsurface conditions:

- (1) In areas where soft, unstable materials are encountered at the surface upon which cohesion-less material is to be placed, remove the unstable material and replace it with predominantly granular material approved by the Architect. Make sufficient depth to develop a firm foundation for the item being installed.
- (2) If the need for such over-excavation has been occasioned by an act or failure to act on the part of the Contractor, make the over-excavation and replacement at no additional cost to the Owner.

D. Shaping:

- (1) At each joint in pipe, recess the bottom of the trench as required into the firm foundation in such a manner as to relieve the bell of the pipe of all load and to ensure continuous bearing of the pipe barrel on the firm foundation.
- (2) Accurately shape all pipe sub-grade and fit the bottom of the trench to the pipe shape. Use a drag template shaped to conform to the outer surface of the pipe if other methods do not produce satisfactory results.

3.12 BEDDING FOR PIPES

A. General: Place the specified cohesion-less material in six (6) inch (maximum) loose lifts, simultaneously on each side of the pipe for the full width of the trench and hand tamp each lift, to a minimum depth of one foot above the outside diameter of the pipe barrel.

B. Densification:

- (1) Flooding and/or mass jetting shall be allowed only outside the pavement limits. Trench fill above the pipe zone under paved areas shall be densified by wetting and vibratory/impact machine compaction.
- (2) Take special care to provide firm bedding support on the underside of the pipe and fittings for the full length of the pipe.

C. Alternate bedding: Other bedding procedures and materials may be used if prior approval has been obtained from the Architect.

3.13 BACKFILL FOR PIPES

A. Using on-site materials: After the pipe has been thoroughly bedded and covered, spread the on-site material in uniform lifts of not more than eight inches in uncompacted thickness, and then compact as specified in this Section. Repeat the spreading and compacting procedure until adjacent grade level is attained.

B. Using imported cohesion-less material: After the pipe has been thoroughly bedded and covered, fill the remaining portion of the trench with the specified cohesion-less material, and density as specified in this Section.

3.14 WASTE MATERIAL DISPOSAL

A. Disposal of excavated material: Except as hereinafter provided, excavated material shall, insofar as practicable, and if suitable, be used in embankment and fill or at such other places within the construction limits as may be specified or directed, depending on the nature of the material. No useable material shall be wasted without authority. The Contractor shall provide

the Architect with written approval from a landowner on whose land waste material is to be disposed.

- B. If more material is excavated from within required cut slope lines than is needed to construction embankment of fill, the excess may be used, when directed by the Architect, to widen embankment, or flatten fill slopes, or both, or be otherwise disposed.
- C. Disposing of organic material: All brush, limbs, tops and other debris resulting from the clearing, or such material may be reduced to chips by processing through a brush chipping machine; when a brush chipping machine is used, the chips shall be disposed of outside the limits of the project site, or stored for future use as mulching material in a manner approved by the Architect.
- D. Disposing of inorganic material: Materials excavated or removed during the construction of the project shall become the property of the Contractor unless otherwise shown on the plans or specifications. Materials reserved for use shall be removed and stored outside the limits of construction at the location and in the manner approved by the Architect. Materials that become the property of the Contractor shall be removed from the project before acceptance of the project.
- E. Rubble:
 - (1) All concrete, stone, brick and other materials which have been broken into pieces such that the largest face is not greater than 1 square foot in area and which have no salvage value shall be placed in designated embankments in parallel layers. All voids shall be completely filled with sound earth and compacted to the specified density. Such rubble material shall not be placed closer than 12 inches to the sub-grade.
 - (2) Pieces of suitable size rubble may be used in the construction of riprap, tree wells, and similar structures, or may be used otherwise as approved by the Architect.

3.15 SPECIAL STRUCTURAL REQUIREMENTS

- A. Structures with special requirements are all buildings, manholes, storm-water catch basins, valve vaults and boxes, culvert headwalls, diversion chambers and similar structures located in the graded areas of the site.
- B. Time for curing and completing structure:
 - (1) Backfill against concrete walls will not be permitted prior to the expiration of the specified curing time applicable to the latest concrete placed in the completed wall and in no case earlier than seven days following the completion of concrete placement. Backfill against concrete walls of a design such that horizontal support for the wall is provided by

slabs, struts, or other structural systems located near the top of the wall shall not be started until after the slabs, struts, or other structural systems are completed.

- (2) Backfill against unit masonry walls shall in no case be placed earlier than 48 hours after the masonry is completed. In cases where the masonry wall is to receive horizontal support from structural systems at the top of the wall, backfill operations shall not be started prior to completion of the structural system.
 - (3) Walls of any types, or other parts of the structure, damaged or showing excessive displacement as a result of the backfilling operation, shall be repaired or removed and rebuilt as directed by the Architect. Such work ordered repaired or removed and rebuilt shall be performed by the Contractor without additional cost to the Owner.
- C. Backfill preparation: After forms for concrete masonry have been removed and after the surface of the concrete has been prepared to receive backfill; after unit masonry construction below grade is completed; after damp-proofing of walls, if required, is completed; after below grade utility lines have been installed, inspected and approved, and all specified tests have been performed, and all other work required to be performed prior to backfilling is completed, the excavation shall be cleaned of all waste concrete, spills from masonry units, lumber, sticks and other deleterious substances and then be backfilled as herein specified.

3.16 FIELD TESTING

- A. Unless specified otherwise, the Contractor shall coordinate with the owner's testing lab the following field density tests to insure required densities are being obtained as specified. Initial required testing will be paid by the owner.
- (1) One test for each 10,000 square feet or fraction thereof per lift of general fill.
 - (2) Two tests for each 10,000 square feet or fraction thereof per lift of structural fill under slabs, foundations and pavements.
 - (3) One test per lift for each other type of fill, if so directed by the Architect.
- B. Compaction effort: At the beginning of compaction of each type of material by a specific piece of equipment, the minimum number of passes shall be determined to meet the specified densities, as witnessed by the Architect. The minimum required number of machine passes determined shall be considered only a working guideline and shall in no way relieve the contractor of his responsibility for providing the specified density in the compacted fill.
- C. Conditions for acceptance of compacted fill:
- (1) Each lift of fill material shall be placed, compacted, and tested for in-place density as herein specified and shall be approved by the Architect, or the Architect's agent on site, prior to placement of the next overlying lift of fill material.

- (2) Compacted fill shall be considered acceptable provided that all of the following conditions are met.
 - (a) At least two (2) in-place density tests conducted on the lift indicate specified compaction for each test on the lift indicating less than specified compaction.
 - (b) Not more than 20% of all in-place density tests conducted on the completed fill, or any single lift therein, shall indicate less than the specified degree of compaction.
 - (c) No in-place density test on an acceptable lift of fill shall indicate density of more than 3% below the specified percentage of maximum density required.
 - (d) There are no isolated areas of soft yielding fill within the area of the lift, or portion thereof, as determined visually by the Architect, or the Architect's agent, or the inspector on site.
 - (3) Any lift of fill material, or portion thereof, failing to meet the above criteria shall be re-compacted, removed and replaced, or otherwise treated by the Contractor to produce the specified in-place density as herein defined at no additional cost to the Owner, including testing.
 - (4) All reworked areas of fill shall be retested for in-place density and approved prior to placement of the next overlying lift of fill material. The Architect shall reserve the right to retest any area of questionable compaction and the contractor shall provide such testing at no additional cost to the Owner.
- D. Sub-grade compaction: Compaction of natural in-place sub-grade material under footings, slabs, etc. shall be approved based upon in-place density test results and in accordance with the same acceptability criterion as specified above for compacted fill.

End of Section

Section 02281

TERMITE CONTROL

PART ONE - GENERAL

1.01 WORK INCLUDED

- A. Soil treatment below slabs-on-grade for subterranean insects.
- B. Soil treatment at interior and exterior foundation perimeter, for subterranean insects.

1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in soil treatment for termite control with three (3) years documented experience.
- B. Materials: Provide certification that toxicants conform to specified requirements.
- C. Material packaging: Manufacturer's labels and seals identifying content.

1.03 REGULATORY REQUIREMENTS

- A. Conform to State of Indiana requirements for application licensing.
- B. Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.
- C. Submit manufacturer's installation instructions.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit documents.
- B. Accurately record moisture content of soil before treatment, date and rate of application, areas of application, diary of meter readings and corresponding soil coverage.

1.05 WARRANTY

- A. Provide five (5) year bonded guaranty for material and installation.

- B. Bonded guaranty cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites; repairs to building or building contents so caused.
- C. Inspect work annually and report in writing to the Owner.
- D. Owner reserves the right to renew bonded guaranty for an additional five (5) years at a cost to be agreed to at that time with the applicator.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Toxicant chemical: Water based emulsion, uniform composition, synthetic dye to permit visual identification of treated soil, of the generic chemical, termader or equal.

2.02 MIX DILUTION

- A. Dilute toxicant chemical to a one percent solution or as recommended by manufacturer.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.
- B. Beginning of application means acceptance of soil conditions.

3.02 APPLICATION

- A. Apply toxicant twelve (12) hours prior to installation of vapor barrier under slab-on-grade or finish grading outside foundation walls.
- B. Apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant to soil at the following rates or as recommended by manufacturer and approved by architect, using metered applicator:
 - (1) Under floor slabs-on-grade: 1 1/2 gallon per 10 sq.ft.
 - (2) Both sides of foundation wall: to a depth of eight (8) feet. One gallon per 2.5 cu. ft. of soil.

- (3) Soil within 5 feet of building perimeter for a depth of five (5) feet. One gallon per 2.5 cu. ft.
- D. Apply extra treatment to structure penetrations, pipe, ducts, and other soil penetrations.
- E. Apply as a coarse spray to ensure uniform distribution
- F. Coordinate soil treatment at foundation perimeter with finish grading and landscaping work to avoid disturbance of treated soil. Retreat disturbed treated soil.
- G. Application rates indicated are per normal suggested manufacturer's instructions. If other application rates are necessary due to environmental, governmental or industrial standards, the applicator should inform the contractor and bring it to the architect's attention.

3.03 RETREATMENT

- A. If inspection identifies the presence of termites, retreat soil and retest.
- B. Use same toxicant as for original treatment.

Section 03100

CONCRETE FORMWORK

PART ONE - GENERAL

1.01 DESCRIPTION

- A. The work to be performed under this section consists of furnishing all materials, labor and equipment needed for the construction of the forms for concrete work including: sidewalks, retaining walls, curbs, floors, paving, footings, abutments, and all other cast-in-place concrete work shown on drawings and/or specified. The work is to be completed in accordance with these specifications, the drawings and reference standards.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete work - Section 03110
- B. Steel Reinforcement for concrete - Section 03210

1.03 WORK INSTALLED

- A. Built-in items: Build in all items in the concrete for the attachment of other materials, including, but not necessarily limited to clip angles, bolts, inserts, sleeves, dovetail slots, water stops, mechanical and electrical items and other as required. Coordinate installations with respective contractors.

1.04 QUALITY ASSURANCE

- A. General design criteria: Conform to ACI 318-63, Design.
- B. Requirements of regulatory agencies: Erect forms to meet requirements of the local Building Code.
- C. Allowable tolerances:
 - (1) Concrete, paving, aprons, entrance slabs, walks and other horizontal surfaces shall be finished within a tolerance of 1/4" in linear ft. in any direction except where drains occur in which case the slabs will be sloped uniformly to drains. Where drains are indicated the surfaces shall be sloped uniformly. Deflection of forms between supports shall be within 1/4" 10 feet tolerance.
 - (2) Walls, retaining walls, ramped surfaces, steps and other concrete surfaces shall conform to the details shown on drawings and is plumb, level or sloped as indicated on drawings.

- (3) Any concrete not conforming to the drawings and the above specifications shall be corrected to the satisfaction of the Architect and at no additional cost to the Owner.

1.05 SUBMITTALS

- A. Manufacturer's literature: Description and recommended installation instructions, including ties, spreaders, corner forms, and form release agents.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. On delivery to job site, store form materials above ground on framework or blocking with adequate cover and ventilation to maintain usability.
- B. Handle materials in a manner not to damage them in any way which would affect usability.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Forms may be of wood or metal and be constructed to produce shapes, lines and dimensions as shown on the drawings and in these specifications with sufficient strength and bracing to support the loads and pressures imposed on them and sufficiently tight to prevent leakage of concrete. Plywood is to be of form grade, studs and wales to be selected for straightness.
- B. Forms for footings to be No. 2 common lumber or better, or plywood. Form for footings may be omitted when conditions are approved by the Architect.
- C. Form oil shall be a light clear paraffin base oil that will not discolor or otherwise injure the surface of the concrete and shall be approved for form use, or as approved by the Architect.

PART THREE - EXECUTION

3.01 CONSTRUCTION AND PLACEMENT OF FORMS

- A. The contractor shall check form work during installation to assure proper lines, shape and elevations, also plumb, level, sloped as required.
- B. Contractor is required to notify Architect 24 hours in advance when he is planning to pour, so the Architect has a chance to inspect the forms prior to placing concrete.
- C. The contractor shall maintain a constant check of form work during placement of concrete for wall alignment, line, shape, and leakage. If during placement of concrete any weakness develops and the form work shows any undue settlement, deflection or other distortion from the correct lines and elevations, the work shall be stopped until corrections have been made.
- D. Screeds for slabs shall be checked immediately prior to and during placing of concrete.

- E. Form oil shall be applied, before the placement of reinforcing steel, and at the manufacturer's recommended rate of application with any excess wiped off.

3.02 REMOVAL OF FORMS

- A. Form work shall be removed in such a manner as to insure the complete safety of the structure. Forms for walls and other members not supporting the weight of the concrete may be removed after 24 hours provided the concrete is hardened sufficiently to resist damage from removal operations.
- B. Any cracks or other damage resulting from the removal of forms shall be corrected as directed by the Architect.

Section 03110

CONCRETE WORK

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Extent of work: The work to be performed under this section consists of furnishing all labor, materials and equipment to construct all concrete sidewalks, walls, footings and foundations, retaining walls, entrance slabs and sidewalks or other cast-in-place concrete as shown on the drawings or described in these specifications.
- B. The work under this section shall be carefully coordinated with filling, grading and compaction of subgrades specified elsewhere to insure that the subgrades are properly prepared to receive concrete. Also coordinated with the electrical and mechanical trades.
- C. The Contractor is to notify the Architect at least one day (24 hours) before making any concrete pours so that the Architect can inspect the subgrades and form work before placement of concrete.
- D. Related work specified elsewhere:
 - (1) Concrete form work - Section 03100.
 - (2) Steel reinforcement for concrete - Section 03210.

1.02 QUALITY ASSURANCE

- A. Concrete work: Concrete paving, aprons, entrance slabs, walks and other horizontal surfaces shall be finished within a tolerance of 1/4" when measured with a 10 foot straight edge in any direction except when sloped uniformly to a drain.
- B. Walls, ramped surfaces, steps and other structures shall conform to the details shown on drawings and be plumb, level, or sloped within the tolerances given above.
- C. Any concrete installed that does not conform to the drawings or to the specified tolerances will be corrected to the satisfaction of the Architect.
- D. Cold weather protection: Adequate equipment shall be provided for heating the concrete during freezing or near freezing weather. No frozen material or ice will be used. All forms, reinforcing and earth that comes in contact with the concrete shall be free of frost when air temperature is below 40 degrees F. Concrete mix shall be between 50 degrees F and 70 degrees F and adequate means provided to maintain a temperature of 70 degrees F for 3 days or 50

degrees F for five days or as much additional time as needed to insure proper protection and curing of the concrete. The covering or shelter is to remain in place 24 hours after heating is discontinued. Use of Calcium Chloride, salt or other chemicals will not be allowed.

E. Hot weather requirements:

- (1) Concrete placed in hot weather shall have a placing temperature which will not cause difficulty in loss of slump, flash set, or cold joints. During hot weather the Contractor shall take adequate precautions to reduce the detrimental effects of these conditions.
- (2) Forms, subgrades and reinforcement shall be sprinkled with cool water just prior to placement of the concrete, and the area around the work shall be wetted down to cool the surrounding air and to increase its humidity.
- (3) Concrete shall be placed and finished as speedily as possible and ample personnel shall be available to accomplish this. All tools, equipment and materials needed for the screeding, working and curing of the concrete shall be on site prior to the need for them.

1.03 STANDARD SPECIFICATIONS

- A. The ACI Publication "Standards and Code Requirements for Concrete and Reinforced Concrete", latest edition shall govern all concrete work except as otherwise specified herein.

PART TWO - PRODUCTS

2.01 CONCRETE MATERIALS

- A. All materials, unless otherwise indicated, noted or specified, shall conform to the latest edition of the standard specification of the American Society for Testing Materials covering the material being used.
- B. All exterior concrete shall be air entrained 6% to 7%. Air entrainment shall be provided by the use of air entrainment Portland Cement Type 1-A conforming to ASTM Designation 175, or may be provided by the use of an air entrainment admixture conforming to the requirements of ASTM Specification for Air Entrainment Admixtures for Concrete, Designation C260.
- C. Aggregate for all concrete shall be regular stone conforming to ASTM C33.
- D. Sand shall be thoroughly washed and shall be free from loam, soft stone, or other ingredients which would affect the strength of the concrete. Sand shall be well graded from course to fine with course particles predominating, but containing no grains which will not pass through a 1/4" mesh. ASTM C33.

- E. The methods used in piling and handling aggregates shall be such that the fine and coarse aggregates shall be kept separate prior to their placing into the mixer. They shall be kept clean and free from foreign substances. No aggregates shall be used in work which has not been stored on the project site, or ready mix plant for at least twenty four hours. Aggregates shall be stored so as to insure the preservation of their quality and fitness for the work. When considered necessary by the Architect, they shall be placed on wooden platforms or other hard, clean surfaces and not on the ground, and shall be located so as to facilitate proper inspection.
- F. Vapor barrier under slabs as shown on the drawings.
- G. Expansion joint material for slabs on grade shall be bituminous type, premolded expansion joint conforming to ASTM Specification D-994, and shall be of the thickness indicated on drawings.
- H. Water: Clean fresh water, free of oil, acid, organic, or other deleterious substances.
- I. Curing compound exterior concrete shall be white pigmented type and conform to the requirements of AASHTO Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete, (Designation M148) or 6 mils. plastic sheeting. During cold weather, insulated blanket coverings meeting the requirements of the State Highway Specifications shall be used for curing all concrete.

2.02 DESIGN OF MIX

- A. The concrete mix shall be proportioned and designed to develop a minimum ultimate compressive strength of 3500 psi for all footings and 4000 psi elsewhere, at 28 days and shall be such as to produce concrete that will work readily into the corners and angles of the form and around the reinforcement without excessive spreading and without permitting the materials to segregate or free water to collect on the surface.
- B. A minimum of 5 1/2 sacks of cement per yard shall be used for 3500 psi concrete and 6 sacks per yard for the 4000 psi concrete.
- C. No more than 6 1/2 gallons of water per sack (94# cement) shall be used per batch. The water content of the concrete shall be the least that will produce uniformly dense concrete free from aggregate pockets or honeycombs. Corrections shall be made for the amount of moisture contained in the aggregates and allowances shall be made for absorption of moisture by the aggregates during the period of mixing and handling.
- D. The water-cement ratio, including free water in the aggregate, shall not exceed that approved by the Architect. Variations and correcting the proportions and amount of aggregates used shall be approved by the Architect.
- E. Cement mortar for topping and grouting shall be mixed in the proportions of one part cement to not more than two parts, clean, fine sand, unless otherwise noted.

- F. The proportions herein specified for mixing of concrete shall not be varied except as may be found necessary to meet the test requirements herein specified and then only on the instructions of the Architect.

2.03 AFFIDAVITS ON MATERIALS

- A. If requested by the Owner, the Contractor shall obtain from the various materials suppliers notarized affidavits that the materials meet the ASTM and AASHTO Specifications and other standards referred to above, as applicable to each type of material.

PART THREE - EXECUTION

- A. Plant mix concrete: If plant mix or mixed-in-transit concrete is used, each shipment shall be accomplished by duplicate certificates, showing analysis of the mix, it shall be produced in.

- B. Job mix concrete:

- (1) If concrete is prepared at the site, it shall be mixed in a standard type of mechanical batch mixer that mixes one complete batch at a time, which is entirely discharged before another is introduced.
- (2) The concrete shall be mixed to the desired consistency and until the mass is uniform in color and homogeneous.
- (3) The mixing shall continue for at least one (1) minute after all ingredients are in the mixer.
- (4) During the period of mixing, the drum shall operate at the speed for which it was designed, except that the peripheral speed of the drum shall not be less than 175 nor more than 225 ft. per minute.
- (5) If this procedure does not effect a thorough mixing of the concrete, an additional number of turns at the same rate of speed shall be given until a thorough mixing of each mix of concrete is secured. The entire contents of the mixer shall be removed from the drum before material for the succeeding batch is placed therein and the mixer shall preferably be equipped with mechanical means for preventing the addition of aggregate or water after mixing has commenced.
- (6) The mixer shall be equipped with adequate water storage and a calibrated measuring device for accurately measuring the amount of water used in each batch. The mixer shall be equipped with a batch meter for accurately recording the time of mixing of each batch and also an attachment for automatically locking the discharge chute so as to prevent the emptying of the mixer until the materials have been mixed with the specified minimum time. No mixer shall be operated above its rate capacity, or be used which has a rated

capacity of less than one (1) sack batch, and batches requiring a fractional sack of cement shall not be mixed unless the cement is batched by weight.

- (7) The first batch of concrete materials placed in the mixer shall contain an additional quantity of cement, sand and water, sufficient to coat the inside surface of the drum without diminishing the mortar cement of the mix. Upon the cessation of mixing for any considerable length of time, the mixer shall be thoroughly cleaned.
- (8) Care shall be taken to secure the exact proportions at all times. The mixed concrete shall be, as stated hereinbefore, of plastic consistency that will flow into the form of trenches and about reinforcement where used for any reinforced work but shall not be so wet as to cause separation of materials.
- (9) Concrete shall be mixed only as required for immediate use and shall be conveyed directly from the mixer and deposited in place. Concrete in which the initial set has occurred shall not be used.
- (10) A competent foreman shall be in attendance at the mixer to give account of each batch, which leaves the mixer.

3.02 PLACEMENT OF CONCRETE

- A. Proper provisions shall be made before the concrete is placed to embed all inserts, including inserts to be provided by others.
- B. It will be each subcontractor's responsibility to provide the Contractor with information regarding opening or chases he will require in the concrete work and to provide all his items which will be cast into, embedded in or will otherwise be monolithic with the concrete pour. The contractor, prior to placing any concrete, shall give written notice to the Architect and all subcontractors of his intention to place concrete and his schedule of placing.
- C. All slabs shall be fitted to the top surface in one continuous operation. If possible, the placing of concrete shall be carried on as a continuous operation until the completion of the section. If for any reason, placing of concrete has to be stopped before the completion of the part being poured, greatest care must be exercised to stop at a point where the joint will not weaken the construction. Such joint shall be at the point of minimum shear stress in the concrete.
- D. The maximum pour for slabs shall be as noted in General Notes of the drawings.
- E. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. The use of long troughs and chutes for conveying concrete from the mixer to the forms shall be permitted only on authorization of the Architect.

- F. All chutes, troughs, etc. shall be kept clean and free from coatings of hardened concrete by flushing with water after each run; water used for flushing shall be discharged clear of the concrete already in place.
- G. Concrete shall not be permitted to drop freely more than five (5) feet and it will not be permissible to allow concrete to run or be taken to fill each part of the form by depositing the concrete as near final position as possible. The coarse aggregates shall be worked back from the forms and the concrete forced around the reinforcement without displacing bars. Concrete shall not be permitted to flow under runways or other obstructions that make spading impossible.
- H. Concrete shall be spaded and puddled with proper tools into compact homogeneous mass.
- I. The concrete shall be placed as rapidly, continuously and in as large areas as possible, or until the unit of operation as previously approved has been compacted. In any given operation the batches shall be placed so that each shall be installed and compacted before the preceding one has taken its initial set, so that perfect joining will be effected without marked indication of the finished faces of concrete.
- J. The Contractor shall keep a capable mechanic on the job during the placement of concrete to keep reinforcement in proper alignment and spacing.
- K. Insert asphalt strips of sufficient width against all masonry where cement work is installed, to protect masonry while concrete is being placed.

3.03 MECHANICAL VIBRATION

- A. The concrete shall be compacted by means of mechanical vibrator operated within the mass of concrete.
- B. Vibration shall be supplemented by hand spading. The concrete shall be spaded by hand in all corners and angles of the forms and along all form faces as elsewhere herein specified. The concrete shall be vibrated with a frequency of not less than 7000 impulses per minute, the vibration shall be of sufficient intensity and duration to cause flow or settlement into place and complete compaction. Care must be exercised that concrete is not over-vibrated, particularly if it is of relatively wet consistency exceeding 4" in slump and that vibrators are not used to transport concrete in the forms. Vibrators should be inserted and withdrawn at many points from 18" to 30" apart for short periods, usually from 5 to 15 seconds is sufficient, in preference to insertion for longer periods at wider intervals. Systematic spacing of insertions of the vibrator should be established to insure that no concrete is missed. Vibration shall be applied to the mass at the point of deposit and in the body of freshly deposited concrete.

- C. The mechanical vibrator shall be of a type and design approved by the Architect. It should be adequately powered and capable of transmitting vibrations of the required frequency to the concrete.
- D. The vibrator shall be applied to the concrete immediately after deposit and so manipulated that the concrete is reduced to a uniform plastic mass thoroughly compacted. It should be thoroughly compacted around the reinforcement and worked into the corners and angles of the forms. The vibrators shall not be attached to the forms or the reinforcement nor shall it be placed on reinforcing steel.
- E. Concrete shall be placed in layers of uniform thickness and the apparatus so operated that the vibrating element does not penetrate through the layers of fresh concrete and disturb partially hardened concrete in lower layers. Vibrators shall not be pushed into the mass of concrete too rapidly and should be withdrawn slowly.

3.04 REMOVAL OF DEFECTIVE CONCRETE

- A. After forms have been removed any concrete not formed as indicated on drawings, or out of plumb, level, or alignment, or otherwise out of required tolerances shall be removed and replaced at no additional expense to the Owner.

3.05 BONDING NEW CONCRETE TO HARDENED CONCRETE

- A. Before depositing new concrete against concrete which has hardened, the surface of the hardened concrete shall be picked and wire brushed clean to remove foreign matter, loose particles, and laitance. The hardened concrete shall then be dampened with water and thoroughly covered with a coat of neat cement mortar of similar proportions of the mortar in the concrete. The fresh concrete shall be placed before the mortar has taken its initial set.

3.06 RETEMPERING

- A. Concrete shall be mixed and delivered in such quantities as are required for immediate use, and shall be placed while fresh, before losses of slump occurs. When concrete arrives at the site with slump below that suitable for placing, water may be added only if neither the maximum slump is exceeded or the water cement ratio is exceeded. Any water added shall be incorporated by additional mixing equal to at least one-half of the total mixing required. Driver is to note on delivery tickets the amount of water added and additional mixing.

3.07 CONTROL JOINTS

- A. Provide control joints at the locations indicated on the drawings. The joints shall be formed as detailed and shall be at least one-fourth of slab depth. Contraction joints shall be formed to straight lines. Edges of slabs and those where edging is shown on the drawings shall be

rounded with a radius not larger than 1/8". Construction joints shall conform to the details shown on the drawings.

3.08 EXPANSION JOINTS

- A. Expansion joints shall be installed at the locations shown on the drawings. Expansion joints in the walks shall be installed at approximately 25 linear foot intervals. The joint material shall be placed the full depth of slabs and flush with the top surface. All expansion joints and edges of concrete shall be jointed and edged in accordance with customary practice. Reinforcing shall not extend through expansion joints.

3.09 VAPOR BARRIER

- A. The vapor barrier previously specified and shown on the drawings shall consist of a 6 mil. thickness of "polyethylene sheeting" lapped not less than 6" and sealed at edges with an adhesive as recommended by the manufacturer of the vapor barrier.

3.10 FINISHING WALLS

- A. All interior exposed concrete shall have all fins and projections removed and the rough surface produced by this operation shall be rubbed smooth. All depressions shall be filled with mortar of the same proportions as the mortar of the same proportions as the mortar used in the body of the concrete and this mortar shall be smoothed with a wooden float. This work shall be done closely following removal of the forms. All exposed surfaces in finished and unfinished rooms shall be left clean and smooth and shall present a neat and finished appearance.
- B. Concrete which has a total area of honeycombed surfaces in excess of one percent of the total surface area of the forms used for any member of the pour in which the honeycombing is present will not be accepted and must be entirely removed and new concrete substituted by the contractor at his own expense. Work of other Contractors adjacent to or incorporated in the concrete to be removed shall be removed and replaced protected, and repaired to the satisfaction of the Architect at the general contractor's expense.
- C. Honeycomb surfaces, for the purpose of enforcing this specification, are hereby defined as the concrete surfaces, next to forms, in which there are voids between the particles of coarse aggregate.
- D. The small amount of honeycomb permitted to remain shall be filled with mortar of the same consistency as the mortar used in the body of the concrete and smoothed with a wooden float, closely following removal of forms. The Architect shall stop the removal of forms unless the requirements of this section are carried out. Tops of walls shall be floated smooth. The Contractor shall also perform any other operations in addition to those specified herein that may be required to produce the results specified.

- E. All exterior exposed walls shall be given the following treatment: Prepare a grout of about the proportions of one part cement to one part fine sand. Grout shall be of the consistency that will permit its application to vertical surfaces with a stiff bristle brush. The grout shall be brushed and floated on the previously dampened concrete. Allow grout to remain on wall until the cement has partially set, then remove excess grout with a steel trowel. After drying for an hour or longer, depending on weather conditions, rub the wall vigorously with burlap to completely clean the grout from the surface leaving pits filled, but there shall not be a visible film of grout on the surface. To lighten up the surface, replace part of the grey cement with approximately 30% of white cement. Rubbing up a lather with a carborundum stone shall not be permitted.

3.11 FINISHING FLOORS

- A. Immediately following the pour, the concrete shall be screeded off to bring the top surface to proper contour and elevations. Floors, unless otherwise noted, shall be held perfectly level. Where drains occur or slope is indicated, they shall be pitched toward drain or in direction indicated on drawings.
- B. Soon after screeding and while the concrete is still plastic, the surface shall be floated with wood or metal floats and brought to a high grade.
- C. Floor shall be steel troweled to a smooth and perfect surface after the concrete has hardened enough so that water and fine material are not worked to the surface.
- D. Do not trowel while concrete is too soft or plastic, as this will result in a less wear-resistant surface.
- E. No walking or wheeling shall be permitted on the concrete floors until concrete is thoroughly set.
- F. Floors shall be protected until final completion of the job. Any rough places which develop shall be machine ground before any covering is applied.
- G. Excess water shall be screeded off and the surfaces left clean and level.
- H. In placing depressed slabs, forms shall be provided for forming the edges of depressed sections. These shall be accurately placed with breaks located as directed.

3.12 FINISHING EXTERIOR WORK

- A. Steps and walks shall have a broom finish which shall be done after the concrete is hard enough so that it will retain the scoring.
- B. Concrete drives, concrete platforms, etc. shall be finished in the following manner.

- (1) As soon as water has risen to the surface, it shall be floated and then troweled to a smooth and perfect surface. As soon as concrete has set sufficiently to be firm, remove the forms from the riser and steps, and remove all fins, ridges, etc. from the surface.

3.13 PROTECTION

- A. All concrete shall be properly protected from damage during construction. No vehicles or equipment shall be permitted on paved areas during the curing period. The Contractor shall keep on the job an adequate supply of waterproof paper or polyethylene sheeting, or the types previously specified, for protection of concrete surfaces from damage by rains (or snow) that may occur during finishing operations.

3.14 OPENING TO TRAFFIC

- A. Upon completion of the specified 7 day curing period, the Contractor shall removal any coverings and other debris. No vehicles or construction equipment shall be permitted on the paved surfaces for at least 14 days after the concrete has been placed. The areas may be opened to light vehicular traffic and the Contractor shall be solely responsible for any cracks or other damage resulting from vehicles or construction equipment.

3.15 TESTING

- A. The contractor shall assist the owner's testing laboratory in taking concrete test. The cost of the initial tests will be paid by the owner.

END OF SECTION

Section 03210

STEEL REINFORCEMENT FOR CONCRETE

PART ONE - GENERAL

1.01 DESCRIPTION

- A. The work to be performed under this section consists of furnishing all labor, materials, and equipment required for the steel reinforcing of all concrete construction as shown on the drawings.
- B. Related work described elsewhere includes:
 - (1) Concrete form work Section 03100
 - (2) Concrete work Section 03110

1.02 PRODUCT DELIVERY AND STORAGE

- A. Deliver steel reinforcing to site in bundles with tags indicating bar size and length.
- B. All reinforcing when stored on site is to be on skids or platforms above ground surface and protected from mechanical damage and corrosion.
- C. Deliver and store welding electrodes in accordance with AWS D 12.1.

PART TWO - PRODUCTS

2.01 MATERIAL, GENERAL

- A. Reinforcing steel for concrete work shall conform to ASTM A15 specifications for Billet Steel Bars for concrete reinforcement, Intermediate Grade, with 40,000 psi minimum yield point. Sizes as shown on drawings.
- B. Wire mesh for concrete reinforcement shall be of types and sizes shown on the drawings, and shall conform to the requirements of ASTM A-185 Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement.
- C. Metal chairs, bolster, spacers, form ties, and other devices necessary for placing, spacing, supporting, and securing reinforcement shall conform to the requirements of the Concrete Reinforcing Steel Institute, "Manual of Standard Practice for Reinforcing Concrete

Construction". Form ties shall be of a type that when forms are removed no metal remains within 1 inch of the surface.

PART THREE - EXECUTION

3.01 GENERAL

- A. Installation of steel bar reinforcing: Install steel bar of the sizes shown on the drawings in the locations shown on the drawings.
- B. When lapps occur lap and weld for a sufficient length to develop tensile strength of bar, or lap (minimum 30 bar diameter(s) and tie with wire.
- C. Install all reinforcing, bar and fabric, so that no steel reinforcing comes within 1" of any concrete surface.
- D. Install welded wire fabric using chairs, bolsters, spacers, or form ties to the location shown on the drawings.

END OF SECTION

Section 04100

MORTAR

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Mortar shall be masonry cement mortar (patent mortar) for all masonry work. Mortar shall consist of Portland cement patent mortar clean sand aggregate, and water.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Masonry Accessories - Section 04150
- B. Unit Masonry - Section 04200

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Mortar: Mortar for all masonry work shall conform to the requirements of ASTM Specifications C 270. All mortar shall have a minimum compressive strength of 900 pounds per square inch at 28 days after placement. Masonry cement mortar (patent mortar) such as "Brixment" or "LoneStar" may be used if such mortar meets the requirements specified herein.
- B. Aggregate: Aggregate for mortar shall conform to ASTM specifications C 144. Aggregate shall be clean, sharp sand, free of injurious amounts of organic material.
- C. Water: Water shall be clean, potable and free from deleterious amounts of organic substances or oils, acids, salts, or other contaminants.
- D. Admixtures: Calcium chloride or other admixtures shall not be used unless approved by the Architect.

2.02 MORTAR MIXES

- A. All mortar mixes shall be in the quantity as recommended by the manufacturer.

PART THREE - EXECUTION

3.01 BATCHING, TEMPERING, MIXING

- A. Mortar shall be carefully proportioned by the Contractor to obtain the specified strength. The method of measuring materials for mortar shall be such that the specified proportions can be consistently controlled. Sand shall be measured in a container having a known volume.
- B. All mortars shall be machine mixed, except as otherwise noted for small batches, for a minimum period of five minutes with the proper amount of water for the correct workability. The mixer shall be cleaned after each batch to prevent contamination by set mortar. Mortar shall be used as soon as practicable after mixing. Excessive retempering of mortar will be cause for rejection. Retempering may be done on the board but no water shall be added if there is significant stiffening

3.02 STORAGE AND PROTECTION

- A. Mortar materials and sand shall be stored in such manner to prevent deterioration and intrusion of deleterious materials. Mortar materials are to be kept dry and free of water.

END OF SECTION

Section 04150

MASONRY ACCESSORIES

PART ONE - GENERAL

1.01 DESCRIPTION

- A. The work covered by this Section shall include the furnishing of all labor, materials, plant, equipment and appliances required to complete masonry accessories as shown on the Drawings and as specified, complete, in strict accordance with this Section of the Specifications, the Drawings, and referenced standards.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Mortar - Section 04100
- B. Unit Masonry System - Section 04200
- C. Sealants and caulking - Section 07951

PART TWO - PRODUCTS

2.01 ANCHORS AND TIE SYSTEMS

- A. Anchors and ties shall be zinc coated ferrous metal of the types specified. Zinc coating ASTM A 153, Class B-1, B-2 or B-3 as applicable. Copper cladding of steel wire shall conform to the requirements as specified for Grade 30 HS wire in ASTM B 227.

2.02 JOINT REINFORCEMENT

- A. Masonry joint reinforcement shall be factory fabricated from zinc-coated cold-drawn steel wire, ASTM A82. Reinforcement shall consist of two or more deformed longitudinal wires No. 9 gauge, weld connected with minimum No. 9 gauge cross sires, forming a truss or ladder design. Zinc coating, ASTM A 116, Class 1, except those cross wires used for cavity wall ties, shall be Class 3. Out-to-out spacing of longitudinal wires shall be approximately 2 inches less than the nominal width of the block or width in which it is placed. Distance between welded contacts of cross wires with each longitudinal wire shall not exceed 16 inches. Joint reinforcement shall be furnished in flat sections 10 to 20 feet in length except that factory formed corner reinforcements and other special shapes may be less in lengths.

PART THREE - EXECUTION

3.01 REPLACING REINFORCEMENT

- A. Masonry joint reinforcement shall be placed so that longitudinal wires are located over face-shell mortar beds and are fully embedded in the mortar for their entire length with minimum mortar cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations. Reinforcement at openings shall extend not less than 24 inches beyond the end of sills or lintels or to the end of the panel, if the distance to the end of the panel is less than 24 inches. Reinforcement shall be lapped 6 inches or more. Factory fabricated sections shall be installed at corners and wall intersections.

- B. Align all vertical cells to maintain a clean, unobstructed system of flues.

3.02 SPLICES AND REINFORCEMENT

- A. Splices may be made only at such points and in such manner that the structural strength of the member will not be reduced. Lapped slices shall provide sufficient lap to transfer the working stress of the reinforcement by bond and shear. Minimum lap shall be 30 bar diameters. Welded or mechanical connections shall develop the strength of the reinforcement.

3.03 GROUTING

- A. Perform wall grouting as may be required and shown on drawings in strict accordance with the provisions for highlift grouting as described in Chapter 24 of the Uniform Building Code, latest edition. Do not grout until masonry has cured at least 24 hours. Consolidate all grout at time of pouring by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidation later by puddling before the plasticity is lost.

3.04 CONTROL JOINTS

- A. Control joints shall be provided in accordance with the locations and details shown on the Drawings, shall be constructed by using special control joint units, open end stretcher units, or metal-sash-jamb units, and control joint key. Control joints shall extend through bond beams, unless otherwise indicated. On the weather side of exterior walls, control joints shall be raked out about 1/2 inch and left ready for caulking and sealing. On the exposed-to-view faces of interior walls, control joints shall be raked to a depth of 3/8 inch and neatly tooled square and smooth.

END OF SECTION

Section 04200

UNIT MASONRY

PART ONE - GENERAL

1.01 DESCRIPTION

- A. The work covered by this Section shall include the furnishing of all labor, materials, equipments, and appliances required to complete the masonry work shown on the Drawings and as herein specified, complete, in strict accordance with this Section of the specifications, the Drawings, and referenced standards.
- B. Scope: The work covered by this Section shall include the following:
- (1) Furnishing and installing the masonry, complete.
 - (2) Furnishing and installing masonry ties, anchors, reinforcement and concrete, mortar, and grout for embedding such reinforcement.
 - (3) Furnishing and installing masonry and precast concrete lintels, sills, coping, and other masonry trim to be built in the masonry.
 - (4) Building into masonry all bolts, anchors, nailing blocks, inserts, window and door frames, vents, conduits, and related work to be built in, including items furnished and located by other trades or specified in other sections.
 - (5) Furnishing and installing any bracing, forming, and shoring in conjunction with and in the course of constructing the masonry and not provided in other sections.
 - (6) Furnishing test specimens and samples of materials as specified.
 - (7) Cleaning the masonry and removal of surplus material and waste.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Mortar - Section 04100
- B. Masonry accessories - Section 04150
- C. Sealants and caulking - Section 07951

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Use all means necessary to protect masonry materials before, during, and after installation, and to prevent the installed work and materials of all other trades that are to be incorporated into the masonry work.
- B. All masonry materials shall be stored in a dry place and be protected against intrusion of foreign matter. Any cement, lime, or mortar containing lumps that are not easily crushed between the fingers shall not be used in the work.
- C. Sand shall be handled and stored in such a manner as to prevent segregation of the particles and the intrusion of any foreign material.
- D. All masonry units shall be stored in a shed or stock-piled above ground on platforms and covered with waterproof tarpaulin or other approved covering. The covering shall completely enclose the material, and be securely fastened down.
- E. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete masonry units, as specified below, shall be of modular dimensions where available, and shall include all closures, jamb units, headers and special spaces and sizes required to complete the work as shown. Units shall be of the same manufacturer, composition, size, and appearance and shall be cured by the same process. Units shall be sound and free from cracks, chipped edges, or other defects that would interfere with their proper setting or impair the strength, appearance or durability of the construction. Units shall be free of any deleterious matter that will stain plaster or corrode metal, shall be adequately cured before shipment, and shall be delivered to the job site in an air-dry condition.
 - (1) Hollow load bearing and light weight units: Hollow load bearing and light weight units shall conform to Standard Specifications for Hollow Load Bearing Concrete Masonry Units (ASTM C90-64T or latest revision thereof).
 - (2) Solid load bearing units: Solid load bearing units shall conform to Standard Specification for Solid Load Bearing Concrete Masonry Units (ASTM C145).

PART THREE - EXECUTION

3.01 GENERAL

- A. Lay only dry masonry units.
- B. Use masonry saws to cut and fit masonry units.
- C. Bond: Running bond with vertical joints located at center of masonry units in alternate course below, or as shown on drawings.
- D. Tolerances for masonry construction.
 - (1) Variation from the plumb.
 - (a) In the lines and surfaces of columns, walls, and arises: In 10 feet - 1/4 inch; in any story or 20 feet maximum - 1/4 inch, in 40 feet or more - 3/8 inch.
 - (b) For external corners, control joints and other conspicuous lines: In any story or 20 feet maximum - 1/4 inch; in 40 feet or more - 3/8 inch.
 - (2) Variation from the level or the grades indicated on the Drawings.
 - (a) For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines: In any bay or 20 feet maximum - 1/4 inch; in 40 feet or more - 3/8 inch.
 - (3) Variation of the linear building lines from established position in plan related portion of columns, walls and partitions.
 - (a) In any bay or 20 feet maximum - 3/8 inch; in 40 feet or more - 5/8 inch.
 - (4) Variation in cross-sectional dimensions of columns and in the thickness of walls.
 - (a) Minus 1/4 inch; plus 3/8 inch.
- E. Adjust masonry unit to final position while mortar is soft and plastic.
- F. If units are displaced after mortar has stiffened, remove, clean joints and units or mortar and relay with fresh mortar.
- G. Adjust shelf angles to keep masonry level and at proper elevation.

- H. Provide pressure-relieving joints by placing a continuous 1/8 inch foam neoprene pad under the shelf angle and seal joint with sealant specified in Section 07951 - Sealant and Caulking.
- I. When joining fresh masonry to set or partially set masonry construction, clean exposed surface of set masonry and remove loose mortar prior to laying fresh masonry.

3.02 PROTECTION OF WORK

- A. Protect sills, ledges and off-sets from mortar drippings or other damage during construction.
- B. Remove misplaced mortar or grout immediately.
- C. Protect face materials against staining.

3.03 MORTAR BEDS

- A. Hollow units.
 - (1) Lay with full mortar coverage on horizontal and vertical face shells.
 - (2) Provide full mortar coverage on horizontal and vertical face shells and webs in all courses of the following:
 - (a) Piers, columns and pilasters.
 - (b) Starting course on footings and solid foundation walls.
 - (c) Where adjacent to cells or cavities to be filled with grout.
- B. Solid units: Lay with full mortar coverage on horizontal and vertical joints.

3.04 JOINTS

- A. Horizontal and vertical face joints
 - (1) Nominal thickness: 3/8 inch.
 - (2) Construct uniform joints.
 - (3) Shove vertical joints tight.
 - (4) Strike joints flush in surfaces to be plastered, stuccoed, or covered with other masonry, or other surface applied finish other than paint.

- (5) Tool joints in exposed or to be painted surfaces when thumbprint hard with round jointer, or sled runner type jointer.
 - (6) Remove mortar protruding into cells of cavities to be reinforced or filled.
 - (7) Fill horizontal joints with mortar between top of masonry partitions and underside of concrete slabs or beams.
- B. Collar joints: Except in cavity walls, fill with mortar by back purging either facing or backing wythe and shoving, or grouting.

3.05 BUILT IN WORK

- A. Avoid cutting and patching.
- B. Install bolts, anchors, nailing blocks, inserts, frames, vents, flashings, conduit and other built-in items.
- C. Solidly grout spaces around built-in items.

3.06 POINTING AND CLEANING

- A. At final completion of unit masonry work fill holes in joints and tool.
- B. Cut out and repoint defective joints.
- C. Dry brush masonry surface after mortar has set, at end of each day's work and after final pointing.
- D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

END OF SECTION

Section 05200

MISCELLANEOUS METAL

PART ONE - GENERAL

1.01 GENERAL

- A. The General conditions and other Contract Documents are hereby made a part of this Section to the same extent as if written out in full.

1.02 SCOPE

- A. Furnish, fabricate and erect as required, all miscellaneous metal items indicated, noted or detailed on the drawings and specified.

1.03 SHOP DRAWINGS

- A. Provide complete shop drawings and setting drawings of all items for approval prior to fabrication.
- B. Miscellaneous metal fabricators shall obtain all necessary field measurements at the job site and will be held responsible for their accuracy and for the accurate fitting of this work with the work of others.

PART TWO - PRODUCTS

2.01 MATERIAL

- A. All material shall be new and shall conform to ASTM designation for the metals used. All aluminum shall be 6063T5 or T6 alloy.

2.02 ANGLES, PLATES AND LINTELS

- A. Provide opening angles, lintels, and plates on roof and in walls, and miscellaneous supports shown, requiring fabricating in accordance with notes and details.
- B. Provide all relieving angles, lintels and other steel supports for all masonry, and veneer, including bolts, inserts, etc., as required and not provided in other trade sections. Provide clip angles, channels, plates, etc., as per notes and details, including bolts, anchors, screws, shop and field connections, and miscellaneous fastenings required to make installation complete.

PART THREE - EXECUTION

3.01 DISSIMILAR MATERIALS

- A. Wherever dissimilar metals come in contact, lead or neoprene washer, spacers, gaskets, or other approved material shall be inserted between them to provide insulation against electrolytic action.

3.02 WORKMANSHIP

- A. All work performed as per Standard Practice ACIS and National Association of Architectural Metal Manufacturers.
- B. The fabricator shall verify all dimensions of work adjoining the work hereunder. Such other work shall be inspected before fabrication and/or installation of items specified herein. Measurements of adjoining work shall be obtained so that work shall fit closely to spaces provided.
- C. Workmanship required in the execution of the work shall be of the best quality and subject to the approval of the Architect.
- D. The fabricator shall furnish all necessary templates and patterns required by other trades. He shall also furnish all items except as otherwise specified, pertaining to the work hereunder that is to be built into structural work under other Sections. The erector shall supervise and be responsible for the proper location and installation of such built-in items.
- E. Metal work shall be well formed to shape and size, with sharp lines and angles. Shearing and punching shall leave clean, true lines and surfaces. Permanent connection shall be welded or riveted where practicable.
- F. Exposed surfaces of casting shall have a smooth finish and sharp lines and arises that are well defined. Joints shall be milled to a close fit.
- G. Rivet and bolt heads shall be counter sunk flush with surface.
- H. Fastenings shall be concealed where possible. Thickness of metals and details as assembling and support shall give ample strength and stiffness. Joints exposed to the weather shall be formed to exclude water.
- I. Holes in structural steel framing for attaching miscellaneous items will be provided by the steel fabricator if information is given in ample time by the miscellaneous metal fabricator.

- J. Welding shall be in accordance with current "Code for Arc and Gas Welding in Building Construction" of the American Welding Society. Exposed welded joints shall be ground smooth.
- K. Miscellaneous metal work to be built-in shall be into masonry, concrete and/or stone work as detailed or required, and in such cases the holes shall be carefully drilled by this fabricator unless provided under other sections, and the work properly secured, poured with Por-Rok, molten lead or sulphur, sealed and neatly filled and finished.

3.03 SHOP PAINTING

- A. All ferrous metals shall be given one (1) shop coat of zinc chromate rust inhibitive primer paint adaptable for light colored field painting. Wet mil thickness not less than four (4) mils; dry, not less than two (2) mils. Field touch-up shall be done by the erector using paint furnished by the fabricator. Finish painting will be done by the painting subcontractor.

END OF SECTION

Section 06001

CARPENTRY WORK

PART ONE - GENERAL

1.01 DESCRIPTION

A. Work included: Provide all carpentry needed for a complete and proper installation as shown on drawings, including but not necessarily limited to:

- (1) Fitting and installing all wood doors and stock hollow metal doors.
- (2) Provide all materials and tools necessary for a complete installation.

B. Related work described elsewhere:

- | | |
|------------------------------------|---------------|
| (1) Interior Finish Carpentry | Section 06210 |
| (2) Cabinetwork | Section 06410 |
| (3) Solid Surface Countertops | Section 06415 |
| (3) Wood Doors and Wood Door Frame | Section 08210 |
| (4) Aluminum Clad Windows | Section 08521 |
| (6) Finish Hardware | Section 08710 |

1.02 QUALITY ASSURANCE

A. Standards: Comply with standards specified herein and with the general requirements of the specifications.

B. Qualifications of personnel:

- (1) Throughout progress of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills and who shall be present at the site and shall direct all work performed under this Section.

- (2) In actual installation of the work of this Section, use adequate numbers of skilled workmen to ensure installation in strict accordance with the approved design and the approved recommendation of the materials manufacturers.

1.03 SUBMITTALS

- A. General: Comply with the general requirements of these specifications. Submit the following product data for approval after aware of the contract.
- (1) Manufacturer's specifications and other data to demonstrate compliance with the specifications.
 - (2) Samples of the full range of colors and patterns and of exposed accessories from proposed manufacturers.
 - (3) Manufacturer's recommended installation procedures, material list and shop drawings indicating seam locations and structure.

1.04 PRODUCT HANDLING

- A. Protection:
- (1) Use all means necessary to protect lumber materials before, during and after delivery to the job site, and to protect the installed work and materials of all other trades.
 - (2) Deliver the materials to the job site and store, all in a safe area, out of the way of traffic, and shored up off the ground surface.
 - (3) Identify all framing lumber as to grades, and store all grades separately from other grades. Ensure proper ventilation and protect from moisture and humidity.
 - (4) Protect all metal products with adequate waterproof outer wrappings.
 - (5) Use extreme care in the off-loading of lumber to prevent damage, splitting, and breaking of materials.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 LUMBER AND FASTENINGS

- A. Framing lumber shall be Douglas Fir construction grade or SPF No. 2 or better for studs, #1 southern yellow pine for joist and rafters unless otherwise indicated on the drawings.
- B. Provide fasteners properly selected for the material to be fastened and to the substrate to which the material is to be fixed.
- C. All plywood subfloor is to be 3/4" thick T&G and all roof sheathing is to be 5/8" plywood or 15/32" OSB unless otherwise indicated on drawings.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Selection of lumber pieces:
 - (1) Carefully select all members. Select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making connections.
 - (2) Cut out and discard all defects which will render a piece unable to serve its intended function. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.
 - (3) Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels, or other framing components.

3.02 GENERAL FRAMING

- A. General:
 - (1) In addition to all framing operations normal to fabrication and erection indicated on the Drawings, install all backing required for work of other trades.
 - (2) Set all horizontal or sloped members with crown up.
 - (3) Do not notch, bore, or cut members for pipes, ducts, conduits, or other reasons except as shown on the Drawings or as specifically approved in advance by the Architect.

- (4) Install all plywood subfloors with construction adhesive on joists and nailing. All beams other than non window and service door headers shall be glued and nailed.

3.03 DELIVERIES

- A. Stockpiling: Stockpile all materials sufficiently in advance of need to ensure their availability in a timely manner for this work.
- B. Delivery schedule: Make as many trips to the job site as are necessary to deliver all materials of this Section in a timely manner to ensure orderly progress of the total work.

3.04 INSTALLATION OF OTHER FINISH HARDWARE

- A. Locations: Using only the specified finish hardware, and the proper equipment for the purpose, install all finish hardware.
- B. Anchoring: Anchor all components firmly into position for long life under hard use. Use only the anchoring devices furnished with the hardware items, unless otherwise specifically directed.

3.05 INSPECTION, ADJUSTMENT, AND REPORTING

- A. General: Using the personnel described in Paragraph 1.02B of the Section, inspect each item of installed finish hardware. Verify that each such item has been installed in strict accordance with the manufacturer's recommendations is in proper condition, and functions in its intended manner.
- B. Adjustment: On all finish hardware items designed to permit adjustment, submit a written report stating:
- (1) That all installed finish hardware has been inspected in accordance with Article.
 - (2) That all installed finish hardware is in accordance with these Specifications as to quality, type, appearance, operation, and all other specified attributes.
 - (3) A precise list, by door opening number and hardware item, of all items of finish hardware which do not meet the specified requirements in furnishing, in installation, or both.

3.06 ALIGNMENT

- A. On all framing members to receive a finished wall or ceiling, align the finish subsurface to vary not more than 1/8 inch from the plane of surfaces of adjacent framing and furring members.

3.07 FASTENING

A. Nailing:

- (1) Use only common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise called for on the Drawings.
- (2) For conditions not covered in the Nailing Schedule, provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike provided, however, that 16d nails may be used to connect two pieces of two inch nominal thickness.
- (3) Do all nailing without splitting wood. Pre-bore as required. Replace all split members.

B. Bolting: Drill holes 1/16 inch larger in diameter than the bolts being used. Drill straight and true from one side only. Bolt threads shall not bear on wood. Use washers under head and nut where both bear on wood; use washers under all nuts.

C. Screws: For lag screws and wood screws, pre-bore holes same diameter as root of thread; enlarge holes to shank diameter for length of shank. Screw, do not drive, all lag screws and wood screws.

3.08 NAILING SCHEDULE

A. Unless otherwise indicated on the Drawings or required by pertinent codes and regulations, provide at least the following nailing:

- | | |
|------------------------------------|--|
| (1) Blocking to joist bearing | Two 10d toenailed each side |
| (2) Blocking to joist or stud | Two 10d toenailed each side |
| (3) One inch brace to stud | Two 8d face nailed |
| (4) Two inch brace to stud | Two 16d face nailed |
| (5) Bridging to joist | Two 8d toenailed |
| (6) Built-up beams eight inches or | 16d @ twelve inches or less in depth centers, staggered |
| (7) Joist and rafters: to support | Two 10d toenailed each side at laps (twelve inches minimum) Four 16d face nailed |
| (8) Multiple joists | 16d @ twelve inches on centers, staggered |
| (9) Joists to sill or girder | Two 16d toenailed |

(10)One inch furring to underside	Two 8d (one straight; of joists one slanted)
(11)Two inch furring to underside	Two 16d (one straight; of joists one slanted)
(12)Studs toenailed to plate	Two 10d each side
(13)Studs end nailed to plate	Two 20d
(14)Studs nailed together	16d @ twelve inches on centers, staggered
(15)Plates:	16d @ twelve inches on centers, staggered . At splices Two 16d face nailed. Plate lap at cornersTwo 16d face nailed

3.09 CLEANING UP

- A. General: Keep the premises in a neat, safe, and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut ends, and debris.

END OF SECTION

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: AHA A135.4.
- D. MDF: ANSI A208.2, Grade 130.
- E. Particleboard: ANSI A208.1, Grade M-2.
- F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.25626579 06 2023-1

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. Lumber: Comply with performance requirements in AWPA C20, Interior Type Kiln dry after treatment to a maximum moisture content of 19 percent.
- B. Plywood: Comply with performance requirements in AWPA C27, Interior Type Kiln dry after treatment to a maximum moisture content of 15 percent.
- C. Application: Where indicated.

2.3 STANDING AND RUNNING TRIM

- A. Hardwood Lumber Trim:
 - 1. Species and Grade: Red oak; Clear; NHLA.
 - 2. Maximum Moisture Content: 10 percent.
- B. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA HWM 2, N-grade wood moldings made to patterns included in WMMPA WM 1
 - 1. Species: Red oak.
 - 2. Maximum Moisture Content: 9 percent.

2.4 SHELVING AND CLOTHES RODS

- A. Shelving: Made from 3/4 inch thick melamine-faced particleboard with applied 3mm PVC front edge. Do not use particleboard or MDF that contains urea formaldehyde.
- B. Shelf Cleats: 3/4-by-3-1/2-inch boards with hole and notch to receive clothes rods, as specified above for shelving.

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

D. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.

E. Clothes Rods: 1-1/2-inch- diameter, clear, kiln-dried hardwood.

2.5 MISCELLANEOUS MATERIALS

A. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue.

1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 – EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work.

2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.

3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

3.4 SHELVING AND CLOTHES ROD INSTALLATION

- A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
- B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c.
- C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- D. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports

3.5 INSTALLATION OF WOOD DOORS

- A. Initial inspection of doors: Prior to start of installation of each door, carefully inspect the door and verify:
 - (1) That the door furnished is the proper door for the opening, as described on the Door Schedule in the Drawings.
 - (2) That the door is in sound condition, unblemished, without warp, twist, bow, or other attributes causing it to be rejected upon installation.
- B. Handling: Carry all doors, do not drag them. Use extreme care in handling to prevent damage.
- C. Fitting: Trim all wood doors as necessary to provide a uniform clearance of between 3 mm (1/8") and 5 mm (3/16") at jambs and head, and a uniform clearance at the threshold or floor to properly clear the floor covering described on the Finish Schedule in the Drawings.
- D. Installing: For each door, verify the hardware type as described on the Door Schedule in the Drawings and verify that hardware actually supplied is the hardware specified. Using only the specified hinges or butts, and the proper equipment for the purpose, install the door into the opening with the following hinge or butt locations throughout the work:
 - (1) Top hinge or butt: The center of the hinge or butt not more than 28 cm (11") below the top of the door;
 - (2) Bottom hinge or butt: The center of the hinge or butt not more than 33 cm (13") above the finish floor;
 - (3) Intermediate hinge, butt, or pivot: Equidistant between the top and bottom hinge, butt, or pivot.

E. Finishing:

- (1) With fine sandpaper, working only in direction of the grain of the wood, remove all rough edges resulting from door trimming and leave the installed door in condition to receive its final finish.
- (2) Carefully touch-up all trimmed surfaces, applying a finish equal in all respects to the factory-prefinish.

END OF SECTION

Section 06240

LAMINATED PLASTIC

PART ONE-GENERAL

1.01 DESCRIPTION

- A. Work included: Provide all laminated plastic, complete, in place, as shown on the Drawings, specified, herein, and needed for a complete and proper installation.
- B. Related work described elsewhere:
 - (1) Carpentry – Section 06001
 - (2) Cabinetwork – Section 06410

1.02 QUALITY ASSURANCE

- A. Standards: Comply with the standards specified herein and as listed in Section 01085.
- B. Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.03 SUBMITTALS

- A. Product data:
 - (1) Within 20 calendar days after award of the Contract, submit:
 - (a) Complete materials list of all items proposed to be furnished and installed under this Section.
 - (b) Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
 - (c) Samples of the full range of colors and patterns available in each of the specified grades from the proposed manufacturer.
 - (d) Manufacturer's recommended installation procedures.
 - (2) The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspection and accepting or rejecting actual installation procedures used on the work.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials of the Section before, during, and after installation and to protect the work and materials of all other trades.

- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO – PRODUCT

2.01 GENERAL

- A. All plastic laminate shall be “general purpose”, “postforming”, or “specified purpose” type as recommended by the Contractor and approved by the Architect for use on the various surfaces, and shall be “high wear ARP” type finish in accordance with the provisions of NEMA LD3.
- B. Countertops are to be $\frac{3}{4}$ ' thick with $\frac{3}{4}$ ' front drop, unless otherwise indicated.

2.02 COLORS AND PATTERNS

- A. All countertops are to be as called out on drawings.

END OF SECTION

Section 06410

CABINETWORK

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Provide all cabinetwork shown on the Drawings, complete in place, as specified herein.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified in the General Requirements of these Specifications.
- B. Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- C. Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- D. Certification: In addition to complying with all pertinent codes and regulations, comply with the Custom Grade Requirements for Construction and Joinery of the Architectural Woodwork Institute and provide certification on Shop Drawings.

1.03 SUBMITTALS

- A. General:
- (1) Comply with the general requirements of these specifications. Submit the following product data for approval after award of the contract.
 - (a) Manufacturer's specifications and other data to demonstrate compliance with these specifications.
 - (b) Samples of the full range of colors and patterns and of exposed accessories from proposed manufacturers.
 - (c) Manufacturer's recommended installation procedures, material list and shop drawings indicating seam locations and structure.

- (2) The manufacturer's recommended installation procedures when accepted will be the basis for inspection and acceptance or rejection of work.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 CABINETS

- A. General: Fabricate and replace cabinet doors and drawers to the dimensions and arrangements shown on the Drawings, and according to the requirements of this Section.
- B. Products:
 - (1) Cabinet door fronts are to be solid ¾" oak as shown on drawings.
 - (2) Cabinet drawer fronts are to be solid ¾" oak as shown on drawings.

PART THREE - EXECUTION

3.01 FABRICATION

- A. Fabricate the work of this Section in strict accordance with the original design and the approved Shop Drawings.

3.02 INSTALLATION

- A. Inspection: Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Installation: Install all components in strict accordance with the original design and the approved Shop Drawings anchoring all items firmly into position for long life under hard use.
- C. Any filler strips used in cabinet installation shall have the same finish as the cabinets. All cabinets shall be installed plumb and level and securely anchored. All hardware shall be properly adjusted. All shelving bear on all four bearing points. All exposed surfaces shall have the same finish as the front of the cabinets.

3.03 CLEANING AND ADJUSTMENT

- A. Upon completion of the installation, visually inspect each installed item, thoroughly clean all surfaces by using the cleaning materials recommended by the manufacturer of the finish being cleaned, and carefully adjust all operating components for optimum operation.

END OF SECTION

06410 - 3

Section 07212

INSULATION

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Extent of work: The work to be performed under this Section includes, but is not necessarily limited to, furnishing all workers, materials, and equipment to insulate all areas and items as shown on the Drawings, specified herein, in accordance with the General Requirements and chosen manufacturers' directions as approved by the Architect for a complete and finished job.

(1) Wall and Ceiling Insulation

- B. Coordination: The work of this Section shall be coordinated with all other crafts pertinent to an on-schedule, finished and complete job.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified herein, the General Requirements and those of the chosen manufacturers as approved by the Architect.
- B. Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Architect.
- C. Qualification of workers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. General: Comply with the General Requirements of these Specifications and submit the following product data for approval after aware of the Contract:
- (1) Manufacturer's specifications, installation procedures and other data to demonstrate compliance with these specifications.
- (2) The manufacturer's recommended installation procedures when accepted will become the basis for inspection and acceptance or rejection of the work.

1.04 PRODUCT HANDLING

- A. Delivery and storage: Deliver materials to job site and store in their original containers or wrappings with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations.
- B. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.
- C. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Ceiling Insulation shall be a minimum of R-38 in ceiling of the appropriate thickness fiberglass or blown-in cellulose equal to Certainteed, Johns Manville, or Owens-Corning.
- B. Wall Insulation: Exterior wall perimeter insulation shall be a minimum of R-19 of the appropriate thickness fiberglass batts or as shown on Drawings.
- C. Foundation Insulation shall be insulation board as shown on Drawings. The insulation board shall be rigid foundation insulation which meets the requirements of federal specification HH-I-524C Type I.
- D. Exterior Wall Vapor Barrier: All exterior frame or furred walls shall have a 6 mil vapor barrier or kraft-faced batts installed on the interior side of the wall.
- E. Exterior Frame Walls Air Barrier: Tyvek or equal air barrier is required on all exterior frame walls covered with sidings or veneers.
- F. Sound Insulation: Sound insulation is to be unfaced fiberglass with an STC rating as shown on the Drawings.

PART THREE - EXECUTION

- A. Wall and Ceiling: Ceiling and wall insulation shall be installed strictly following manufacturer's directions as approved by the Architect and in accordance with the Drawings and these Specifications.

END OF SECTION

SECTION 07311

ASPHALT SHINGLES

PART ONE - GENERAL

1.01 DESCRIPTION

- A. The work in this section shall include the furnishing and installation of asphalt shingles as shown on the drawings and as specified herein. Installation shall include all plant, material, equipment, and appliances required to perform installation operations.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Carpentry: Section 06001
- B. Flashing and Sheet Metal: Section 07620

1.03 QUALITY ASSURANCE

- A. References:
 - 1. Underwriters Laboratories
 - 2. UL Wind Resistant Label
 - 3. ASTM E 108 Class A fire resistance
 - 4. Self sealing ASTM D 3161
 - 5. Higher Tear Resistance ASTM D3462
- B. Install Asphalt shingles to meet requirements of the Manufacturer's instruction.

1.04 SUBMITTALS

- A. Samples:
 - 1. Shingles: two of each style selected indicating full range of color.
 - 2. Roll Roofing: two pieces, 12" x 12" indicating full range of color.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials with manufacturer's labels intact and legible.
- B. Deliver materials in sealed packages with Underwriter's Laboratories, Inc. labels.
- C. Store materials on raised platforms and protect with coverings at outdoor locations.
- D. Do not stack bundles of shingles more than 3 ft. high.
- E. Store rolled goods on end.

1.06 JOB CONDITIONS

- A. Do not install underlayment or shingles on wet surfaces.
- B. Do not apply shingles when air temperature is below 32°F.

1.07 GUARANTEE

- A. Materials: Guarantee against manufacturing defects for 30 years.
- B. Workmanship: Guarantee against defects for 1 year.

PART TWO - PRODUCTS:

2.01 MATERIALS

- A. Square tab butt strip shingles.
 - 1. ASTM E108 - Type I and D3161, Type I.
 - 2. Approximate Size: 36" long x 12" wide, 5-5/8" exposure.
 - 3. Minimum Weight: 220 lbs/sq.
 - 4. U.L. Listed Class C self-sealing material for wind resistance.
- B. Asphalt shingles shall be produced by manufacturers regularly engaged in the manufacture of similar items with a history of successful production acceptable to the Architect and equal to Certainteed XT 30, color as selected by Owner.
- C. Asphalt-Saturated roofing felt: ASTM D-226 No. 15, organic, unperformed, 36" wide.
- D. Mineral surface roll roofing: ASTM D-249 matching shingles in color and texture for valley flashing if required. (Double flash valley).
- E. Smooth surface roll roofing: ASTM D-224 55 lbs., grade if required.
- F. Hip and Ridge Shingles: preformed, manufacturer's standard.
- G. Nails: Galvanized steel material 10 Ga., barbed shank, 3/8 in head, 1 in. minimum length.
- H. Bituminous Plastic Cement: FS SS-C-1538, Type I.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Assure that surfaces to which shingles are to be applied are uniform, smooth, sound, clean, dry, and free of irregularities.
- B. Verify that installation of metal flashings has been completed.
- C. Verify that work of other trades which penetrates roof deck has been completed.
- D. Do not start work until unsatisfactory conditions are corrected.

3.02 APPLICATION

A. Felt underlayment:

1. Decks with slope 3 in 12 or greater:
 - a. Lay one layer of felt horizontally over entire roof, lapping each course over lower course 2 in. minimum at horizontal joints and 4 in. side lap at end joints.
 - b. Lap felt 6 in. from both sides over hips and ridges.
 - c. Secure underlayment to deck with sufficient fasteners to hold in place until shingles are applied.
2. Valley underlayment:
 - a. Apply 36 in. wide underlayment, centered in valley, and nail in position.
 - b. Cut horizontal courses of underlayment to overlap valley underlayment 6 in. minimum.

B. Felt flashings:

1. Eaves flashing:
 - a. Decks with slope 4 in 12 or greater:
 - 1) Apply course of mineral surface roofing or smooth roll roofing to overhang underlayment and metal drip edge 3/8 in.
 - 2) Extend roll roofing to 12 in. minimum inside interior wall line of building.
2. Open Valley Flashing:
 - a. Place 18 in. wide mineral surfaced roof roofing, centered in valley, surfaced side down, lower edge cut flush with bottom of eaves flashing strip.
 - b. Nail 1 in. from each edge to hold strip in place.
 - c. Splice by overlapping ends of upper segments 12 in. over lower segments, and secure with bituminous plastic cement.
 - d. Place second strip of 3 ft. wide mineral surfaced roll roofing over first strip with surfaced side up, centered in valley, secure and lapped same as underlying strip.
3. Closed Valley Flashing:
 - a. Center smooth surface roll roofing in 3 ft. within valley over felt underlayment.

C. Square tab butt strip shingles:

1. Starter strip:
 - a. Apply row of inverted shingles along lower eave edge, tabs facing up roof.
 - b. Nail 3 in. from eave edge, nail heads not exposed to first course cutouts.
2. First and succeeding courses:
 - a. Start first course with full shingle at break.

- b. Cutouts break joints on halves.
 - 1) Start second course with full shingle minus 1/2 first tab.
 - 2) Start third course with full shingle minus full tab.
 - 3) Start fourth course with full shingle minus first 1-1/2 tabs.
 - 4) Center cutouts on tabs of course below.

D. Hips and Ridges:

- (1) Cut rectangular shingles, minimum 9 in. x 12 in. from square but shingles strips or mineral surface roll roofing.
- (2) Bend each shingle lengthwise on center for equal exposure on each side of hip or ridge.
- (3) Warm shingles if necessary before bending to avoid breakage.
- (4) Beginning at bottom of hip or end of ridge, apply shingles with 5 in. minimum exposure.
- (5) Nail each shingle on each side, 5½ in. back from exposed end and 1 in. up from edge.

E. Valley:

1. Open Valley:

- a. Before roofing is applied, snap two chalk lines along full valley length, one on each side, 6 in. apart at ridge, diverging at rate of 1/8 in.ft. toward eave.
- b. Clip upper corner of each shingle end at angle parallel to valley.
- c. Cement last shingle to valley lining with bituminous plastic cement.

2. Closed Valley:

- a. Lay shingles along eaves of roof crossing valley, extending over adjoining roof deck 12 in. minimum.
- b. Lay first course along eaves of adjoining roof and extend across valley on top of previously applied shingles 12 in. minimum.
- c. Lay succeeding courses alternately.
- d. Nail no closer than 5 in. to valley center line and apply two nails at end of each terminal strip.

3.03 ADJUST AND CLEAN

- A. Replace damaged shingles.
- B. Remove excess shingles, part of extra stock and debris from project site.

END OF SECTION

SECTION 07610

SHEET METAL ROOFING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to work in this Section.

1.02 DESCRIPTION OF WORK

- A. Furnishing and installation of metal roof system, including but not limited to:
 - 1. Modified bitumen sheet underlayment at locations per "Design Requirements" below. Roofing felt underlayment at the remainder of the roof.
 - 2. Coil-coated galvanized steel sheets, shop-finished, flouropolymer, in color specified.
 - 3. Roof panels, standing seam at 18-inch centers, secured to nail-base insulation.
 - 4. Eave, ridge, hip and valley flashing, vent closures, and related trim to complete the system.
 - 5. Clips, screws, and required fasteners.
 - 6. Sealants within system.
- B. Related Sections:
 - 1. Wood perimeter nailers: Section 06105.
 - 2. Sheet metal flashing; eave fascia flashing; gutters and downspouts; and snow guards, applied to the perimeter of the sheet metal roofing: Section 07710.
- C. Design Requirements: Color coated galvanized steel panels with accessories:
 - 1. Underlayment: Use sheet underlayment and felt underlayment as follows:
 - a. Sheet Underlayment: Run parallel to eaves in one or more widths, to extend from the eave edge up the slope to a point inside the interior wall line. Run at least 24" out from valley centerlines.
 - b. Felt Underlayment: Cover the remaining substrate with felt underlayment, providing one ply, with 3" side laps and 4" end laps.

2. Standing Seam Panels: Progressively installed from starter trim. Male standing seams secured with clips screwed to plywood substrate. Female standing seams factory filled with sealant, and snapped over male standing seams and clips.
3. Ridge, rake and save flashings. Matching color of panels.

D. Performance Requirements:

1. Design Loads: 35 psf wind loads, positive or negative. Joints shall remain closed, and component stresses shall stay within the elastic limit.
2. Thermal Stresses: Ambient Temperature range of 120 degrees F; surface temperature range of 180 degrees F; without opening of joints (except expansion joints), buckling of components, excessive stresses on fastenings, failure of joint sealants, unusual or excessive noise, or other detrimental effects.
3. Water Penetration: Watertight under all conditions, with only secondary reliance on sealants. Weep holes to drain water to the exterior. Meeting ASTM E 331, for inward static air pressure between 6.24 and 12.0 psf.
4. Air Infiltration: No air leakage when tested per ASTM E 283, at pressure differentials up to 1.57 psf.
5. Construction: Stock cold rolled sections as far as practicable. Conceal all fasteners as far as possible, except as otherwise detailed or approved.

E. Submittals:

1. Product List: Name the manufacturer and product lines.
2. Product Data: Include shop finish product data, and manufacturer's installation instructions.
3. Shop Drawings: Include field verified dimensions. Show methods of joining, thickness of metals, necessary reinforcements, provision for expansion and contraction, anchorage and structural support, and all sealing and fastening. Include structural calculations.
4. Samples: Shop finish color samples. Actual production samples on galvanized steel sheet. Small assembled samples showing starting and terminating and metal panels, upon request.

F. Erector Qualifications: The system manufacturer, or an entity directly responsible to the manufacturer, employing skilled, experience workers under competent supervision.

G. Preceding Conditions: Examine substrates and report improper conditions preventing proper installation or endanger the system's permanency or warranty.

- H. Environmental Requirements: Avoid sealant application in temperatures below 40 degrees F. unless explicitly approved otherwise.
- I. Protection: Protect adjacent finished work. Protect system components with integral or previously applied finish. Repair or replace all work damaged by the work of this Section.
- J. Construction Aids: provide hoisting, ladders, scaffolding, and other construction aids as required.
- K. Warranty: Commencing upon twenty-four (24) hours notice from the Owner, the Erector shall determine the cause of leakage or other observed defects, and correct such conditions, during the correction period established by the Conditions of the Contract.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers and Metal Panel Systems:
 - 1. ACI Building Components (formerly Carlisle Engineered Metals), Stafford, Texas, 713/495-0244, or 1 800 669-9324 (AP Series).
 - 2. Copper Sales, Inc. (Una-Clad) Minneapolis, Minnesota 55441, 612/545-1604 or 1 800 426-7737 (UL-4).
 - 3. Petersen Aluminum Corporation, Elk Grove Village, IL 60007, 1 800 722-2523 (Snap-Clad), represented by Marty Widfong and Associates, Gladwin, Michigan 1 800 457-2661.
 - a. Metal Building Components, Inc. (MBCI), Shelbyville, Indiana, 317 398-4400, "LokSeam".
- B. Metal Panel Materials and Accessories:
 - 1. Metal: 24 gauge ASTM A446-72 structural quality steel sheet. Grade A in the gauges specified, with an ASTM A 525 G90 (1.25 oz) galvanized coating.
 - 2. Prime Coating: Prime system applied to coiled steel before forming. Water and acid rinses, chromate baths, per approved primer system. The primer applied to achieve 0.5 mils dry coating thickness.
 - 3. Color Coating: (Exterior face of all panels, flashing, trim and other visible surfaces) Coil coated fluoropolymer top coat, "Kynar 500", Atochem North American, Inc. or "Hular 5000", Ausimont USA Inc., "Nebular S", the Glidden Company, "Fluoroceram", Morton International, Inc., or "Duranar", PPG Industries.

- a. Submit color samples to architect for approval.
- 4. Sealants for joints not Subject to Movement: Butyl base sealant, such as Presstite Div. No. 432 Butyl Caulk, Three-M Co. No. 202 Butyl Sealant, or Pecora Chemical Corp. Butyl Rubber Sealant BC-158.
- 5. Elastomeric Sealant: Per Fed. Spec. TT-S-00230c or TT-S-00227e, such as Dow-Corning Building Sealant, Pecora NR 100 urethane, GE Construction Sealant, or Tremco Dymeric. Sealant shall match color of anodized aluminum members.
- 6. Preformed Mastic Tape: NAAMM Standard SS-1C-68 "Specifications for Non-Skinning Non-Resilient Performed Sealant Compound".
- 7. Fasteners and Clips: Provide manufacturer's standard fastening system for anchorage. Furnish expansion type clips where required. Fasteners shall be stainless steel, concealed.
- 8. Closures: Sponge neoprene closures cut to fit the profile of the panel or trim as applicable, to properly seal the panels.

C. Underlayments:

- 1. Underlayment Felt: No. 30 felt, ASTM D 226, asphalt saturated.
- 2. Self Sealing Underlayment: Waterproof, self-adhering sheet with modified bitumen bottom layer. Disposable release film on bottom. Include manufacturer's primers from among the following:
 - a. "Bituthene Ice and Water Shield", Grace Construction Products Division, Cambridge, Massachusetts, 617/876-1400.
 - b. "Weather Watch" Ice and Water Barrier, GAF Building Materials Corporation, Wayne, New Jersey, with district offices in Mount Vernon, Indiana 812/836-4861.
 - c. "Deck-Dri", Owens-Corning Fiberglas Corp., Residential Roofing Division, Toledo, Ohio 419/258-8000. Polyethylene top surface and modified asphalt bottom layer.
 - d. "Storm Shield", Tarmac Roofing Systems, Inc., Wilmington, Delaware, 302/475-7974. Non-woven fiberglass mat saturated and coated with rubberized bitumen, coated on top with fine granules.
 - e. "Nord Shield Ice and Water Gard", Nord Bitumi U.S., Inc. Springfield, New Jersey, 800/445-1337 or 201/467-8669.

E. Fabrications:

- 1. Panels: Fabricate per approved Shop Drawings. Continuously roll-form the panels. At gabled canopy roofs, provide panels and battens in one-piece lengths from ridge to bottom of fascia. At gable end panels, provide panels and battens in one-piece lengths from top to bottom of gable.

2. Flashings, Trim and Closures: Provide brake-formed flashings, trim, and closures to match color texture of the panels.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation:

1. Underlayment: Locate and lap per "Design Requirements" above.
 - a. Sheet Underlayment: Roll the sheets out, tacky side down, while pulling out the separator sheet. Press the sheets uniformly to adhere to the substrate. Lap edges at least 3 inches, and ends at least 6 inches. Press the laps with a hand roller. Do not leave exposed to weather.
 - b. Felt Underlayment: Install horizontally. Lap at least 6 inches over the sheet underlayment. Lap ends at least 4 inches.

B. Metal Roofing Installation: Install the system in accordance with the manufacturer's installation instructions and approved Shop Drawings. All parts when completed shall be within the following tolerances:

1. Tolerances: Deviation from established vertical or horizontal shall not exceed 1/8" per 12 ft. Offset from true alignment between two consecutive members in line, end to end, shall not exceed 1/16".
2. Flashing and Accessories: Install flashing and trim behind or under panels.
3. Panels: Erect the panels progressively in the approved sequence, installing closures and sealant at the end of each panel. Engage each panel with the previous panel and fasten using the appropriate device. Terminate the panels at adjacent construction with the proper termination trim closure.
4. Closures and Flashing: Install closures and flashings as detailed or otherwise required.
5. Touch-up: Touch-up all coated sheet metal and incidental primed metal surfaces as required, using a compatible air-dry spray.

END OF SECTION

Section 07620

SHEET METAL FLASHING & TRIM

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Provide all flashing and sheet metal not specifically described in other Sections of these Specifications but required to prevent penetration of water through exterior shell of the building or other surfaces.

1.02 RELATED WORK DESCRIBED ELSEWHERE

- A. Unit Masonry - Section 04200
- B. Sealants and Caulking - Section 07951
- C. Painting - Section 09900

1.03 QUALITY ASSURANCE

- A. Standards: Comply with standards specified in this Section.
- B. Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacture of similar items and with a history of successful production acceptable to the Architect.
- C. Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

1.04 SUBMITTALS

- A. General: Comply with provisions of appropriate Sections in Division One of these Specifications.
- B. Manufacturer's data: Within 45 calendar days after award of the Contract, submit:
 - (1) Complete materials list of all items proposed to be furnished and installed under this Section.
 - (2) Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

- (3) Shop Drawings showing all proposed work of this Section.
 - (4) Manufacturer's recommended installation procedures.
- C. Inspection: The manufacturer's recommended installation procedures, when approved by the Architect will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 DESIGN

- A. Standard commercial items may be used for flashing, trim and reglets, provided all such items meet or exceed the quality standards specified herein.
- B. Quality standards: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in "Architectural Sheet Metal Manual", current edition, of the Sheet Metal and Air-conditioning Contractors National Association.

2.02 MATERIALS AND GAUGES

- A. Where sheet metal is required, and no material or gauge is indicated on the Drawings, provide the highest quality and gauge commensurate with the referenced standards.

2.03 GALVANIZED IRON

- A. General: Sheet metal or iron shall be standard brand of open-hearth copper-bearing steel, copper-molybdenum iron, or pure iron sheets.
- B. Zinc coating:
 - (1) All galvanized sheets shall have a zinc coating applied by hot-dip process to all surfaces.
 - (2) Zinc coating shall weigh not less than 391 grams per sq. m. (1 1/4 oz. per sq. ft.) of surfaces covered and shall conform with ASTM A93.

2.04 NAILS, RIVETS AND FASTENERS

A. Fasteners:

- (1) General: Aluminum fasteners shall be used with aluminum sheet metal, galvanized nails and cadmium plated screws, rivets, bolts and nuts shall be used with galvanized sheet metals.
- (2) Nails: Flathead, wire, barbed, slating type, FS FF-N-105B.
- (3) Screws: Self-tapping, sheet metal type, FS FF-S-102CL.
- (4) Rivets: Type and size recommended by sheet metal manufacturer.
- (5) Bolts: Hex head, FS FF-5-575.
- (6) Nuts: Hex head, FS FF-N-8360.
- (7) Expansion Anchors: FS FF-B-588C.
- (8) Gutter spikes; shall be compatible with gutter material. Length shall be up to 3 inches longer than gutter opening width, provided spike does not penetrate past solid backing.
- (9) Gutter spike ferules: Material same as gutter, length to match gutter opening width.

2.05 FLUX

- A. All flux used for galvanized iron or steel shall be raw muriatic acid.

2.06 SOLDER

- A. All solder used on galvanized sheet steel shall conform to ASTM B32.
- B. Other materials: All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and as selected by the Contractor subject to the approval of the Architect.

2.07 COLOR

- A. Color of aluminum or galvanized steel shall be same as color required for trim subject to approval of the Architect.

PART THREE - EXECUTION

3.01 INSPECTION

A. General:

- (1) Form all sheet metal accurately and to the dimensions and shapes required, finishing all molded and broken surfaces with true, sharp, and straight lines and angled and where intercepting other members, coping to an accurate fit, soldering securely.
- (2) Unless otherwise specifically permitted by the Architect, turn all exposed edges back 13 mm (1/2").
- (3) Make all lock seams, where soldered, at least 13 mm (1/2") wide.
- (4) Where lap seams are not soldered, lap according to pitch but in no case less than 75 mm (3").
- (5) Make all flat and lap seams in direction of flow.

B. Joints:

- (1) Join parts with rivets or sheet metal screws where necessary for strength or stiffness.
- (2) Provide suitable watertight expansion joints for all runs of more than 12.4 m (40"), except where closer spacing is indicated on the Drawings or required for proper installation.

C. Nailing:

- (1) Whenever possible, secure metal by means of clips or cleats without nailing through the metal.
- (2) In general, space all nails, rivets, and screws not more than 20 cm (18") apart and, where exposed to the weather, use lead washers.
- (3) For nailing into wood, use barbed roofing nails 32 mm (1 1/4") long by 11 gauge.
- (4) For nailing into concrete, use drilled plugholes and plugs.
- (5) Hem exposed edges.
- (6) Angle bottom edges of exposed vertical surfaces to form drips.

D. Copings: Install copings on parapet and securely fasten in accordance with manufacturer's instructions.

- E. Cants and closures: Install cants and closures of required sizes and tapered to fit roof slopes. Closures and cants shall be securely fastened to roof deck.

3.02 EMBEDMENT

- A. Embed all metal in connection with roofs in a solid bed or sealant, using materials and methods described in Section 07951 of these Specifications or other materials and methods approved in advance by the Architect.

3.03 SOLDERING

- A. General:

- (1) Thoroughly clean and tin all joint material prior to soldering.
- (2) Perform all soldering slowly with a well heated copper in order to heat the seams thoroughly and to completely fill them with solder.
- (3) Perform all soldering with a heavy soldering copper of blunt design, properly tinned for use.
- (4) Make all exposed soldering on finished surfaces neat, full flowing and smooth.

- B. Cleaning: After soldering, thoroughly wash acid flux with a soda solution.

3.04 TESTS

- A. Upon request of the Architect, demonstrate by hose or standing water that all flashing and sheet metal is completely watertight.

3.05 CLEANING

- A. Leave work clean and free of stains, scraps and debris.

END OF SECTION

SECTION 07630

ROOFING AND SIDING METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents:
 - 1. Drawings and general provisions of the Subcontract apply to this Section.
 - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
 - 1. Prefabricated and prefabricated metal wall panels including related trim, flashings, closures, and installation accessories.
- C. Related Sections:
 - 1. Division 01 Section "General Requirements."
 - 2. Division 04 Section "Concrete Unit Masonry".
 - 3. Division 07 Section "Sheet Metal Flashing and Trim".
 - 4. Division 07 Section "Joint Sealants".
 - 5. Division 07 Section "Hollow Metal Doors and Frames".
 - 6. Division 07 Section "Painting".

1.2 REFERENCES

- A. General:
 - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
 - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
 - 3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.
- B. ASTM International:
 - 1. ASTM A653 / A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM A792 / A792M Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 3. ASTM E1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
 - 4. ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

1.3 SUBMITTALS

- A. Submit under provisions of Divisions 01 Section "General Requirements" and "Special Procedures."
- B. Product Data: Manufacturer's specifications, product data and installation instructions.
- C. Shop Drawings: Shop and erection drawings for metal panels, trim, flashings, closures, sub-girts, fastenings, sealant and accessories. Show metal gages, dimensions and finishes. Indicate relationships and connections to adjacent materials.
- D. Engineering Calculations: Engineering calculations substantiating compliance with structural requirements of Article 1.04A "Structural Requirements" shall be prepared, signed and wet-stamped by a Structural Engineer licensed in the State of California.
- E. Samples: Full profile width X 12 inches (300 mm) long for approval of each metal panel color, finish and profile.
- F. Warranty: Submit 3 copies of required warranties.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer's Qualifications: Minimum of ten (10) years of successful experience in fabricating metal systems in this type and size.
 - 2. Erector's Qualifications: Erector acceptable to panel manufacturer.
- B. Regulatory Requirements: California Building Code (CBC), latest edition, Chapter 16 as modified by Division 01 Section "Lateral Force Procedures".

1.5 DELIVERY, STORAGE AND HANDLING

- A. Transport, handle, and store panels and trim in a manner to preclude damage or staining of any nature.
- B. Remove panels and trim which are cracked, bent, chipped, scratched, stained or otherwise unsuitable for installation and replace with new.

1.6 WARRANTY

- A. Warrant metal finish for a period of twenty (20) years from date of installation against chipping, cracking, checking, peeling, blistering and color change within the limitations stated in panel manufacturer's standard warranty.
- B. Subcontractor's Warranty: Warrant panel system, including flashings, sealants, fasteners, and accessories against defective materials and/or workmanship, to remain watertight and weatherproof for 2 years following Notice of Substantial Completion in accordance with the requirements of Division 01 Section "General Requirements".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. ACI Building Components (Stafford, TX, 800-669-9324)
- B. Copper Sales Inc. Una-Clad (Minneapolis, MN 800-426-7737)
- C. Petersen Aluminum Corporation Snap-Clad (Elk Grove Village, IL, 800-457-2661)
- D. Metal Building Components Inc. MBCI LokSeam (Shelbyville, IN 317-398-4400)
- E. or approved equal.

2.2 MATERIALS

- A. Metal Panels: 24 gauge ASTM A446-72 structural quality steel sheet. Grade A in the gauges specified, with an ASTM A 525 G90 (1.25 oz) galvanized coating.

2.3 ACCESSORIES

- A. Trim, Closures and Flashings: Of same manufacture, material, gage and finish as wall panels.
- B. Fasteners: As per manufacturer's recommendations for conditions of use, stainless steel or hot dip galvanized. Fasteners shall be designed to be concealed where possible.
- C. Sealants and Sealant Tapes: Non-sagging, non-bleeding type as per approved manufacturer's recommendations. Factory applied sidelap sealant is required. Field applied sidelap sealant is not permitted.
- D. Profile Closures: Neoprene or polyethylene foam, die-cut or formed to panel configuration.
- E. Building Paper: Waterproof, duplex paper conforming to Fed. Spec. UU-B-790, Type I, Grade B.

2.4 FINISHES

- A. Outboard Metal Surfaces: Referenced manufacturer's polyvinylidene fluoride (Kynar 500 with minimum 70% resin) enamel finish consisting of thermosetting 0.8 mil polyvinylidene fluoride finish coat applied over 0.2 mil epoxy prime coat with total dry film coating thickness of not less than 1 mil.
 - 1. Colors: As indicated on the Architectural Drawings.
- B. Inboard Metal Surfaces: 0.35 mil polyester finish coat over 0.15 mil epoxy prime coat with total dry film coating thickness of not less than 0.5 mils.

2.5 FABRICATION

- A. Factory fabricate components ready for field assembly, in accordance with manufacturer's specifications and recommendations and reviewed shop drawings for the particular installations and conditions indicated.
- B. Fabricate wall panels in single lengths, top to bottom, as per field measurements. Transverse joints are not permitted.
- C. Fabricate trim and flashings in longest practical lengths.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

- A. Prior to commencing work, examine surfaces and framing to receive wall panels and accessories and report in writing any conditions that would prevent the proper installation of the system. Starting work implies acceptance of surfaces as satisfactory.

3.2 COORDINATION

- A. Coordinate installation of wall panels and accessories with installation of work of other trades whose work adjoins with the work of this Section.

3.3 PREPARATION

- A. Apply building paper to metal framing prior to installing sub-girts. Lap 2 inches (50 mm) min. at edges and 6 inches (150 mm) at ends and fasten with self-tapping metal screws with neoprene washers.

3.4 INSTALLATION

- A. Install wall panels, flashings, closures, trim and accessories as per Drawing requirements, reviewed shop drawings and manufacturer's specifications, instructions and recommendations, and so as to provide a watertight installation.
- B. Erect components using manufacturer's own crews or approved and licensed erector.
- C. Remove any strippable protective coating on the panels, trim and flashings prior to installation. In any case, do not allow strippable coating to remain in extreme heat, cold, or in direct sunlight or other UV source.
- D. Install work true, square and plumb, field cuts, bending and fitting neatly and accurately done without damage to surfaces.
- E. Fit adjacent panels together so that joints are uniform, tight and in full contact.

- F. Unless shown or specified otherwise, conceal fasteners. Where exposed fasteners are required for formed metal trim, they shall be uniformly spaced and aligned. Heads of exposed fasteners shall match adjacent panel and trim faces.
- G. Provide sealants as per manufacturer's directions and recommendations and so as to provide a watertight installation.
- H. Protect dissimilar metals from galvanic corrosion.

3.5 CLEANING

- A. Clean exposed surfaces free of dirt, dust and construction soil. Touch up abrasions in factory applied coatings. Where extent of damage will not permit inconspicuous touch-up and repair, remove damaged items from the site and replace with new.

3.6 PROTECTION

- A. Protect work until entire installation is fully completed.

END OF SECTION

Section 07951

SEALANTS AND CAULKING

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Throughout the work, caulk and seal all joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of air and passage of moisture.
- B. Related work described elsewhere:
 - (1) Adhere strictly to the caulking and sealant details shown on the Drawings.
 - (2) Doors and windows.
 - (3) Painting and finishing.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified in this Section as listed in Division One.
- B. Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect. Acceptable manufacturers are W.P. Grace Co., and DAP, Inc.
- C. Qualifications of installers:
 - (1) Proper caulking and proper installation of sealants require that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.
 - (2) For caulking and installation of sealants throughout the work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the Drawings and the installation requirements called for in this Section.

1.03 SUBMITTALS

- A. General: Comply with provisions appropriate in Division One.
- B. Manufacturers' data:

- (1) Within 7 calendar days after award of the Contract, submit:
 - (a) A complete materials list showing all items proposed to be furnished and installed under this Section.
 - (b) Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.
 - (c) Specifications, installation instructions, and general recommendations from the materials manufacturers showing procedures under which it is proposed that the material will be installed.
- (2) Upon approval by the Architect, the proposed installation procedures will be come the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

1.04 PRODUCT HANDLING

- A. Delivery and storage: Deliver all materials of this Section to the job site in the original unopened containers with all labels intact and legible at time of use. Store only under conditions recommended by the manufacturers. Do not retain on the job site any material which has exceeded the shelf life recommended by its manufacturer.
- B. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 GENERAL SCHEDULE

- A. Sealants shall be provided as follows:

<u>Feature</u>	<u>Sealant Type</u>
Control joints in masonry	Polysulfide
Sawed control joints in concrete slab	Polysulfide or rubber-asphalt
Expansion joints in concrete and masonry, interior	Polysulfide or polyurethane

Around frames and louvers in exterior walls
Joints in sills and thresholds

Acrylic or polysulfide
Acrylic or polysulfide

Around frames in interior walls

Oil-base caulk, butyl or acryl

2.02 POLYSULFIDE AND POLYURETHANE SEALANT

- A. Polysulfide and polyurethane sealants shall be one-component elastomeric sealants conforming to Federal Specifications TT-S-230A or two-component rubber-base sealants conforming to Federal Specifications TT-S-227B. Use Type 1, self-leveling, in joints on horizontal surfaces; use Type 2, non-sag, for joints in vertical and slope surfaces.

2.03 EPOXY

- A. All interior non-metallic floor slab sawed control joints shall be filled with Euco Epoxy 491 by Euclid Chemical Company, Sikadur Lo-Mod Mortar by Sika Chemical Corporation, or equal.

2.04 ACRYLIC SEALANT

- A. Acrylic polymer sealant shall be solvent release type conforming to Federal Specification TT-S-230A.

2.05 BUTYL SEALANT

- A. Butyl polymer sealant shall be solvent release type conforming to Federal Specifications TT-S-001657, Type 1.

2.06 RUBBER - ASPHALT SEALANT

- A. Cold applied sealant shall conform to ASTM D 1850 and Federal Specifications SS-S0158. Hot applied sealant shall conform to ASTM D 1190 and Federal Specifications SS-S-164.

2.07 CAULKING

- A. Oil-base and resin base caulk shall conform to Federal Specifications TT-S-00598.

2.08 ROPE YARN

- A. Rope yarn packing shall conform to Federal Specifications HH-P-117.

2.09 BACK-UPS AND FILLERS

- A. Back-ups and fillers shall be non-absorbent and non-staining, compatible with sealant and primer. Do not use materials impregnated with oil or bitumen. Resilient fillers shall be closed-cell resilient urethane foam, Polyvinyl chloride foam, polyethylene foam, vinyl or sponge rubber, or polycholorene tubes or rods. Fillers shall be approximately 25% to 50% wider than the joint. Braiding hose or rod stock to obtain sufficient size will not be permitted.
- B. Supporting type fillers shall be closed-cell rigid foam, cork or non-impregnated fiber board of the size indicated and as required for proper installation or sealant.

2.10 BOND BREAKERS

- A. Bond breakers shall be polyethylene tape with pressure-sensitive adhesive, aluminum foil or wax paper.

2.11 PRIMER

- A. Primers shall be non-staining type, as recommended by manufacturer of sealant for the material in contact.

2.12 COLORS

All sealant and caulking compounds shall be non-staining and color fast. Colors shall, in general, match the adjacent surfaces.

2.13 BOND - PREVENTIVE MATERIALS

- A. Use only one of the following as best suited for the application and as recommended by the manufacturer of the sealant used:
 - (1) Polyethylene tape, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated;
 - (2) Aluminum foil conforming to MIL-SPEC-MIL-A-148E;
 - (3) Wax paper conforming to Fed. Spec. UU-P-270.

2.14 MASKING TAPE

- A. For masking around joints, provide masking tape conforming to Federal Specification UU-T-106C.

2.15 OTHER MATERIALS

- A. All other materials, not specifically described but required for complete and proper caulking and installation of sealants, shall be first quality of their respective kinds, new and as selected by the Contractor subject to the approval of the Architect.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Concrete and ceramic tile surfaces:

- (1) All surfaces in contact with sealant shall be dry, sound and well brushed and wiped free from dust.
- (2) Use solvent to remove oil and grease, wiping the surfaces with clean rags.
- (3) Where surfaces have been treated, remove the surface treatment by use of sandblasting or wire brushing.
- (4) Remove all latency and mortar from the joint cavity.
- (5) Where backstop is required, insert the approved backup material in the joint cavity to the depth required.

B. Steel surfaces:

- (1) Steel surfaces in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish, the metal shall be scraped or wire brushed to remove all scale.
- (2) Use solvent to remove all oil and grease, wiping the surface clean with rags.
- (3) Remove protective coatings on steel by sandblasting or by a solvent that leaves no residue.

C. Aluminum surfaces:

- (1) Aluminum surfaces in contact with sealant shall be cleaned of temporary protective coatings, dirt, oil and grease.
- (2) When masking tape is used for a protective cover, remove the tape just prior to applying the sealant.
- (3) Use only such solvents to remove protective coatings as are recommended for that purpose by the manufacturer of the aluminum work, and which are non-staining.

3.03 INSTALLATION OF BACKUP MATERIALS

- A. Use only the backup material recommended by the manufacturer of the sealant and approved by the Architect for the particular installation, compressing the backup material 25% to 50% to secure a positive and secure fit. When using backup for tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.

3.04 PRIMING

- A. Use only the primer recommended by the manufacturer of the sealant and approved by the Architect for the particular installation. Apply the primer in strict accordance with the manufacturer's recommendations as approved by the Architect.

3.05 BOND-BREAKER INSTALLATION

- A. Install an approved bond-breaker where recommended by the manufacturer of the sealant and where directed by the Architect, adhering strictly to the installation recommendations as approved by the Architect.

3.06 INSTALLATION OF SEALANTS

- A. General: Prior to start of installation in each joint, verify the joint type according to the details in the Drawings, and verify that the required proportion of width of joint has been secured.
- B. Equipment: Apply sealant under pressure with hand or power-actuated gun or other appropriate means. Guns shall have nozzle of proper size and shall provide sufficient pressure to completely fill joints as designed.
- C. Masking: Thoroughly and completely mask all joints where the appearance of sealant on adjacent surfaces would be objectionable.
- D. Installation of sealant: Install the sealant in strict accordance with the manufacturer's recommendations as approved by the Architect, thoroughly filling all joints to the recommended depth.

E. Tooling: Tool all joints to the profile shown on the details in the Drawings.

F. Clean up:

- (1) Remove masking tape immediately after joints have been tooled.
- (2) Clean adjacent surfaces free from sealant as the installation progresses. Use solvent or cleaning agent as recommended by the sealant manufacturer.

END OF SECTION

SECTION 08110

METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Installation of metal doors and frames.

1.2 RELATED SECTIONS

- A. Section 04810 - Unit Masonry Assemblies; Placement of anchors in masonry construction.
- B. Section 08210 - Wood Doors.
- C. Section 08710 - Door Hardware.
- D. Section 09900 - Paints and Coatings.

1.3 SUBMITTALS

- A. Product Data: Submit 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.
- B. Certificates:
 - 1. Provide manufacturer's certification that products comply with referenced standards as applicable.
- C. Shop Drawings:
 - 1. Show all openings in the door schedule and/or the Drawings.
 - 2. Provide details of door design, door construction details and methods of assembling sections, hardware locations, anchorage and fastening methods, door frame types and details, anchor types and spacing, and finish requirements.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and finishes.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: _____

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Products shall be marked with Architect's opening number on all doors, frames, misc. parts and cartons.
- B. Upon delivery, inspect all materials for damage; notify shipper and supplier if damage is found.
- C. Protect products from moisture, construction traffic, and damage.
 - 1. Store vertically under cover.
 - 2. Place units on 4 inch (102 mm) high wood sills or in a manner that will prevent rust or damage.
 - 3. Do not use non-vented plastic or canvas shelters.
 - 4. Should wrappers become wet, remove immediately.
 - 5. Provide 1/4 inch (6 mm) space between doors to promote air circulation.

1.6 COORDINATION

- A. Coordinate with door opening construction and door frame and door hardware installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: _____

2.2 MATERIALS

- A. Doors, frames, frame anchors, and hardware reinforcing for each of the levels and models specified shall be provided to meet the requirements of the performance levels specified..

2.3 FRAMES

- A. Provide Levels and Models in accordance with ANSI/SDI A250.8 as indicated in the door schedule.
- B. Interior frames: Frame configuration and depth as indicated on drawings.
- C. Provide knockdown field assembled type frames unless otherwise indicated.
- D. Provide face welded type frames unless otherwise indicated.
- E. Provide frames, other than slip-on drywall type with a minimum of three anchors per jamb suitable for the adjoining wall construction. Provide anchors of not less than 0.042 inch (1.0 mm) in thickness or 0.167 inch (4.2 mm) diameter wire. Frames over 7 feet 6 inches (2286 mm) shall be provided with an additional anchor per jamb.
- F. Slip-on drywall frame anchors shall be as provided by the manufacturer to assure performance specified.

- G. Base anchors shall be provided, other than slip-on drywall type, with minimum thickness of 0.042 inch (1.0mm). For existing masonry wall conditions that do not allow for the use of a floor anchor, an additional jamb anchor shall be provided.
- H. Prepare all frames for all mortise template hardware and reinforced only for surface mounted hardware. Drilling and/or tapping shall be completed by others.
- I. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

2.4 DOORS

- A. Interior doors: Provide interior doors in accordance with ANSI/SDI A250.8 and in the configuration and sizes as indicated on the door schedule:
- B. End closure: The top and bottom of the doors shall be closed with channels or closures. The channels or closures shall have a minimum material thickness of 0.042 inch (1.0 mm).
 - 1. Inverted closure channels: Set flange edges flush with door top/bottom.
 - 2. Flush closure channels: Set back face of channel web flush with door top/bottom.
- C. Core: Provide in accordance with ANSI/SDI A250.8.
- D. Door edge design: Provide in accordance with ANSI/SDI A250.8.
- E. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.
- F. Provide steel astragals where indicated on the Drawings or where required by the manufacturer or NFPA 80.

2.5 FABRICATION

- A. Fabricate doors and frames in accordance with ANSI/SDI A250.8.
- B. Prime finish: Doors and frames shall be thoroughly cleaned, and chemically treated to insure maximum paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."
- C. Factory applied finish: Meet the performance requirements and acceptance criteria as stated in ANSI/SDI A250.3. Color shall be:
 - 1. As selected from the manufacturers standard colors.
 - 2. Custom color as selected by the Architect.
- D. Design clearances: Fabricate doors and frames to maintain the following clearances:
 - 1. The clearance between the door and frame shall be 1/8 inch (3.2 mm) in the

- case of both single swing and pairs of doors.
2. The clearance between the meeting edges of pairs of doors shall be 3/16 inch (4.8 mm) plus or minus 1/16 inch (1.6 mm). For fire rated applications, the clearances between the meeting edges of pairs of doors shall be 1/8 inch (3.2 mm) plus or minus 1/16 inch (1.6 mm).
 3. The clearance measured from the bottom of the door to the bottom of the frame (undercut) shall be a maximum of 3/4 inch (19.1 mm) unless otherwise specified. Fire door undercuts shall comply with ANSI/NFPA 80, "Fire Doors and Fire Windows."
 4. The clearance between the face of the door and the stop shall be 1/16 inch (1.6 mm) to 3/32 inch (2.4 mm).
 5. All clearances shall be, unless otherwise specified in this document, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).
 6. The clearance at the bottom shall be 5/8 inch (15.8 mm).
 7. The clearance at the bottom shall be 3/4 inch (19.1 mm).
 8. The clearance between the face of the door and doorstop shall be 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm).
 9. All clearances shall be, unless otherwise specified, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are suitable before beginning installation of frames. Do not begin installation until conditions have been properly prepared.
 1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
 2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
 3. Verify that drywall construction walls are the correct thickness.
- B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Install frames plumb, level, rigid, and in true alignment in accordance with ANSI A250.11 and DHI A115.1G.
- B. Install fire rated doors and frames in accordance with NFPA 80.
- C. All frames other than slip-on types shall be fastened to the adjacent structure so as to retain their position and stability. Drywall slip-on frames shall be installed in prepared wall openings in accordance with manufacturer's instructions.
- D. Install frames as masonry is laid-up. Fill welded wrap-around frames in masonry construction solid with grout. Brace or fasten frame in such a way to prevent

pressure of the grout from deforming frame. Coordinate with work specified in Section 04810.

- E. Install frames in stucco construction as work progresses. Fill welded wrap-around frames solid with grout where indicated. Brace or fasten frame in such a way to prevent pressure of the grout from deforming frame. Coordinate with work specified in Section 09220.
- F. Grout shall be mixed to provide a 4 inch (102 mm) maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
- G. If additives are used in masonry or plaster work during cold weather, field coat the inside of steel frames with a bituminous compound to prevent corrosion.
- H. Doors shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance. Doors shall be adjusted to maintain perimeter clearances specified. Shimming shall be performed by the installer as needed to assure the proper clearances are achieved.

3.3 ADJUST AND CLEAN

- A. Adjust doors for proper operation, free from binding or other defects.
- B. Clean and restore soiled surfaces. Remove scraps and debris and leave site in a clean condition.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SCHEDULE

- A. Refer to Door and Frame Schedule appended to this section.

END OF SECTION

Section 08111

STOCK HOLLOW METAL WORK

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Provide all standard hollow metal doors and frames, complete in place, not specifically described in other Sections of these Specifications but indicated on the Drawings or otherwise required for a complete and operable facility.
- B. Related work described elsewhere:
 - (1) Carpentry Work - Section 06001

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified in this Section and with the general requirements of these specifications.
- B. Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Owner.
- C. Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. Single source: All work of this Section shall be produced by a single manufacturer unless otherwise approved by the Owner.

1.02 SUBMITTALS

- A. General: Comply with provisions of the general requirements.
- B. Manufacturers' data:
 - (1) Within 30 calendar days after award of the contract, submit:
 - (a) Complete materials list of all items proposed to be furnished and installed under this Section.
 - (b) Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

- (c) Shop drawings showing details of each frame type, elevations of each door design type, details of all openings, and all details of construction, installation, and anchorage.
 - (d) Manufacturer's recommended installation procedures.
- (2) The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all requirements and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Hollow metal doors and frames:
 - (1) Doors and door frames shall be equal to Ceco Corp., Amweld or Republic Builders Products Corp. Frames are to be 18 gauge steel, rolled formed with integral stops and rebates and may be of welded unit construction or knock down type.
 - (2) Provide U.L. labeled frames and doors where required on the drawings.

2.02 FABRICATION

- A. General:
 - (1) Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles.
 - (2) Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the site.
 - (3) Fabricate exposed faces of doors and panels from only cold-rolled steel.

- (4) Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).
- B. Exposed fasteners: Provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.
- C. Finish hardware preparation:
- (1) Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware suppliers. Comply with applicable requirements of ANSI A115.
 - (2) Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at site.
 - (3) Locate finish hardware in accordance with "Recommended Locations for Builders Hardware", published by the National Builders Hardware Association.
- D. Shop painting:
- (1) Clean, treat and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces.
 - (2) Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before the application of the shop coat of paint.
 - (3) Apply shop coat of prime paint of even consistency to provide an uniformly finished surface ready to receive field-applied paint.

PART THREE - EXECUTION

3.01 INSPECTION

- A. General: Install hollow metal units and accessories in accordance with manufacturer's data, and as herein specified.
- B. Placing frames:
- (1) Comply with the provisions of Standard 100 of the Steel Door Institute, unless otherwise indicated.

- (2) Except for frames located at in-place concrete or masonry openings, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surface smooth and undamaged.
- (3) In masonry construction, locate three wall anchors per jamb at hinge and strike levels. Building-in of anchors and grouting of frames will be performed under provisions of Division 4 of these Specifications.
- (4) At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices. If attached with screws, provide "Z" fillers at each screw location to prevent collapse or distortion of frame when screws are tightened.
- (5) When installed in prepared openings in concrete or masonry construction, install sealant between frame and concrete or masonry in compliance with the requirements of Section 07951.

3.03 ADJUST AND CLEAN

- A. Final adjustments: Check and read just operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise damaged.
- B. Prime coat touch-up: Immediately after erection, sand smooth all rusted or damaged areas of prime coat and apply touch-up of compatible air drying primer.

END OF SECTION

08111 - 4

Section 08210

WOOD DOORS

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Furnish and deliver to the job site all wood doors indicated on the Drawings, specified herein, or needed for a complete and proper installation.
- B. Related work described elsewhere:
 - (1) Carpentry Work - Section 06001
 - (2) Finish Hardware - Section 08710

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified herein and with the General Requirements.
- B. Qualifications of manufacturer: All wood doors shall meet the NWMA approval and I.S. 1 series requirements. Fire doors shall also bear the UL label for the designated rating.

1.03 SUBMITTALS

- A. General: Comply with the provisions of the general requirements.
- B. Product data: After award of Contract, submit:
 - (1) Complete materials list showing all items proposed to be furnished and delivered under this Section.
 - (2) Sufficient data to demonstrate that all such items meet or exceed the specified requirements.
 - (3) A copy of the guarantee proposed to be furnished.

1.04 GUARANTEE

- A. Upon delivery of the doors of this Section to the job site, and as condition of their acceptance, deliver to the Owner two copies of an agreement written on the door manufacturer's standard form, signed by the door manufacturer and the Contractor agreeing to replace or repair defective doors which have warped (bow, cup, or twist). The guarantee shall also include

refinishing and reinstalling which may be required due to repair or replacement of defective doors. Guarantee shall be in effect for a period of one year following date of acceptance.

1.05 PRODUCT HANDLING

- A. Protection: Protect the materials of this Section during transit, storage, and handling to prevent deterioration, damage and soiling.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 WOOD DOORS

- A. General: Interior doors shall be of the sizes, types, and designs shown on the Drawings. Doors shall be pre-finished, with no dark spots or extreme variations.
- B. Adhesives and bonds: Use only adhesives and bonds conforming to NWMA I.S. - 1 standards, Type II, for interior wood doors. Adhesives shall be non-staining.
- C. Warp tolerances shall be in accordance with NWMA I.S. - 1.
- D. Hardware: Doors shall be pre-machined for hardware.

PART THREE - EXECUTION

3.01 DELIVERY

- A. Deliver the work of this Section to the job site in a timely manner to permit the orderly progress of the total work.

3.02 INSTALLATION

- A. Installation of the work of this Section is described in Carpentry Section 06001.

END OF SECTION

Section 08360

SECTIONAL OVERHEAD DOORS

PART ONE - GENERAL

1.01 WORK INCLUDED

- A. Powered overhead sectional door.
- B. Garage door panels.
- C. Operating hardware and supports.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish anchors to Section 04150 for placement in wall construction.

1.03 RELATED WORK

- A. Section 05200 - Miscellaneous: Steel frame for door opening.
- B. Section 08700 - Hardware: Lock cylinders.

1.04 REFERENCES

- A. ANSI A216 - Section Overhead Type Door (NAGDM 102).
- B. ANSI/ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical) Quality.
- C. ANSI/ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Commercial Quality.

1.05 SYSTEM DESCRIPTION

- A. Panels: Flush steel 1-3/8 inches.
- B. Standard lift track and hardware.
- C. Doors to be equipped with powered door openers – see door hardware schedule.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in overhead door construction with three years minimum experience.
- B. Applicator: Company specializing in installing overhead doors with two years documented experience and/or approved by manufacturer.
- C. Door construction: ANSI A216.1

1.07 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01300.
- B. Indicate opening dimensions and tolerances, component construction, connections and details, anchorage methods and spacing, hardware and location, and installation details.
- C. Submit manufacturer's installation instructions under provisions of Section 01300.

1.08 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01720.
- B. Include data for shaft and gearing, lubrication frequency, control adjustments, and spare part sources.

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. C.H.I.
- B. Wayne-Dalton
- C. Overhead
- D. Raynor
- E. Barcol
- F. Substitutions: Under provisions of Section 01300.

2.02 MATERIALS

- A. Sectional, overhead, insulated door, sheet steel: ANSI/ASTM A526; galvanized to 1.25 oz/sq.ft. flat.

- B. Insulation: Rigid polyurethane, same thickness as core framing members bonded to facing.

2.03 COMPONENTS

- A. Panels: Flush steel construction; outer steel sheet of 24 gage thick, v-grooved profile; inner steel sheet of 24 gage thick, flat with roll formed struts profile; core reinforcement of 24 gage thick sheet steel roll formed to v shape; rabbeted weather joints at meeting rails; insulated.
- B. Track: 13 gage thick by 3 inch wide rolled steel track, continuous, vertical mounted; galvanized steel mounted brackets, 1/4 inch thick.
- C. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel ball bearing rollers, located at top and bottom of each panel at meeting joint.
- D. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position; interior handle; lock master keyed.
- E. Door panel weatherstripping: At bottom of door panel, full width; u-shaped astragal.
- F. Jamb weatherstripping: Roll formed steel fitted full height of jamb with integral resilient weatherstripping in moderate contact with door panels.

2.04 FINISHES

- A. Exterior steel: Structural quality, hot-dipped, galvanized steel with an alloyed coating of zinc-aluminum, factory finished with baked-on polyester primer and white polyester finish coats.
- B. Interior steel: Same as exterior.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within limits.
- B. Beginning of installation means acceptance of existing surfaces.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit and air and vapor barrier seal.
- B. Apply sealer.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.
- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07951.
- F. Install perimeter trim and closures.

3.04 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Variation from Plumb: 1/16 inch maximum.
- C. Variation from Level: 1/16 inch maximum.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

3.05 ADJUSTING AND CLEANING

- A. Adjust door assembly.
- B. Clean doors and frames.
- C. Remove labels and visible markings.

3.06 DOOR OPENERS

- A. The electric operators will be as listed on the door hardware schedule. Openers are to be installed on each door.

Section 08410

ALUMINUM ENTRANCES AND STOREFRONT

PART ONE – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to work in this Section.

1.02 DESCRIPTION OF WORK

- A. Included herein as materials and installation required:
 - 1. Exterior storefront system work on North façade as shown on the Drawings.

1.03 SHOP DRAWINGS AND SAMPLES

- A. Submit for approval to the Architect in accordance with requirements of Section 01300 Submittals and Substitutions shop drawings showing details and sizes of all aluminum sections and samples.
- B. Shop drawings and/or manufacturer's cuts are required. Prior to submittal to the Architect, obtain written acceptance from the glass manufacturer that details are proper for the type of glass to be used.

1.04 SPECIAL REQUIREMENTS

- A. Except where higher standards are required herein, work shall conform to applicable provisions of the following manuals of the National Association of Architectural Metal Manufacturers.
 - 1. Architectural Metals Handbook.
 - 2. Entrance Manual.
 - 3. Metal Finishes Manual.
- B. Completed work shall be capable of safely sustaining a positive and negative pressure of 30 psf or more per local building code requirements with deflections not to exceed 1/175 of the spans involved, except that maximum deflections shall not exceed 3/4" (whichever is the least) and remain watertight against water infiltration. This requirement includes interior locations. Reinforce aluminum framing with internal steel sections as required to achieve this loading (including wind, snow, and dead loads, glass, etc.) and/or deflections. Submit design calculations for approval, made by the manufacturer to attest to above requirements.

- C. Furnish all anchors, inserts, clips and collateral items with adequate setting information required to be built into adjacent work. Do all cutting and fitting of this work, and of adjacent work as necessary to make all work fit together properly.
- D. Coordinate the development of finishes specified herein so as to match finishes or adjacent items or surfaces, as approved.
- E. Outside dimensions and profiles of the various components shall follow details shown on the drawings. Internal arrangements of un-exposed members, reinforcement, connections and fastenings shall be the manufacturer's standard, providing the appearance and performance conforming to the intent of the Contract Documents.

PART TWO – PRODUCTS

2.01 MATERIALS

- A. Metals shall be free from defects impairing strength, durability or appearance, and shall be best commercial quality for purposes specified, made with structural properties to safely withstand strains or stresses to which they will be normally subjected. Protect metals from injury at shops, in transit to job, until erected in place, completed, inspected and accepted.
- B. Aluminum: commercially pure alloys of proper types to receive approved matching anodized finish defined, of proper temper for the conditions involved; extrusions not less than .125" thick, sheet .0625" thick, unless other thickness is specified hereinafter for a particular item.
- C. Carbon Steel – ASTM A 36.
- D. Sealant: refer to caulking section. Color shall match adjacent surfaces as approved.
- E. Paint: on carbon steel surfaces use rust-inhibitive type standard with the manufacturer as approved.
- F. Fasteners: including nuts, washers, bolts, clips, etc. where exposed use flat head screws with Phillips head screwdriver. For aluminum work; cadmium coated steel, slot, stainless steel or aluminum where concealed, aluminum of proper temper to withstand the stresses and of proper alloy to match adjacent finish where exposed. Bronze work; same material as adjacent members, with suitable temper to withstand the stresses (threaded members shall have U.S. Standard threads). Stainless steel work; same material as adjacent members. Carbon steel ASTM A 307 bolts.
- G. Resilient Gaskets: flat stock neoprene closed cell sponge (ASTM D735 Type SC-42) or solid stock (ASTM D735 Type SC-310), of thickness to fill joint when under 25% compression, by D.S. Brown Co., Rubatex Division of Great American Industries, Inc., or approved substitute.

2.02 FINISH

- A. Finish for aluminum surfaces: Factory-applied, Kynar 500 fluorocarbon coating, full strength, two coat systems, each coat baked on separately.
 - 1. Color: Custom color as selected by Architect.
 - 2. Quality Standard: AAMA 605.2-1980, for high performance organic coatings.

2.03 WORKMANSHIP, FABRICATION AND INSTALLATION

- A. All of this work shall be performed in a shop where the grade of work is of recognized quality. All workmanship and finishes shall be first class in every particular, strictly in accordance with the best practice. Employ only skilled workmen for fabrication and installation. Cut and finish all miters to a tight true-line fit. Faces of metal in contact shall have hairline joint and be water-tight. To greatest extent possible, assemble work with concealed fittings. Install moldings and trim at joints so as to be in perfect alignment.
- B. Do cutting, punching, drilling and tapping as required for attachment of adjacent work coming in contact with ornamental metal work where so indicated, or where directions for same are given prior to or with approval of shop drawings.
- C. Weights of connections, accessories, etc. shall be adequate to safely sustain and withstand stresses and strains to which they will be subjected. Accessories and connections to steel, unless otherwise specified, shall be steel.
- D. Items to be built into adjacent work shall be of form required for anchorage, or be provided with suitable anchors, expansion shields, etc., as required for proper anchorage.
- E. Install all supporting members, fastenings, framing, hangers, bracing, brackets, straps, bolts, angles as required to set and connect work rigidly and properly to structural system, masonry or other construction.
- F. Use machine screws, in tapped holes, of same material and finish as exposed ornamental metal where fasteners for attachment of ornamental metal to steel supports are exposed. Use weathertight type sleeves, of similar shape to long members so as to allow for expansion and contraction movement.
- G. Grind smooth exposed brazing or welding and polish to match finish of adjacent metals, using filler metal compatible with base metal.
- H. Provide sharp, clean breaks in sheet work with minimum radius on bends. Refinish any bends showing stretch lines so as to match adjoining surfaces. Finish curved work to true radii.
- I. Set and brace or connect the work in place, until fully built in or until final connections are made. Remove temporary bracing or connections.
- J. Design and fabricate ornamental metal work so as to prevent distortion to the ornamental metals or damage to the anchorage and supports, due to expansion or contraction.

- K. Shop-assemble work to the extent practical for field erection. If work cannot be permanently shop-assembled, completely assemble the work in the shop, mark for identifications and disassemble for shipment, to insure proper assembly and fit in actual location.
- L. Install all hardware for doors (furnished under Hardware Section or Specifications except as noted in hardware schedule); adjust doors for proper operation. Doors shall operate smoothly and easily; without drag or binding, and shall fit weathertight to stops when closed.
- M. Provide and maintain temporary protections as required to prevent damage to work included herein due to operations or placing adjacent or subsequent work. Upon completion, conduct careful inspection of work performing all adjustments, corrections of defects and cleaning as required. Leave all doors and other operating members in proper operating condition with no drag, binding or racking. Remove all removable protective coatings from finished surfaces and clean the finish surfaces, all in accordance with the directives of the standards referred to herein before or the manufacturer.

2.04 ALUMINUM ITEMS

- A. Doors, Frames, and Entrances:
Fabricate doors, frames, entrances, including vestibules, sidelights, transoms, windows, etc., of custom color to match aluminum glazing frame. Work shall be complete with weatherstripping, vinyl glazing mouldings, steel bent plate reinforcing, steel base plates, reinforcement for hardware and related accessories shown or required for a proper rigid installation and hardware per schedule.
- B. All aluminum tube work to receive glass (aluminum doors, transoms, etc.) is included (but not limited to) work under this section.
- C. Doors shall be of types and sizes as detailed and scheduled with medium stile, similar to "Kawneer Model 375" (with 10" bottom rail) or similar approved by Architect. Provide internal reinforcement of stile to rail connection and at all corners. Provide vinyl or neoprene glazing channels to accept proper glass thickness in doors. Provide weatherstrip astragal insert in meeting stiles of pairs of exterior doors. Provide manufacturer's standard vinyl or pile weatherstripping. Furnishing only of push and pull devices, and/or concealed panic bar devices, closers, hinges etc., to be included under hardware section. All preparation of aluminum doors for hardware as later selected shall be include in this work.

NOTE: Concealed panic bar, handicapped, etc. preparation of aluminum ground level doors, may be required, fabricator shall be included in the reuirqred work without added costs.

All hardware for aluminum swing doors shall be installed and adjusted by this division. Make final adjustments after installation of glass. Aluminum thresholds; supplied under Hardwar Division of work shall be installed at each aluminum door where scheduled under this Division.

- D. GENERAL: Framing systems specified are base on Kawneer and are to be used at the following locations:
1. North Façade – 2nd Floor as indicated on the Drawings.
 - a. Kawneer “series 400” system (dry-glaze) or similar approved with approximately 1-3/4” x 4” reinforcing with internal steel as required to withstand design loading required or approved equal.

PART THREE – EXECUTION

3.01 EXECUTION

- A. Inspection and Preparation:
1. Inspect previously installed materials and do not begin the installation of an assembly until unsatisfactory conditions have been corrected.
 2. Removed interfering concrete, dirt and other deleterious materials from openings before setting the framing.
- B. Installation:
1. Erect framing according to manufacturer’s directions, plumb, level, square, in proper alignment with other work and within the following maximum permissible tolerances:
 - a. Limit variations from plumb, level or dimensioned angle to the following:
 - 1) 1/8” maximum deviation in any story height, or in any 10 ft. vertical or angular run, or in any 20 ft. horizontal run.
 - 2) 1/4” maximum deviation in any 40 ft. run, any direction.
 - b. Limit variations from location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to the following:
 - 1) 3/8” total maximum deviation in any member at any location.
 - 2) 1/8” maximum change in deviation for any member for any 10 ft. run, any direction.
 - c. Limit offsets in the end-to-end and edge-to-edge alignments for adjoining and consecutive members, which form planes, continuous runs or profiles, to the following:
 - 1) 1/16” maximum offset in any flush alignment, including any which are to be 1/2” or less out-of-flush, and including any which are separated 2” or less by a reveal or protrusion of more than 2” width.

- 2) 1/8" maximum offset in alignments which are to be out-of-flush by more than 1/2" or separated by a reveal or protrusion of more than 2" width.
2. Securely anchor each assembly in place to provide structural performance requirements. Provide shims, clips, anchors, fasteners and accessories wherever practical.
3. Apply sealants and tapes within assemblies for a watertight installation.
4. Protect aluminum from contact with non-compatible materials. Paint concealed surfaces in contact with concrete or masonry with zinc chromate or black asphaltum, or separate the materials with sealant or glazing tape.
5. Install gaskets wherever directed by the Engineer/Architect where ever building movement is anticipated, as required or recommended.

3.02 PROTECTION AND CLEANING

- A. All work shall be carefully protected so as to avoid damage in transit and delivered in perfect condition. Any work delivered in damaged condition will be rejected, and replaced by Contractor without cost to the Owner.
- B. All metal work will be carefully protected from injury, staining, etc., during execution of work of building. At completion of work, Contractor shall remove all protection, clean all metal work, all damages repaired, touch up work shall be done and entire work left in perfect condition.

END OF SECTION

Section 08521

ALUMINUM CLAD WINDOWS

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Furnish and deliver to the site all aluminum windows shown on the Drawings, specified herein, and installed as recommended by the manufacturer as approved by the Architect.
- B. Related work described elsewhere:
- (1) Carpentry Section 06001
 - (2) Finish Hardware Section 08710
 - (3) Sealants and Caulking Section 07951

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified herein and with the General Requirements.
- B. Qualifications of Manufacturer: Products used in the work of this Section shall be produced by the manufacturers regularly engaged with manufacture of similar items and with a history of successful production acceptable to the Architect.

1.03 SUBMITTALS

- A. General: Comply with the provisions of the General Requirements, applicable laws, safety and building codes.
- B. Product date: Within 30 calendar days of the award of Contract, submit:
- (1) Complete materials list showing all items proposed to be furnished and delivered under this Section.
 - (2) Sufficient data to demonstrate that all such items meet or exceed the specified requirements.
 - (3) A copy of the guarantee proposed to be furnished.

1.04 PRODUCT HANDLING

- A. Protection: Protect materials of this Section during transit, storage, handling and installation to prevent deterioration, damage and soiling.
 - (1) Package and mark each window for location to correspond with opening number on the Drawings.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 ALUMINUM CLAD WINDOWS

- A. Exterior windows: Windows shall be located and sized as shown on drawings. Windows are to be equal to Pella Lifestyle Series or Andersen E-Series. Glazing is to be insulated, low-e.

PART THREE - EXECUTION

3.01 DELIVERY

- A. Deliver all aluminum clad window units to the job site in a timely manner to permit orderly progress of the total work.

3.02 INSTALLATION

- A. Installation of window units shall be as shown on the Drawings, specified herein and in strict accordance with the manufacturer's installation direction as approved by the Architect.

END OF SECTION

SECTION 08710
DOOR HARDWARE

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.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

- B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

- C. Related Sections:

1. Division 08 Section "Operations and Maintenance".
2. Division 08 Section "Door Schedule".
3. Division 08 Section "Hollow Metal Doors and Frames".
4. Division 08 Section "Interior Aluminum Doors and Frames".
5. Division 08 Section "Flush Wood Doors".
6. Division 08 Section "Aluminum-Framed Entrances and Storefronts".

- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.
9. 521 CMR - Massachusetts Architectural Board Regulations.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. ULC-S319 - Electronic Access Control Systems.
5. ULC-60839-11-1, Alarm and Electronic Security Systems - Part 11-1: Electronic Access Control Systems - System and Components Requirements.
6. CAN-ULC-S533 - Egress Door Securing and Releasing Devices.
7. UL 305 - Panic Hardware.
8. ULC-S132, Emergency Exit and Emergency Fire Exit Hardware.
9. ULC-S533 - Egress Door Securing and Releasing Devices.
10. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data,

Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of tornado or hurricane storm shelter assemblies.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Building Information Modeling (BIM) Qualifications: BIM software tools and processes are used to produce and support data integration of product and technical information used in specifications, submittals, project reviews, decision support, and quality assurance during all phases of Project design, construction, and facility management. Door and hardware schedules and the associated product data parameters are to be derived, updated, and fully integrated with the coordinated Building Information Modeling as required under Division 01.
- F. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- G. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- H. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s),

Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

K. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

- D. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain

unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.

- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum

overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
2. Manufacturers:
 - a. Pemko (PE).

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Standard.
- C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

- D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - Keymark.
 - b. Corbin Russwin (RU) - Access 3 AP.
 - c. Corbin Russwin (RU) - Pyramid.
 - d. Medeco (MC) - Bilevel.
 - e. Medeco (MC) - X4.
 - f. Sargent (SA) - Degree DG1.
 - g. Sargent (SA) - XC.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- F. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
- G. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.7 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
- B. Cylindrical Indicator Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Provide locksets with functions and features as follows:
 - a. Visual status indicators in rose, displaying bold visuals for vacant or occupied lock status.
 - b. Meets ANSI/BHMA A156.41 for single motion egress.
 - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - d. Three-year limited warranty.
 - 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - YPL Series.
- C. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 Certified Products Directory (CPD) listed. Locks are to be non-handed and fully field reversible.
 - 1. Provide locksets with functions and features as follows:
 - a. Meets ANSI/BHMA A156.41 for single motion egress.
 - b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - d. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
 - e. Five-year limited warranty for mechanical functions.
 - 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 5300LN Series.
 - b. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 4600LN Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. Five-year limited warranty for mechanical features.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 6000 Series.

2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:

- a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 3500 Series.
 - b. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 5800 Series.
 - c. Norton Rixson (NO) - 8500 Series.
 - d. Norton Rixson (NO) - 410 Series.
- C. Door Closers, Surface Mounted (Light Commercial): ANSI/BHMA 156.4, minimum Grade 3 Certified Products Directory (CPD) listed surface mounted, light commercial grade door closers. Non-handed, minimum sizes 2 to 4 Provide closer standard packed for regular, top-jamb, and parallel arm type mounting applications.
- 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 1100 Series.
 - b. Norton Rixson (NO) - 1700 Series.

2.11 SURFACE MOUNTED CLOSER HOLDERS

- A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.
- 1. Manufacturers:
 - a. Norton Rixson (RF) - 980/990 Series.
 - b. Sargent Manufacturing (SA) - 1560 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
 - a. Rockwood (RO).

2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Rockwood (RO).

2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. Pemko (PE).

2.15 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.

- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should 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 and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

- B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. YA - ASSA ABLOY ACCENTRA
5. RF - Rixson
6. SU - Securitron

END OF SECTION 08710

SECTION 09260

GYPSUM WALLBOARD

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work Included: Furnish all labor, materials, and equipment necessary, but not limited to, preparation and installation of gypsum wallboard on walls as shown on Drawings, specified herein as required for a complete and proper job.
- B. Finish Preparation: It shall be the General Contractor's responsibility to tape and spackle all dry wall and make ready to receive finish by others.

1.02 RELATED WORK

- A. Sealants and Caulking Section 07951
- B. Store and protect wallboard from moisture and damage and exposure to the weather.

1.03 TEMPERATURES AND VENTILATION

- A. In cold weather and during period of gypsum wall board installation and joint finishing, temperatures in the area where work is in progress, and in place, shall be maintained uniformly within a range of 55° to 65°, with ventilation to eliminate excessive moisture in the building.

PART TWO - PRODUCTS

2.01 GYPSUM WALLBOARD AND TAPE

- A. Gypsum wallboard shall be as manufactured by United States Gypsum Gold Bond, Georgia Pacific, or equal approved by the Architect.
 - (1) Wallboard shall be 48" wide x 1/2" or 5/8" thick with a asphalt gypsum core enclosed in specially formulated water repellent paper on both sides or equal as shown on drawing.
 - (2) Wallboard shall be Fire Rated Type conforming to AST, C36 - 64 Type x Board.
 - a. Use blueboard or equal on all walls behind all plumbing fixtures and wet areas.
 - b. Use Type X on all walls required to be one hour rated.

- (3) Joint tape shall be strong fibrous perforated tape as recommended by the manufacturer.
- B. Gypsum exterior sheathing shall be as manufactured by U.S.G., Georgia Pacific or equal approved by the architect.
 - (1) Sheathing shall be 5/8" thick and acceptable to the exterior insulation and finish system.
- C. Spackling compound shall be plastic cement requiring only the addition of water as recommended by the manufacturer.
- D. Accessories - Use manufacturer recommended products such as USG-Perf-A-Tape and all purpose ready mix compound. Also use USG No. 093 control joints, USG acoustical sealant, USG corner bead #103 and 701-B, and USG Type "W" or "S" bugle head screws in appropriate size.

PART THREE - EXECUTION

3.01 INSTALLATION OF WALLBOARD

- A. Wallboard shall be attached to framing supports by power driven drywall screws 12" o.c. Screws shall be staggered on adjoining edges or ends. All ends and edges of all gypsum wallboard shall occur over nailing members. Joints on opposite sides of a partition shall be so arranged as to occur on different studs.
- B. Screws shall provide a slight depression below the surface of the wallboard. Screws shall not be driven closer than 3/8 inch from edges and ends of the board.
- C. While fasteners are being driven, the wallboard shall be held in firm contact with support. Attachment should proceed from central portion of the wallboard towards ends and edges.
- D. Install control joints spaced not over 30' o.c. at locations directed by the Architect.
- E. Inside vertical corners and all joints shall be reinforced with tape reinforcement and filled and sanded in strict accordance with the manufacturer's specifications. Screw head depressions, metal corner reinforcing, and metal trim shall be concealed by at least two coats of compound.
- F. All coats shall be allowed to dry thoroughly between each application of compound. All coats shall be sanded after each application has dried. The final coat and subsequent sanding shall leave all gypsum wallboard uniformly smooth and ready to receive decoration by others.
- G. Where drywall is to be firetaped only, such as above suspended ceilings, taping should be neatly applied.

3.02 INSTALLATION OF SHEATHING

- A. Sheathing shall be installed as required for installation of exterior insulation and finish system as shown on drawings.

3.03 PROTECTION

- A. Proper protection shall be provided during the work for floors, windows, doors and other designated areas.
- B. Defective work shall be corrected to the satisfaction of the Architect and at no expense of the Owner.

END OF SECTION

SECTION 09318

PORCELAIN TILE

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Furnish all labor, materials and equipment necessary but not limited to preparation of surfaces and installing new porcelain tile in areas indicated on Drawings and as specified herein for a good and complete job.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with Standards specified in this Section and the General Requirements.
- B. Qualification of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar products and with a history of successful production acceptable to the Architect.
- C. Qualifications of installers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. General: Comply with provisions of appropriate Sections in Division One of these Specifications.
- B. Manufacturer's data: Within 45 calendar days after award of the Contract, submit:
- (1) Complete materials list of all items proposed to be furnished and installed under this Section.
 - (2) Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
 - (3) Manufacturer's recommended installation procedures, when approved by the Architect will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 DESIGN

A. Porcelain Wall Tile:

- (1) All wall tile shall be as shown on drawings.
- (2) Furnish all shapes, such as but not limited to, cove base, bull nose corners and caps.
- (3) Colors of porcelain wall tile to be shown on drawings. Installation pattern is to be as shown on drawings.
- (4) Grout shall be as shown on drawings as manufactured by *Bonsal with 1/16" grout joints*.

B. Porcelain Floor Tile:

- (1) All floor tile shall be as shown on drawings.
- (2) Grout shall be as shown on drawings as manufactured by *Bonsal with 1/4" grout joints*.

PART THREE - EXECUTION

3.01 WALL PREPARATION

- A. Walls shall be sound, free from dust, grease, oil and made ready for installation.

3.02 INSTALLATION

- A. Wall tile shall be installed to plumb and level lines with all joints in true alignment, set in mastic.
- (1) Waterproof grout in joints shall not be applied until the permanent set of the mastic has occurred. No chipped or damaged tiles shall be installed.
 - (2) All internal corners shall be square and external corners to be bullnose.
- B. Lippage Control: All large format tile to be installed using a lippage control system. Large format tile is defined by the TCNA as any tile with an edge of 15" in length.
- (1) Basis-of-Design: Subject to compliance with requirements, provide the following:
 - i. Raimondi; R.L.S. Leveling System OR EQUAL
 - (2) Install tile spacing and lippage control system per manufacturer's instructions. Joint spacing for each tile type as indicated.

3.03 CLEAN AND PROTECTION

- A. Upon completion, thoroughly clean and properly protect the work specified under this Section. Any defective work shall be corrected to the satisfaction of the Architect and at no expense to the Owner.

END OF SECTION

Section 09510

ACOUSTICAL CEILING

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work Included: Furnish all labor, materials and equipment necessary but not limited to preparation of area. Acoustical ceiling work includes but is not necessarily limited to acoustical tile and metal grid. Install acoustical ceiling in areas indicated on Drawings and specified herein for a good and complete job.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with the standards herein and with the general requirements of the specifications.
- B. Qualifications of Manufacturers: Products used in this work shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Owner.
- C. Qualifications of Installers: Acoustical ceilings shall be installed by skilled workmen trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper installation of this work.

1.03 SUBMITTALS

- A. General: Comply with the general requirements of these specifications. Submit the following product data for approval after award of the contract.
- (1) Manufacturer's specifications and other data to demonstrate compliance with these specifications.
 - (2) Samples of the full range of colors and patterns and of exposed accessories from proposed manufacturers.
 - (3) Manufacturer's recommended installation procedures, material list and shop drawings indicating seam locations and structure.

1.04 PRODUCT HANDLING

- A. Delivery and Storage: Deliver materials to the job site and store in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations.

- B. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 ACOUSTICAL TILE

- A. Where suspended ceilings are indicated on drawings provide Armstrong ceiling tile. Panels are to be as shown on drawings, including accents and color.

2.02 METAL GRID SYSTEM

- A. Where suspended ceilings are indicated on drawings provide Armstrong metal grid system.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be completed. Correct conditions detrimental to the execution.

3.02 INSTALLATION

- A. Install all materials in strict accordance with the manufacturer's recommendation as approved by the Owner.
- B. Cross tees shall be joined to main beams with a positive interlock. At perimeter of walls, angle molding shall be securely anchored and ends of tees shall fit on bottom flange of moldings. The entire grid system shall be installed true to line and level with all cross tees at right angles to the main beams. Angle molding shall be neatly fitted at walls and around offsets. Hanger wires shall be installed not more than 4' on center.
- C. Acoustical tile shall be carefully laid in the grid systems to prevent breaking or damaging edges of tile. Where required to fit sizes other than the tile sizes specified, the tile shall be neatly cut.

END OF SECTION

Section 09660

RESILIENT FLOORING

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Provide all resilient flooring, complete in place, as indicated on the Drawings, specified herein, or otherwise needed for a complete and proper installation of the work of this Section.
- B. Related work described elsewhere:
 - (1) Carpet Section 09680

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. General: Comply with the general requirements of these Specifications. Submit the following product data for approval after award of the contract.
 - (1) Manufacturer's specifications and other data to demonstrate compliance with these specifications.
 - (2) Samples of the full range of colors and patterns and of exposed accessories from proposed manufacturers.
 - (3) Manufacturer's recommended installation procedures, material list and shop drawing indicating seam locations and structure.
- B. The manufacturer's recommended installation procedures when accepted will be the basis for inspection and acceptance or rejection of work.

1.04 PRODUCT HANDLING

- A. Delivery and storage: Deliver materials to the job site and store in their original unopened containers with all labels intact and legible at time of use. Store materials in strict accordance with the manufacturer's recommendations.

- B. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Resilient flooring as specified on Architectural Drawings.
- B. Adhesives shall be waterproof and stabilized type as recommended by the manufacturer of the approved resilient material. Asphalt emulsions and other non-waterproof types will not be acceptable.

2.02 OTHER MATERIALS

- A. All other materials, not specifically described but required for a complete and proper installation of the work in this Section, shall be as recommended by the manufacturer of the resilient materials used, and as approved by the Architect.

PART THREE - EXECUTION

3.01 INSPECTION

- A. General: Examine the areas and conditions under which resilient flooring is to be placed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Surface shall be smooth, level, at the required finish elevation, without more than 3 mm (1/8") in 3 m (10'-0") variation from level or slopes shown.

3.02 PREPARATION

- A. Subfloors: Prior to start of the laying tile units, broom clean or vacuum all surfaces to be covered and inspect the subfloors. Start of laying tile will indicate acceptance of subfloor conditions.

3.03 INSTALLATION

- A. General:
 - (1) Install tile only after all finishing operations, including painting, have been completed. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by tile manufacturer.

- (2) Place tile units with adhesive cement in strict compliance with the manufacturer's recommendation. Butt tile units tightly to vertical surfaces, thresholds, nosing and edging. Scribe as necessary around obstructions and to produce neat joints, laid tight, even and in straight, parallel lines.
- (3) Extend tile units into toe spaces, door reveals, and in closets and similar openings.
- (4) Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non-permanent marking device.
- (5) Lay tile from center markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non-permanent marking device.
- (6) Lay tile from center marks established with principal walls, discounting minor off-sets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut width less than 7.5 cm (3") at room perimeters. Lay tile square to room axis.

B. Matching:

- (1) Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.
- (2) Tightly cement tile to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.
- (3) Lay tile in ashlar pattern with grain in all tile running in the same direction, perpendicular to the pattern.

3.04 CLEANING AND PROTECTION

- A. Remove excess adhesive or other surface blemishes from the tile, using neutral type cleaners recommended by the tile manufacturer. Protect installed flooring from damage until acceptance by the Architect.

3.05 FINISHING

- A. After completion of the work and just prior to final inspection, thoroughly clean tile floors and accessories. Apply wax and buff, with the type of wax, number of coats, and buffing procedures recommended by the tile manufacturer.

END OF SECTION

Section 09680

CARPET

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Provide all carpeting and accessories complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified herein and with all applicable section of the general requirements of the specifications.
- B. Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. General: Comply with the general requirements of these specifications. Submit the following product data for approval after award of the contract.
 - (1) Manufacturer's specifications and other data to demonstrate compliance with these specifications.
 - (2) Samples of the full range of colors and patterns and of exposed accessories from proposed manufacturers.
 - (3) Manufacturer's recommended installation procedures, material list and shop drawing indicating seam locations and structure.
- B. The manufacturer's recommended installation procedures when accepted will be the basis for inspection and acceptance or rejection of work.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- B. Replacement: In the event of damages, immediately make all repairs and replacements needed to satisfy the Architect and at no additional cost to the Owner.

1.05 GUARANTEE

- A. All work included herein shall be guaranteed against any and all defects in workmanship and material which may appear within a period of one year after completion and acceptance of the work by the Architect

PART TWO - PRODUCTS

2.01 FLOOR CARPET

- A. See drawings for style and location.

2.02 PAD

- A. No pad is to be used; carpet is to be direct glue down.

2.03 OTHER MATERIALS

- A. All other materials shall be as recommended by the manufacturers including but not limited to carpet adhesive, seam adhesive, seam tape, tack strips, vinyl or metal carpet strips where carpet butts other floor materials, and shall be shipped to site in original containers. Carpet strips will be required.

PART THREE - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Cleaning: Immediately prior to installation of the work of this Section, thoroughly clean all substrata and remove all oil, grease, paint, varnish, hardeners, and other items which would adversely affect the bond of adhesive.
- B. Smoothing: Make all substrata level and free from irregularities. Assure one constant floor weight after carpet is installed, grinding high spots and filling low spots as required.

3.03 INSTALLATION

- A. General: Installation Method: Glue -down. Carpet to run in the direction recommended by the manufacturer unless specifically otherwise directed. Cut and fit carpet to butt tightly to vertical

surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, threshold, and nosings. Bind and seal cut edges as recommended by carpet manufacturer.

- B. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- C. Seams: Carpet shall be laid with a minimum of seams. Carpet shall be free of wrinkles, bulges, lumps, etc. and all seams shall be properly cut and butted to make tight invisible joints. No small carpet strips shall be used and cross seams through doorways will not be permitted.
- D. Maintain reference markers, hoes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- E. Install pattern parallel to walls and borders.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."
- C. Protect carpet 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 manufacturer.
- D. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.

- E. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
- F. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- G. Provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of foot traffic, maintaining intact until carpeted space is accepted by the Architect.
- H. Clean up: In addition to the general requirements thoroughly clean all carpet surfaces prior to final acceptance of the carpeted areas by the Architect.

END OF SECTION

Section 09900

PAINING

PART ONE - GENERAL

1.01 DESCRIPTION

- A. Work included: Paint and finish all exposed surfaces in accordance with the types of finish shown on the Finish Schedule, in the Drawings and as specified herein.
- B. Related work described elsewhere: Priming or priming and finishing of certain surfaces are specified to be factory performed under pertinent other Sections.
- C. Work not included:
- (1) Do not include painting which is specified under other Sections.
 - (2) Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
 - (3) Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except as may be specified herein.
 - (4) Do not paint any moving parts of operating units; mechanical or electrical parts such as valve operators, linkages, sinkages, sensing devices, and motor shafts, unless otherwise indicated.
 - (5) Do not paint over any required labels or equipment identification, performance rating, name or nomenclature plates.
- D. Shop priming: Shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also for fabricated components such as architectural woodwork, wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.
- E. Definitions: The term "paint" as used herein, means all coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.02 QUALITY ASSURANCE

- A. In case the paint manufacturer's specifications or instructions differ from the above specifications, apply the more stringent requirements to this work. Color finishes on metal surfaces shall be warranted for a period of: 15 years against chipping, cracking, blistering and peeling and for 10 years against excessive chalking and fading. The finishes shall also meet ASTM D-659-44 No. 8 rating when applied to vertical walls, or in excess of ASTM D-659-44 No. 6 rating when applied to roof surfaces and against fading in excess of 5.0 NBS units.
- B. Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- C. Qualifications of workmen:
- (1) Provide at least one person who shall be present at all times during execution of the work of this Section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this Section.
 - (2) Provide adequate numbers of workmen skilled in the necessary crafts and properly informed of the methods and materials to be used.
 - (3) In acceptance or rejection of the work of this Section, the Architect will make no allowance for lack of skill on the part of workmen.
- D. Paint coordination:
- (1) Provide finish coats which are compatible with the prime coats used.
 - (2) Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
 - (3) Upon request, furnish information on the characteristics of the specific finish materials to ensure that compatible prime coats are used.
 - (4) Provide barrier coats over non-compatible primers, or remove the primer and re-prime as required.
 - (5) Notify the Owner in writing of anticipated problems in using the specified systems over prime coating supplied under other sections.

1.03 SUBMITTALS

- A. General: Comply with provisions of the General Requirements of these Specifications.

- B. Manufacturers' data: Within 7 calendar days after award of the Contract, submit:
- (1) Complete materials list of all items proposed to be furnished and installed under this Section.
 - (2) Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
 - (3) For information only, submit two copies of manufacturer's specifications including paint analysis and application instructions for each material. Indicate in the transmittal that a copy of each manufacturer's instructions has been distributed to the applicator.
- C. Upon receipt of review comments, make all revisions and corrections, and resubmit if so required.

1.04 PRODUCT HANDLING

- A. Delivery of materials: Deliver all materials to the job site in original, new and unopened containers bearing the manufacturer's name and label showing the following information:
- (1) Name or title of the material;
 - (2) Fed. Spec. number, if applicable;
 - (3) Manufacturer's stock number;
 - (4) Manufacturer's name;
 - (5) Contents by volume for major constituents;
 - (6) Thinning instructions;
 - (7) Application instructions.
- B. Storage of materials: Provide proper storage to prevent damage to, and deterioration of, paint materials.
- C. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the work and materials of all other trades.
- D. Replacements: In the event of damage; immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.05 JOB CONDITIONS

- A. Surface temperatures: Do not apply solvent-thinned paint when the temperature of surfaces to be painted and the surrounding air temperature are below 45°F., unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect.
- B. Weather conditions: Do not apply paint in snow, rain, fog, or mist, or when the relative humidity exceeds 85% or to damp or wet surfaces; unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect. Applications may be continued during inclement weather within the temperature limits specified by the paint manufacturer during application and drying periods.

1.06 EXTRA STOCK

- A. Amount: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 10% of each color, type, and gloss of paint used on the work.
- B. Packaging: Tightly seal each container and clearly label with the contents and location used.

PART TWO - PRODUCTS

2.01 PAINT MATERIALS

- A. Paint products and materials shall be manufactured by Sherwin Williams, Pittsburgh Paint, MAB, and Porter Paints or equal products of other manufacturers must be approved by the Architect.
- B. General: Provide the best quality grade of the various types of coatings as regularly manufactured by paint materials manufacturers approved by the Architect. Materials not displaying the manufacturer's identification as a standard best-grade product will not be acceptable.
- C. Durability: Provide paints of durable and washable quality. Do not use paint materials which will not withstand normal washing as required to remove pencil marks, ink, ordinary soil, and similar material showing discoloration, loss of gloss, staining, or other damage.
- D. Colors and glosses: The Architect will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained from the materials proposed to be used in the work.
- E. Undercoats and thinners: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer, and use only the

recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

- F. Standards: Provide paint materials which meet or exceed the standards listed for each application in the Painting Schedule in Part Three of this Section.

2.02 APPLICATION EQUIPMENT

- A. General: For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect.
- B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.
- C. Other materials: All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first-quality of their respective kinds, and as selected by the Contractor subject to the approval of the Architect.

PART THREE - EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspection: Prior to installation of the 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. Verify that painting may be completed in strict accordance with the original design and with the manufacturer's recommendations as approved by the Architect.
- B. Discrepancies: Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 MATERIALS PREPARATION

- A. Mix and prepare painting materials in strict accordance with the manufacturer's recommendations as approved by the Owner.
- B. Store materials not in actual use in tightly covered containers.
- C. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.

- D. Stirring: Stir all materials before application to produce a mixture of uniform density, and as required during the application of materials. Do not stir into the material any film which may form on the surface. Remove this film and, if necessary, strain the material before using.

3.03 SURFACE PREPARATION

A. General:

- (1) Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations as approved by the Architect.
- (2) Removal all removable items which are in place and are not scheduled to receive paint finish, or provide surface-applied protection prior to surface preparation and painting operations.
- (3) Following completion of painting in each space or area, reinstall the removed items by using workmen skilled in the necessary trades.
- (4) Clean each surface to be painted prior to applying paint or surface treatment.
- (5) Removal all oil and grease with clean cloths and cleaning solvents of low toxicity and a flash point in excess of 30°C. (100 degrees F.), prior to start of mechanical cleaning.
- (6) Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall into wet, newly painted surfaces.

B. Preparation of wood surfaces:

- (1) Clean all surfaces until they are completely free from dirt, oil, and grease.
- (2) Smooth all finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
- (3) Unless specifically approved by the Owner, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture-meter approved by the Architect.

C. Preparation of metal surfaces:

- (1) Thoroughly clean all surfaces until they are completely free form dirt, oil and grease.

- (2) On galvanized surfaces, use solvent for the initial cleaning and then treat the surface thoroughly with phosphoric acid etch. Removal all etching solution before proceeding.
- (3) Allow to dry thoroughly before application of paint.

D. Preparation of concrete surfaces:

- (1) Remove all curing compounds and efflorescence from concrete and masonry surfaces and roughen as required to provide good adhesion of paints. If washing of the surface of masonry is required, use trisodium phosphate solution followed by clean water rinse. Fill all minor holes and grind off projection to produce a uniform surface.

3.04 PAINT APPLICATION

A. General:

- (1) Slightly vary the color of succeeding coats. Do not apply additional coats until the complete coat has been inspected and approved by the Architect. Only the inspection and approved coats of paint will be considered in determining the number of coats applied.
- (2) Sand and dust between enamel coats to remove all defects visible to the unaided eye from a distance of five feet.

B. Drying:

- (1) Allow sufficient drying time between coats. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.
- (2) Oil-base and oleo-resinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Brush application: Brush out and work all brush coats onto the surface in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

D. Spray application:

- (1) Confine spray application to metal framework and similar surfaces where hand brush work would be inferior.

(2) Wherever spray application is used, apply each coat to provide the equivalent hiding of brush applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

E. Completed work shall match the approved color charts and manufacturer's specifications for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

3.05 PAINTING SCHEDULE

A. General:

(1) Colors shall be standard colors provided by the specified manufacturers and as shown on the Drawings or as directed by the Architect.

(2) Local and National V.O.C. (Volatile Organic Compound) regulations are constantly changing; consult with manufacturer representatives before finalizing the selection.

END OF SECTION

SECTION 22 05 03

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Pipe and pipe fittings for the following systems:
1. Domestic water piping.
 2. Sanitary sewer piping within 5 feet of building.
 3. Storm water piping, within 5 feet of building.
 4. Equipment drains and over flows.
 5. Unions and flanges.
 6. Underground pipe markers.
 7. Bedding and cover materials.
- B. Related Sections:
1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
 2. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
 3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
 4. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product requirements for vibration isolation for placement by this section.
 5. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.
 6. Division 31 - Soils and Aggregate for backfill; Excavation; Trenching; Fill.
 7. Division 33 - Site Water Utility Distribution Piping; Water Service Connections; Sanitary Utility Sewerage Piping; Storm Utility Drainage Piping; Natural-Gas Distribution.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
 2. ASME B16.3 - Malleable Iron Threaded Fittings.
 3. ASME B16.4 - Gray Iron Threaded Fittings.
 4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
 7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
 9. ASME B31.9 - Building Services Piping.
 10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
 11. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 - Standard Specification for Ductile Iron Castings.
7. ASTM B32 - Standard Specification for Solder Metal.
8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B75 - Standard Specification for Seamless Copper Tube.
11. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
12. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
13. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
14. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
15. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
16. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
17. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
18. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
19. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
20. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
21. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
22. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
23. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
24. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
25. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
26. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
27. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
28. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
29. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
30. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

31. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
32. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
33. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
34. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
35. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
36. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
37. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
38. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
39. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
40. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
41. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
42. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
43. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
44. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
45. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
46. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
47. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
8. AWWA C950 - Fiberglass Pressure Pipe.

E. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.
- C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.
- D. Welders' Certificate: Include welders' certification of compliance with ASME Section IX; AWS D1.1.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years' experience or approved by manufacturer.

1.6 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.
- B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. See Division 31 and related Civil Utility plans.

2.2 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing: ASTM B88, Type K or L, annealed.
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
- B. Copper Tubing: ASTM B42, Temper O61 annealed.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.
- C. Copper Tubing: ASTM B42, Temper O61 annealed.
 - 1. Fittings: ASME B16.26 cast bronze.
 - 2. Joints: Flared.
- D. Polyethylene Pipe: ASTM D2239 SDR 19, or ASTM D2447 Schedule 40.
 - 1. Fittings: ASTM D2609, Polyethylene.
 - 2. Joints: Mechanical with stainless steel clamps.
- E. Polyethylene Pipe: AWWA C901; ASTM D3035.
 - 1. Fittings: AWWA C901, molded.

2. Joints: Compression or Butt fusion.

F. Polyethylene Pipe: ASTM D2239 SDR 19, or ASTM D2447 Schedule 40.

1. Fittings: ASTM D2609, Polyethylene.
2. Joints: Mechanical with stainless steel clamps.

2.3 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type K or L, drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder; AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.

B. Copper Tubing: ASTM B88, Type K or L, drawn, rolled grooved ends.

1. Fittings:
2. Design Base: Victaulic
 - a. ASME B16.18 cast copper alloy
 - b. ASME B16.22 wrought copper and bronze
 - c. ASTM B584 bronze sand castings, grooved ends.
3. Joints: Grooved mechanical couplings meeting ASTM F1476.
 - a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
 - b. Gasket: Elastomer composition for operating temperature range from 0 86 degrees F to 180 degrees F.
 - c. Accessories: Stainless steel bolts, nuts, and washers.

C. PEX-a Piping: (Engel-Method Crosslinked Polyethylene) ASTM F876 and F877.

1. Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:
 - a. UNS No. C69300 Lead-free (LF) Brass.
 - b. 20% glass-filled polysulfone as specified in ASTM D 6394.
 - c. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D 6394.
 - d. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D 6394.
 - e. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D 6394.
 - f. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".
2. Pre-Sleeved Piping (1/2 inch (16mm) through 3/4 inch (20mm) nominal pipe size): PEX-a piping, with a high-density polyethylene (HDPE) corrugated sleeve.
3. Pre-Insulated Piping (1/2 inch (16mm) through 2 inch (50mm) nominal pipe size): PEX-a piping, with a closed-cell polyethylene foam insulation
4. Manifolds: Multiple-outlet assembly complying with ASTM F 877 (CAN/CSA B137.5); with ASTM F 1960 outlets.

D. Transition fittings

1. PEX-to-Metal Transition Fittings:
 - a. Manufacturers: Provide fittings from the same manufacturer of the piping.

- b. Threaded Brass to PEX-a Transition: one-piece brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- c. Brass Sweat to PEX-a Transition: one-piece brass fitting with sweat adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- d. PEX-a to Flange Transition: two-piece brass fitting with lead-free ProPEX adapter and steel flange conforming to ASME B 16.5.
- e. PEX-to-Thermoplastic Transition Fittings: CPVC to PEX-a Transition: Thermoplastic fitting with one spigot or socket end and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

E. Valves

- 1. Lead free brass ball valves in compliance with: 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pwG lead free 0.25% Lead max., ASTM F1960, ASTM F 877 with ASTM F1960 compatible connections and shoulder stops to match system.

2.4 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. See Division 31 and related Civil Utility plans.

2.5 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.
 - 1. Fittings: Cast iron, ASTM A74.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
- B. Cast Iron Pipe: CISPI 301, hub-less.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.
- C. Ductile Iron Pipe: AWWA C150 or AWWA C151, bell and spigot ends.
 - 1. Fittings: AWWA C110, ductile gray iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket joint devices.
- D. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.
 - 1. Fittings: PVC, ASTM D2729.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- E. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.
 - 1. Fittings: ASTM D2466, Schedule 40, PVC; ASTM D2467, Schedule 80, PVC; ASTM D2464 PVC, threaded.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.
- F. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
 - 1. Fittings: PVC, ASTM D2665.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.6 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron, ASTM A74.
 - 2. Joints: ASTM C564, rubber gasket joint devices.
- B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. Ductile Iron Pipe: AWWA C151; C104
 - 1. Fittings: AWWA C110, ductile gray iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
- D. Copper Pipe: ASTM B42 Temper O61 annealed; ASTM B302.
 - 1. Fittings: ASME B16.23, cast bronze, or ASME B16.29 wrought copper.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.
- E. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.
 - 1. Fittings: ASTM D2729, PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- F. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
 - 1. Fittings: ASTM D2665, PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- G. PVC Pipe: ASTM D1785 Schedule 40; 80 or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.
 - 1. Fittings: ASTM D2466, Schedule 40, PVC; ASTM D2467, Schedule 80, PVC; ASTM D2464 PVC, threaded.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.7 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. See Division 31 and related Civil Utility plans.

2.8 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74, service weight, bell and spigot ends.
 - 1. Fittings: Cast iron, ASTM A74.
 - 2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. Ductile Iron Pipe: ASTM A746, AWWA C153 thickness
 - 1. Fittings: ASTM F1336 bell & Spigot, ductile gray iron, standard thickness.
 - 2. Joints: ASTM D3212, ASTM F477, ASTM D3139 rubber gasket.

3. Jackets: AWWA C105 polyethylene jacket Double layer, half lapped, 10 mil polyethylene tape.
 4. Coatings: AWWA C153, AWWA C153, AWWA C210, AWWA C116.
- D. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.
1. Fittings: PVC, ASTM D2729.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- E. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679, polyvinyl chloride (PVC) material.
1. Fittings: PVC, ASTM D2665, ASTM D3034, or ASTM F679.
 2. Joints: ASTM F477, elastomeric gaskets.

2.9 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74 service weight, bell and spigot ends.
1. Fittings: Cast iron, ASTM A74.
 2. Joints: ASTM C564, neoprene gasket system or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron, CISPI 301.
 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. Ductile Iron Pipe: ASTM A746, AWWA C153 thickness
1. Fittings: Bell & Spigot; ASTM F1336, ductile gray iron, standard thickness.
 2. Joints: ASTM D3212, ASTM F477, ASTM D3139 rubber gasket.
- D. Ductile Iron Pipe: ASTM A746 – Cut or Roll Grooved, AWWA C153 thickness
1. Fittings: Design Base; Victaulic; shall be ASTM A-536.
 - a. Mechanical; ASTM F-1476, A-234, AWWA C-606.
 - b. Gaskets; ASTM D-2000, Bolts zinc plated; ASTM B-633.
- E. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
1. Fittings: PVC, ASTM D2665 or ASTM D3034.
 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.10 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tubing: ASTM B88, Type L, drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder; AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.
- B. CPVC Pipe: ASTM F441/F441M, Schedule 40 or Schedule 80, chlorinated polyvinyl chloride (CPVC) material listed for the application.
1. Design Base; Spears.
 2. Fittings:
 - a. ASTM F438, CPVC, Schedule 40, socket type.
 - b. ASTM F439, CPVC, Schedule 80, socket type.
 - c. ASTM F437, CPVC, Schedule 80, threaded.
 3. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.11 UNIONS AND FLANGES

- A. Mechanical Grooved connections:
 - 1. Ferrous Piping: Design Base; Victaulic. Class 150, cast iron, grooved.
- B. Unions for Pipe 2 inches and Smaller:
 - 1. Ferrous Piping: Class 150, malleable iron, threaded.
 - 2. Copper Piping: Class 150, bronze unions with soldered brazed joints.
 - 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
 - 4. PVC Piping: PVC.
 - 5. CPVC Piping: CPVC.
- C. Flanges for Pipe 2-1/2 inches and Larger:
 - 1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 - 2. Copper Piping: Class 150, slip-on bronze flanges.
 - 3. PVC Piping: PVC flanges.
 - 4. CPVC Piping: CPVC flanges.
 - 5. Gaskets: 1/16 inch thick preformed neoprene gaskets.
- D. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.12 PIPE MARKERS

- A. Per Section 220553.
- B. Metallic pipe marking: Plastic Ribbon Tape; Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- C. Non-metallic pipe marking: Plastic Ribbon Tape with Trace Wire: Magnetic detectable conductor, brightly colored plastic tape covering.
- D. Tape shall be imprinted with type of service in large letters of contrasting color.

2.13 BEDDING AND COVER MATERIALS

- A. Per Division 31-33.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify excavations are to required grade, dry, and not over-excavated.
- C. Verify trenches are ready to receive piping.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert is as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 3 ft of cover.
- C. Establish minimum separation from other services in accordance with local utility requirements.
- D. Excavate pipe trench
- E. Install pipe to elevation required.
- F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- G. Install pipe on prepared bedding.
- H. Route pipe in straight line.
- I. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- J. Install shutoff and drain valves at locations indicated on Drawings in accordance with code and Brand requirements.
- K. Install plastic ribbon tape continuous buried 6 inches below finish grade, above pipe line. Use tape with trace wire above pipe line of non-metallic piping.
- L. Pipe Cover and Backfilling:
 - 1. Backfill trench.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After hydrostatic test, evenly backfill entire trench width in 6 inches compacted cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors
- H. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- I. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- J. Slope piping and arrange systems to drain at low points.
- K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Insulate piping.
- N. Install pipe identification.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

- A. Install domestic water piping system in accordance with ASME B31.9 and local utility requirements.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

- A. Install sanitary waste and vent piping systems in accordance with ASME B31.9 and in accordance with local plumbing code.
- B. Install bell and spigot pipe with bell end upstream.
- C. Support cast iron drainage piping at every joint.

3.7 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

- A. Install storm drainage piping systems piping in accordance with ASME B31.9 and in accordance with local plumbing code.
- B. Install bell and spigot pipe with bell end upstream.
- C. Support cast iron drainage piping at every joint.

3.8 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with applicable code and local authority having jurisdiction
- C. Test sanitary waste and vent piping system in accordance with applicable code and local authority having jurisdiction.
- D. Test storm drainage piping system in accordance with applicable code and local authority having jurisdiction
- E. Test for Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.9.

3.9 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean and disinfect domestic water distribution system.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.
2. Expansion joints.
3. Expansion compensators.
4. Pipe alignment guides.
5. Swivel joints.
6. Pipe anchors.

B. Related Sections:

1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for piping hangers and supports.
2. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product and installation requirements for vibration isolators used in piping systems.
3. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping used in domestic water systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.
2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.3 DESIGN REQUIREMENTS

- ###### A.
- Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

1.4 SUBMITTALS

- ###### A.
- Division 01 - Submittal Procedures: Requirements for submittals.

- ###### B.
- Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.

- ###### C.
- Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Manufacturer's Installation Instructions: Submit special procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Welders' Certificate: Include welders' certification of compliance with ASME Section IX. AWS D1.1.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. FernCo
 - 2. MetraFlex
 - 3. Victaulic
 - 4. Substitutions: Division 01 - Product Requirements.

2.2 FLEXIBLE PIPE CONNECTORS

- A. Steel Piping:
 - 1. Inner Hose: Stainless Steel Bronze.
 - 2. Exterior Sleeve: Single braided stainless steel bronze.
 - 3. Pressure Rating: 200 psig WOG and 250 degrees F.
 - 4. Joint: Press-Fit; Grooved; Flanged; Threaded; Threaded with Union.
 - 5. Size: Use pipe-sized units.
 - 6. Maximum offset: 1 inch on each side of installed center line.
- B. Copper Piping:
 - 1. Inner Hose: Bronze.
 - 2. Exterior Sleeve: Braided bronze.
 - 3. Pressure Rating: 200 psig WOG and 250 degrees F.
 - 4. Joint: Press-Fit; Grooved; Flanged; Threaded; Threaded with Union.
 - 5. Size: Use pipe sized units.
 - 6. Maximum offset: 1 inch on each side of installed center line.

2.3 EXPANSION JOINTS

- A. Flexible Loop Type with Stainless Steel braided overlay section:
 - 1. Pressure Rating: 200 psig WOG and 250 degrees F.
 - 2. Maximum Compression: 1 inch.
 - 3. Maximum Extension: 1 inch.
 - 4. Joint: Press-Fit; Grooved; Flanged; Threaded; Threaded with Union.
 - 5. Size: Use pipe sized units.
 - 6. Application: Steel or copper piping.
- B. Grooved Coupling with Rubber Bellows Type:
 - 1. Design Base: Victaulic.
 - 2. Pressure Rating: 200 psig WOG and 250 degrees F.
 - 3. Maximum Compression: Modular - As listed per module.
 - 4. Maximum Extension: Modular - As listed per module.
 - 5. Joint: Press-Fit; Grooved.

6. Size: Use pipe sized units.
 7. Application: Steel or copper piping.
- C. Stainless Steel Bellows Type:
1. Pressure Rating: 200 psig WOG and 250 degrees F.
 2. Maximum Compression: 3 inch.
 3. Maximum Extension: 1/4 inch.
 4. Joint: Press-Fit; Grooved; Flanged; Threaded; Threaded with Union.
 5. Size: Use pipe sized units.
 6. Application: Steel piping 3 inch and smaller.
- D. External Ring Controlled Stainless Steel Bellows Type:
1. Pressure Rating: 200 psig WOG and 250 degrees F.
 2. Maximum Compression: 1-1/4 inch.
 3. Maximum Extension: 3/8 inch.
 4. Maximum Offset: 5/16 inch.
 5. Joint: Flanged.
 6. Size: Use pipe sized units.
 7. Accessories: Internal flow liner.
 8. Application: Steel piping 3 inch and larger.
- E. Two-ply Bellows Type:
1. Construction: Bronze with anti-torque device, limit stops, internal guides.
 2. Pressure Rating: 200 psi WOG and 250 degrees F.
 3. Maximum Compression: 3 inch.
 4. Maximum Extension: 1/4 inch.
 5. Joint: Press-Fit; Grooved; Flanged; Threaded; Threaded with Union.
 6. Size: Use pipe sized units.
 7. Application: Copper piping.
- F. Low Pressure Compensators with two-ply Bronze Bellows:
1. Working Pressure: 75 psig.
 2. Maximum Temperatures: 250 degrees F.
 3. Maximum Compression: 1/2 inch.
 4. Maximum Extension: 5/32 inch.
 5. Joint: Welded or Brazed.
 6. Size: Use pipe sized units.
 7. Application: Copper or steel piping 2 inch and smaller.
- G. Copper with Packed Sliding Sleeve:
1. Maximum Temperature: 250 degrees F.
 2. Joint: Press-Fit; Grooved; Flanged; Threaded; Threaded with Union.
 3. Size: Use pipe sized units.
 4. Copper or steel piping 2 inches and larger.
 5. Application: Copper or steel piping 2 inch and larger.

2.4 ACCESSORIES

- A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.
- B. Swivel Joints: Fabricated steel Bronze Cast steel body, double ball bearing race, field lubricated, with O-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install Work in accordance with ASME B31.9.
- B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 22 05 48. Provide line size flexible connectors.
- C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.
- E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 22 05 29 for pipe hanger installation requirements.
- F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Division 01 - Quality Requirements: Manufacturers' field services.
- B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 22 05 23

VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate valves.
2. Ball valves.
3. Plug valves.
4. Butterfly valves.
5. Check valves.
6. Valve stops.

B. Related Sections:

1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
3. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.
4. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping, piping specialties, and equipment used in domestic water systems.
5. Section 22 13 00 - Facility Sanitary Sewerage: Product and installation requirements for piping, piping specialties, and equipment used in sanitary waste and vent systems.

1.2 REFERENCES

A. ASTM International:

1. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
- C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install valves underground when bedding is wet or frozen.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish manufacturer warranty for valves excluding packing.

1.11 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish two packing kits for each size and type of valve.

PART 2 PRODUCTS

2.1 GATE VALVES

- A. Manufacturers:
 - 1. Crane Valve, North America.
 - 2. Hammond Valve.
 - 3. Milwaukee Valve Company.
 - 4. NIBCO, Inc.
 - 5. Stockham Valves & Fittings.
 - 6. Substitutions: Division 01 - Product Requirements
- B. GA-1; 2 inches and Smaller: MSS SP 80, Class 125 bronze body, bronze trim, threaded; union bonnet, stem, wedge disc, alloy seat rings, solder or threaded ends.
- C. GA-2; 2-1/2 inches and Larger: MSS SP 70, Class 125 cast iron body, bronze trim, bolted bonnet, stem, hand-wheel or outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 BALL VALVES

- A. Manufacturers:
 - 1. Crane Valve, North America.
 - 2. Hammond Valve.
 - 3. Milwaukee Valve Company.
 - 4. NIBCO, Inc.
 - 5. Stockham Valves & Fittings.
 - 6. Substitutions: Division 01 - Product Requirements
- B. BA-1; 2 inches and Smaller: MSS SP 110, 400 psi WOG piece bronze body, chrome plated brass or stainless ball, full port, Teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.

- C. BA-2; 2 inches and Smaller: MSS SP 110, Class 150 bronze, two piece body, chrome plated bronze or type 316 stainless steel ball, full port, Teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.
- D. BA-3; 2 inches and Smaller: MSS SP 110, Class 150 bronze, three piece body, chrome plated bronze or type 316 stainless steel ball, full port, Teflon seats, blow-out proof stem, solder or threaded ends, lever handle.
- E. BA-5; 2 inches and Smaller: MSS SP 110, Class 150 Stainless steel body, stainless steel ball, Teflon or reinforced Teflon seats and stuffing box ring, threaded ends, lever handle.
- F. BA-6; 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F, ASTM D1785 PVC body and ball, double lever handle, EPDM or fluorocarbon seals, Teflon seats, full port, union type with threaded ends.
- G. BA-7; 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 210 degrees F, ASTM D1785 CPVC body and ball, double lever handle, EPDM or fluorocarbon seals, Teflon seats, full port, union type with threaded ends.
- H. BA-8; 2 inches and Smaller: 150 psi at 100 degrees F water temperature, maximum service temperature 180 degrees F, ASTM D4101 natural polypropylene body and ball, double lever handle, EPDM fluorocarbon seals, Teflon seats, regular full port, single double union type with socket threaded ends.
- I. BA-9; 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 180 degrees F, ASTM D4101 black polypropylene body and ball, double lever handle, EPDM fluorocarbon seals, Teflon seats, regular full port, single double union type with socket threaded ends.

2.3 BUTTERFLY VALVES

A. Manufacturers:

1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Substitutions: Division 01 - Product Requirements

A. BF-1; 2-1/2 inches and Larger: MSS SP 67, Class 150

1. Body: Cast or ductile iron, wafer, lug or grooved ends, stainless steel stem, extended neck.
2. Disc: Nickel-plated ductile iron, Aluminum bronze, Elastomer coated ductile iron, Chrome plated ductile iron, or stainless steel.
3. Seat: Resilient replaceable EPDM, Buna N, neoprene Viton.
4. Handle and Operator: lever handle with memory stop, or Hand-wheel and gear drive.
Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.4 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers:
 - a. Crane Valve, North America.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO, Inc.
 - e. Stockham Valves & Fittings.
 - f. Substitutions: Division 01 - Product Requirements
2. CK-1; 2 inches and Smaller: MSS SP 80, Class 150 bronze body and cap, bronze seat, Buna-N or Teflon disc selected for application, solder or threaded ends.
3. CK-2; 2-1/2 inches and Larger: MSS SP 71, Class 125 cast iron body, bolted cap, bronze or cast iron disc selected for application, renewable disc seal and seat, flanged ends.
4. CK-3; 2-1/2 inches and Larger: MSS SP 71, Class 125 cast iron body, bronze swing disc, renewable disc seal and seat, flanged ends, outside lever and weight or outside lever and spring.

B. Spring Loaded Check Valves:

1. Manufacturers:
 - a. Crane Valve, North America.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO, Inc.
 - e. Stockham Valves & Fittings.
 - f. Substitutions: Division 01 - Product Requirements.
2. CK-6; 2 inches and Smaller: MSS SP 80, Class 250 bronze body, in-line spring lift check, silent closing, Buna-N or Teflon disc selected for application, integral seat, solder or threaded ends.
3. CK-7; 2-1/2 inches and Larger: MSS SP 71, Class 125 wafer or globe style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

2.5 VALVE STOPS

A. Manufacturers:

1. Design Base: Brass Craft; KT3301 series with C36000 series valve body.
2. LASCO
3. Oatey
4. Substitutions: Division 01 - Product Requirements.

B. Construction:

1. IAPMO listed to ASME A112.18.1-05.
2. Brass ball valve with Teflon seat, ¼-turn operation.
3. Viton or Nitrile O-Rings, one-piece brass body (machined), blow-out proof plated brass stem, chrome plated metal handle, factory leak tested, zinc-plated steel hardware.
4. Where slip-joint connection is used; NBR rubber washer, brass friction rings.
5. Straight or Angled-body based on installation location and preferred routing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install 3/4 inch gate or ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install valves with clearance for installation of insulation and allowing access.
- E. Provide access where valves and fittings are not accessible.
- F. Refer to Section 22 05 29 for pipe hangers.
- G. Refer to Section 22 07 00 for insulation requirements for valves.
- H. Refer to Section 22 05 03 for piping materials applying to various system types.
- I. For installation of valves in domestic water systems refer to Section 22 11 00.
- J. For installation of valves in sanitary systems refer to Section 22 13 00.

3.3 VALVE APPLICATIONS

- A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- B. Install ball, butterfly, or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball, butterfly, or globe valves for throttling, bypass, or manual flow control services.
- D. Install spring loaded check valves on discharge of water pumps.
- E. Install ball or butterfly valves adjacent to equipment when functioning to isolate equipment.
- F. Install ball, butterfly, or gate valves in domestic water systems for shut-off service.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Equipment bases and supports.

B. Related Sections:

1. Division 03 - Execution requirements for placement of inserts or sleeves in concrete forms or housekeeping pads specified by this section.
2. Division 07 - Product requirements for firestopping and joint sealant materials for placement by this section.
3. Division 09 - Painting and Coating; Product and execution requirements for painting specified by this section.
4. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
5. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product and execution requirements for vibration isolators.
6. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
7. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
8. Section 22 14 00 - Facility Storm Drainage: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.

4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: Comply with requirements of Division 07.
- B. Firestop all interruptions to fire rated assemblies, materials, and components.

1.5 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Where fabrication required, indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

- E. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain minimum temperature before, during, and for minimum 3 days after installation of materials.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
1. Carpenter & Paterson Inc.
 2. Cooper/B-Line
 3. Creative Systems Inc.
 4. Flex-Weld, Inc.
 5. Globe Pipe Hanger Products Inc.
 6. Hilti Corp.
 7. ITW Buildex and Illinois Tool Works, Inc.
 8. Michigan Hanger Co.
 9. National Pipe Hanger Corporation.
 10. Unistrut, Tyco International, Ltd.
 11. US Strut, Unitron Products, Inc.
 12. Substitutions: Division 01 - Product Requirements.

2.2 PIPE HANGERS AND SUPPORTS

- A. Plumbing Piping - DWV:
1. Conform to ASME B31.9; ASTM F708; MSS SP58; MSS SP69; MSS SP89.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron; or Carbon steel, adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
- B. Plumbing Piping - Water:
1. Conform to ASME B31.9; ASTM F708; MSS SP58; MSS SP69; MSS SP89.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron; or Carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
 8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 11. Vertical Support: Steel riser clamp.

12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.3 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 INSERTS

- A. Inserts: Malleable iron case; steel shell and expander plug, for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 FLASHING

- A. Metal Flashing: Min 26 gage thick galvanized steel or aluminum.
- B. Metal Counterflashing: Min 22 gage thick galvanized steel or aluminum.
- C. Flashing: flexible sheet listed for application.
- D. Flexible Flashing: Min 40 mil thick sheet of butyl, PIB, or similar material compatible with roofing, sealed to substrate with compatible adhesive to maintain roof warranty.
- E. Caps: Steel or Aluminum, 22 gage minimum; 16 gage at fire resistant elements.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic where not otherwise indicated in Division 07.

2.7 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FORMED STEEL CHANNEL

- A. Product Description: Galvanized min. 12-gage thick steel. Holes typically 1-1/2 inches on center.

2.9 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 07.

2.10 HORIZONTAL PIPING SUPPORT PIER

A. Manufacturers:

1. A Better Idea Inc.; E-Z Sleeper series.
2. Arlington Industries, Inc.; Roof-Topper series.
3. Cooper B-Line; Dura-Blok series.
4. ERICO; Pipe Caddy series.
5. Gastite; Pipe Support RB series.
6. MIFAB; C-Port series.
7. Roof Top Accessories; Keycurb series.
8. Substitutions: Division 01 - Product Requirements.

B. General:

1. Use fabricated supports for consistent method of running all piping and supporting any items across horizontal surfaces or roofs.
2. Material shall be non-corrosive and non-wood; fabricated of rubber, plastic, polymer, or composite.
3. Shall be designed with corrosion resistant factory provision for supports and securing equipment to each pier.

C. Accessories

1. Each support shall rest on separate housekeeping pad, sized larger than the pier base, compatible with the surface where mounted. Where installed on a roof surface, this shall consist of a membrane or other pad of equivalent or compatible material. Where installed on grade, this shall consist of a concrete pad equal to similar walkway or stoop details.
2. Where multiple pipes are routed together in parallel, coordinate for mid-span piers to include roller-type piping support of width and support-base of width necessary to group piping while providing resilient positioning capable of allowing for expansion of each pipe independent of others.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves, system, sealant, and firestopping as applicable.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.

- C. Obtain permission from Architect before using powder-actuated anchors.
- D. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1; ASME B31.5; ASME 31.9; ASTM F708; MSS SP 58; MSS SP 69; MSS SP 89 as applicable.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports or inert protective inserts for copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat all ferrous (steel) hangers and supports exposed to occupied spaces, ready for finish painting.
 - 1. Hangers and supports concealed in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

- M. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members, formed steel channel, or steel pipe and fittings Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.6 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counter-flashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal drains watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel or stainless steel escutcheons at finished surfaces or in occupied spaces. Install galvanized steel or aluminum escutcheons at all exposed penetrations in

mechanical spaces. Caulk to seal all penetrations, use firestopping caulk where penetration is of a rated partition, floor, or roof.

3.8 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 07.

3.9 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements: Requirements for inspecting, testing.
- B. Division 01 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

3.10 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of materials.

3.11 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.12 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAX HANGER SPACING (Feet)	HANGER ROD DIAM. (Inches)
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Polypropylene	4	3/8
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Inertia bases.
 - 2. Vibration isolators.

- B. Related Sections:
 - 1. Division 07 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
 - 2. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping: Product requirements for anchors and piping expansion compensation.
 - 3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI S1.4 - Sound Level Meters.
 - 2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
 - 3. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

- B. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

- C. American Society of Heating, Refrigerating and:
 - 1. ASHRAE Handbook - HVAC Applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials and dimensional data.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ARI 575; ANSI S12.36.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience or approved by manufacturer.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 BASES

- A. Structural Bases:
 - 1. Design: Sufficiently rigid to prevent misalignment or undue stress on equipment, and to transmit design loads to isolators and snubbers.
 - 2. Construction: Cast-in-place high strength reinforced concrete or welded structural steel with gusset brackets, supporting equipment.
 - 3. Support system for plumbing equipment shall be sized and selected to meet requirements of the seismic zone at the project location.

2.2 VIBRATION ISOLATORS

- A. Open Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- B. Restrained Spring Isolators:
 - 1. Spring Isolators:

- a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 5. Restraint: Furnish mounting frame and limit stops.
- C. Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
- D. Restrained Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
- E. Spring Hanger:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators rubber hanger with threaded insert.
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- F. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
 - a. 30 durometer.

- b. Minimum 1/2 inch thick.
 - c. Maximum loading 40 psi.
 - d. Height of ribs: not to exceed 0.7 times width.
 2. Configuration: Single layer. 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.
- G. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.
- H. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- I. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify equipment and piping is installed before work in this section is started.
- C. Verify seismic support hardware for each equipment and piping system meets seismic zone criteria for location of project.

3.2 INSTALLATION

- A. Install isolation for motor driven equipment.
 1. Bases: Set spring-isolated bases for 1 inch clearance between housekeeping pad and base.
- B. Adjust equipment level.
- C. Install spring hangers without binding.
- D. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- F. Provide resiliently mounted equipment and piping with seismic snubbers rated for seismic zone of project. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

G. Support piping connections to isolated equipment resiliently to nearest flexible pipe connector.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements; Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

3.4 SCHEDULES

A. Pipe Isolation Schedule:

Pipe Size Inch	Isolated Distance from Equipment
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Pipe markers.
 - 4. Ceiling tacks.
 - 5. Labels.
 - 6. Lockout devices.

- B. Related Sections:
 - 1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

- B. National Fire Protection Association:
 - 1. NFPA 99 - Standard for Health Care Facilities.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit manufacturers catalog literature for each product required.

- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Brady Worldwide, Inc.
 - 2. Brimar Industries, Inc.
 - 3. Craftmark Identification Systems.
 - 4. Safety Sign Co.
 - 5. Seton Identification Products.
 - 6. Substitutions: Division 1 - Product Requirements.

2.2 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color, or white letters on dark contrasting background color.

2.3 TAGS

- 1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum ½ inch height, 1-1/2 inches diameter or length.
- B. Metal Tags:
 - 1. Brass; Aluminum; Stainless Steel with stamped letters; tag size minimum 1-1/2 inches with finished edges.
- C. Information Tags:
 - 1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.
- D. Tag Chart: Typewritten letter size list of applied tags and location, plastic laminated.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
2. Where marking route of non-metallic piping, use plastic tape/ribbon type with magnetic/detectable trace wire laminated inside.

2.5 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

B. Color code as follows:

1. Plumbing valves: Green.

2.6 LABELS

A. Description: Aluminum; Polyester; Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum or Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Nylon; Steel; or Plastic device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion. For unfinished covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

- F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers.
 - 1. Use tags on piping 3/4 inch diameter and smaller.
 - 2. Identify service, flow direction, and pressure.
 - 3. Install in clear view and align with axis of piping.
 - 4. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
19. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
20. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation in accordance with ASTM E84 for maximum:
 1. All; flame spread index of 25.
 2. Typical; smoke developed index of not exceeding 450.
 3. Plenum; smoke developed index of not exceeding 50
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience or approved by manufacturer.

1.6 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.
 - 3. Johns Manville.
 - 4. Owens-Corning.
 - 5. Substitutions: Division 01 - Product Requirements.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Armacell, LLC. Armaflex.
 - 3. Nomaco. K-flex.
 - 4. Substitutions: Division 01 - Product Requirements.
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
 - 1. Dow Chemical Company.
 - 2. Substitutions: Division 01 - Product Requirements.
- D. Manufacturers for Extruded Polystyrene Insulation Products:
 - 1. Dow Chemical Company.
 - 2. Substitutions: Division 01 - Product Requirements.

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 850 degrees F.
 - 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.

- B. TYPE P-2: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 850 degrees F.

- C. TYPE P-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket. Conform to ASTM C795 for application on Austenitic stainless steel.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 650 degrees F.
 - 3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.

- D. TYPE P-4: ASTM C612; semi-rigid, fibrous glass board noncombustible. Conform to ASTM C795 for application on Austenitic stainless steel.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 650 degrees F.

- E. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

- F. TYPE P-6: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.30 at 75 degrees F.
 - 2. Maximum Service Temperature: 300 degrees F.
 - 3. Operating Temperature Range: Range: Minus 58 to 300 degrees F.

- G. TYPE P-7: ASTM C534, Type I, flexible, non-halogen, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Maximum Service Temperature: 250 degrees F.
 - 3. Operating Temperature Range: Range: Minus 58 to 250 degrees F.

- H. TYPE P-9: ASTM C591, Type IV, Polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.
 - 1. Density: 4.0 pounds per cubic foot.
 - 2. Thermal Conductivity: 180 day aged value of 0.19 at 75 degrees F.
 - 3. Operating Temperature Range: Range: Minus 297 to 300 degrees F.
 - 4. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 4 mils thickness and water vapor permeance of 0.02 perms.

- I. TYPE P-10: ASTM C578, Type XIII, extruded polystyrene insulation, formed into shapes for use as pipe insulation.
 1. Thermal Conductivity: 180 day aged value of 0.259 at 75 degrees F.
 2. Operating Temperature Range: Range: Minus 297 to 165 degrees F.
 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 4 mils thickness and water vapor permeance of 0.02 perms.

2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
 1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
 2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
- B. PVC Plastic Pipe Jacket:
 1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
 2. Thickness: 10 15 30 mil.
 3. Connections: Brush on welding adhesive Tacks Pressure sensitive color matching vinyl tape.
- C. Exterior Pipe Jacket:
 1. Aluminum; ASTM B209.
 - a. Thickness: 0.025 0.032 0.040 inch thick sheet.
 - b. Joining: Longitudinal slip joints and 2 inch laps.
 - c. Fittings: die shaped fitting covers with factory attached protective liner.
 - d. Metal Jacket Bands: 3/8 inch wide; aluminum or stainless steel.
 2. Stainless Steel; ASTM A240/A240M OR ASTM 666 stainless steel.
 - a. Thickness: 0.016 inch thick.
 - b. Metal Jacket Bands: 3/8 inch wide; stainless steel.
- D. Field Applied Glass Fiber Fabric Jacket System:
 1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
 2. Glass Fiber Fabric:
 - a. Cloth: Untreated; 9 oz/sq yd weight.
 - b. Blanket: 1.0 lb/cu ft density.
 3. Indoor Vapor Retarder Finish:
 - a. Cloth: Untreated; 9 oz/sq yd weight.
 - b. Vinyl emulsion type acrylic, compatible with insulation.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum or stainless steel jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- F. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- G. Adhesives: Compatible with insulation.

2.5 EQUIPMENT INSULATION

- A. Factory installed.
 - 1. Protect insulated equipment and repair any damage to equipment insulation and/or jacket protection prior to substantial completion.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping and equipment has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Glass Fiber Board Insulation:
 - 1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Polyisocyanurate Foam Insulation; Extruded Polystyrene Insulation:
1. Wrap elbows and fitting with vapor retarder tape.
 2. Seal butt joints with vapor retarder tape.
- F. Hot Piping Systems less than 140 degrees F:
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- G. Inserts and Shields:
1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized or stainless steel shield between pipe hanger and insulation.
 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- H. Insulation Terminating Points:
1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
 3. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- I. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor):
1. Finish with PVC, ABS, Aluminum, or stainless steel jacket.
- K. Piping Exterior to Building:
1. Provide vapor retarder jacket.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
3. Finish with glass mesh reinforced vapor retarder cement or method recommended by insulation manufacturer for exterior application.
4. Cover with aluminum or stainless steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

L. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Hot Water Supply	P-1; P-2; P-3; P-4; P-5; P-6; P-7	1 inch and smaller	1.0
		1-1/4 inches to 2 inches	1.5
		2-1/2 inches and larger	2.0
Domestic Cold Water	P-1; P-3; P-5; P-6; P-7; P-10	1-1/4 inches and smaller	0.5
		1-1/2 inches and larger	1.0

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Sanitary Sewer Piping (horizontal and vertical above ground within building)	P-1; P-3; P-5; P-6; P-7	All sizes	0.5

END OF SECTION

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressure gage.
2. Pressure gage tap.
3. Water pressure reducing valve.
4. Relief valve.
5. Strainer.
6. Hose bib.
7. Hydrant.
8. Recessed valve box.
9. Backflow preventer.
10. Water hammer arrestor.
11. Thermostatic mixing valve.
12. Compression/Expansion tank.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
4. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
5. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
6. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product requirements for vibration isolators for placement by this section.
7. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
8. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
9. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
6. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
7. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
7. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
8. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
9. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
11. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
12. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

13. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
14. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
15. ASTM D 3311 - Standard Specification for Drain, Waste, and Vent (Dwv) Plastic Fittings Patterns.
16. ASTM E1 - Standard Specification for ASTM Thermometers.
17. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
18. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
19. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
20. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
22. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
23. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
4. AWWA C651 - Disinfecting Water Mains.

G. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

- B. Project Record Documents: Record actual locations of valves and equipment.
- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience or approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING

A. See Section 220503

2.2 VALVES

A. See Section 220523

2.3 PIPE HANGERS AND SUPPORTS

A. See Section 220529

2.4 RELIEF VALVES

A. Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

***** OR *****

2. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi, UL listed for fuel oil, capacities ASME certified and labeled.

B. Temperature and Pressure Relief:

1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.5 HOSE BIBS

A. As Scheduled on Drawings.

2.6 HYDRANTS

A. Design Base: J.R.Smith; 5609QT series.

B. As Scheduled on Drawings.

1. Non-freeze, 1/4-turn, w/vacuum breaker, 3/4" threaded hose connection.
2. Stem-lock type, provide keys to owner.

2.7 RECESSED VALVE BOX

A. Washers, Icemakers: As Scheduled on Drawings.

2.8 BACKFLOW PREVENTERS

- A. Coordinate with local Domestic Water utility and AHJ for specific requirements to provide appropriate backflow prevention for this project site.
- B. Type: As Scheduled on Drawings, generally Reduced Pressure Back Flow Preventer unless otherwise noted.

2.9 WATER HAMMER ARRESTORS

- A. ASSE 1010; stainless steel or copper construction, piston type sized in accordance with PDI WH-201.
- B. Pre-charged suitable for operation in temperature range 34 to 212 degrees F and maximum 150 psi working pressure.

2.10 THERMOSTATIC MIXING VALVES

- A. As Scheduled on Drawings for lavs and sinks.
- B. Flowrate selected

2.11 PRESSURE BALANCED MIXING VALVES

- A. As Scheduled on Drawings for showers.

2.12 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig psig.
- C. Size: inches diameter, inches overall length, gal capacity.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - METERS

- A. Install positive meters as coordinated with Utility, in accordance with AWWA M6, with isolating valves on inlet and outlet.

3.4 INSTALLATION - THERMOMETERS AND GAGES

- A. Install pressure gage for service.
- B. Install gage taps in piping.
- C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.5 INSTALLATION - HANGERS AND SUPPORTS

- A. Pipe Inserts, Hangers and Supports:
 - 1. Install in accordance with Section 22 05 29.

3.6 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 4 ft of cover.
- C. Establish minimum separation of from other services and sanitary sewer piping piping in accordance with code and local Utility requirements.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Excavate pipe trench
- F. Install pipe to elevation required.
- G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted loose depth; compact to 95 percent maximum density.
- H. Install pipe on prepared bedding.

- I. Route pipe in straight line.
- J. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- K. Install shutoff and drain valves at locations indicated on Drawings and in accordance with this Section.
 - 1. Provide ¼-turn valve stops for each fixture.
- L. Install plastic ribbon tape continuous over top of pipe; Refer to Section 22 05 53

3.7 INSTALLATION - ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not accessible.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- L. Install domestic water piping in accordance with ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors.
- N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
- O. Install unions downstream of valves and at equipment or apparatus connections.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

- R. Install gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- S. Install globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- T. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- U. Provide flow controls in water circulating systems as indicated on Drawings
- V. Install potable water protection devices on plumbing lines where contamination of domestic water may occur.
- W. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- X. Test backflow preventers in accordance with ASSE 5013 or 5015 as applicable.
- Y. Install water hammer arrestors complete with accessible isolation valve or air chambers, on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

3.8 INSTALLATION - SERVICE CONNECTIONS

- A. Provide new water service complete with approved reduced pressure and/or double check back-flow preventer and water meter with by-pass valves pressure reducing valve, and strainer.
- B. Provide sleeve for service main entry and support with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
- C. Install all accessories required for pressure regulation and monitoring, expansion, and isolation of DCW service entry.
- D. Coordinate with civil-site work, utility, and sprinkler trade for any associated work required between Domestic Water service and fire suppression service.

3.9 FIELD QUALITY CONTROL

- A. Install Work in accordance with local utility standards and Codes currently adopted by the State.
- B. Division 01 - Quality Requirements; Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- C. Test domestic water piping system in accordance with applicable code and local authority having jurisdiction.

3.10 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Disinfect water distribution system in accordance with appropriate Code requirements.
 - 1. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
 - 2. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
 - 3. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
 - 4. Maintain disinfectant in system for 24 hours.
 - 5. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
 - 6. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
 - 7. Take samples no sooner than 24 hours after flushing, from multiple outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 13 00

FACILITY SANITARY SEWERAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewer piping buried within 5 feet of building.
2. Sanitary sewer piping above grade.
3. Unions and flanges.
4. Valves.
5. Floor drains.
6. Floor sinks.
7. Cleanouts.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
4. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
5. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.
6. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
7. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product requirements for vibration isolators for placement by this section.
8. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
9. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
10. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.14.1 - Backwater Valves.
2. ASME A112.14.3 - Grease Interceptors.
3. ASME A112.14.4 - Grease Removal Devices.
4. ASME A112.21.1 - Floor Drains.
5. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
6. ASME B16.3 - Malleable Iron Threaded Fittings.

7. ASME B16.4 - Gray Iron Threaded Fittings.
8. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
9. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
10. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 - Standard Specification for Ductile Iron Castings.
7. ASTM B32 - Standard Specification for Solder Metal.
8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B75 - Standard Specification for Seamless Copper Tube.
11. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
12. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
13. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
14. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
15. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
16. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
17. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe.
18. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
19. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
20. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
22. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
23. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
24. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
25. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
26. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
27. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

28. ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
29. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
30. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
31. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
32. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
33. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

E. Plumbing and Drainage Institute:

1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

C. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

- D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of equipment and clean-outs.
- C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Municipal Utility standards.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish manufacturer warranty for sewage ejectors and sanitary equipment.

1.12 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 GENERAL

- 1. Manufacturers:
 - a. Carpenter & Paterson Inc.
 - b. Creative Systems Inc.
 - c. Flex-Weld, Inc.
 - d. Globe Pipe Products Inc.
 - e. Superior Valve Co.
 - f. Crane Valve, North America.
 - g. J.R. Smith
 - h. Hammond Valve.
 - i. Milwaukee Valve Company.
 - j. NIBCO, Inc.
 - k. Sioux Chief.
 - l. Stockham Valves & Fittings.
 - m. Zoeller.
 - n. Zurn.
 - o. Substitutions: Division 01 - Product Requirements.

2.2 SANITARY SEWER PIPING - See Section 220503.

2.3 VALVES - See Section 220523.

2.4 PIPE HANGERS AND SUPPORTS - See Section 22 05 29.

2.5 FLOOR DRAINS

- A. Floor Drain (FD-1):
 - 1. Design Base: Josam 32100 series.
 - 2. J.R.Smith; equivalent.
 - 3. Sioux Chief; 'FinishLine' series.
 - 4. ASME A112.21.1; Medium Duty, sized to match piping where shown on Drawings, ductile or cast iron two piece body with double drainage flange, weep holes, reversible clamping collar where necessary for the application, and adjustable 9" round nickel-bronze strainer.
- B. Floor Drain (FD-1) *Trap Primer:
 - 1. Design Base: Josam 32100 series.

2. J.R.Smith; equivalent.
 3. Sioux Chief; 'FinishLine' series.
 4. ASME A112.21.1; Medium Duty, sized to match piping where shown on Drawings, ductile or cast iron two piece body with double drainage flange, weep holes, reversible clamping collar where necessary for the application, and adjustable 9" round nickel-bronze strainer.
 5. Trap Primer Valve: Precision Plumbing Products; Model P2-500.
- C. Floor Drain (FD-3) *Sediment:
1. Design Base: Josam 35130-14-1 series.
 2. J.R.Smith; equivalent.
 3. Sioux Chief 'FinishLine' series.
 4. ASME A112.21.1; ductile or cast iron two piece body with double drainage flange, weep holes, reversible clamping collar where necessary for the application, and grate type top strainer with removable stainless steel sediment basket.
 5. Trap Primer Valve: Precision Plumbing Products; Model P2-500.
- D. Floor Drain (FD-4) *Open Receptacle:
1. Design Base: J.R.Smith; Model 3020
 2. Josam; equivalent.
 3. Sioux Chief 'FinishLine' series.
 4. ASME A112.21.1; ductile or cast iron two piece body with double drainage flange, weep holes, reversible clamping collar where necessary for the application, and adjustable after-pour 8" round nickel-bronze strainer with aluminum or nickel-bronze funnel to act as an Open Receptacle.

2.6 CLEANOUTS

- A. Exterior Surfaced Areas (COTG-1): Cast nickel bronze access frame and non-skid cover.
- B. Exterior Unsurfaced Areas (COTG-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- C. Interior Finished Floor Areas (COTF): Lacquered Galvanized cast iron body with anchor flange, reversible clamping collar where necessary for the application, threaded top assembly, and round scored cover with gasket in service areas and round square depressed cover with gasket to accept floor finish in finished floor areas.
- D. Interior Finished Wall Areas (COTW): Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- E. Interior Unfinished Accessible Areas (COTP): Plug; Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.7 BACK WATER VALVES

- A. Cast Iron: ASME A112.14.1; lacquered cast iron body and cover, brass valve, 6 inch extension sleeve, and access cover.
- B. Plastic: PVC body and valve, 6 inch extension sleeve, and access cover.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - HANGERS AND SUPPORTS - See Section 21 05 48.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 4 ft of cover unless otherwise noted or required by site conditions, including frost depth.
- C. Establish minimum separation from other services and piping in accordance with local AHJ, municipal code and utility requirements.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Excavate pipe trench.
- F. Install pipe to elevation required.
- G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted loose depth; compact to 95 percent maximum density.
- H. Install pipe on prepared bedding.
- I. Route pipe in straight line.
- J. Install plastic ribbon tape continuous over top of pipe. buried 6 inches below finish grade, above pipe line; Refer to Section 22 05 53
- K. Pipe Cover and Backfilling:
 - 1. Backfill trench

2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to $\frac{1}{4}$ or $\frac{1}{8}$ inch per foot minimum to match applicable Plumbing Code. Maintain gradients.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Do not spread piping, conserve space.
- H. Group piping whenever practical at common elevations.
- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation.
- K. Provide access where valves and fittings are not accessible.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- O. Install bell and spigot pipe with bell end upstream.
- P. Sleeve pipes passing through partitions, walls and floors.
- Q. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

- R. Support cast iron drainage piping at every joint.

3.6 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements; Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test sanitary waste and vent piping system in accordance with applicable code and local authority having jurisdiction (AHJ).

3.7 SCHEDULES

- A. See Drawings.

END OF SECTION

SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial electric water heater.
- B. Related Sections:
 - 1. Division 03 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
 - 2. Section: 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.
 - 3. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. American Society of Mechanical Engineers:
 - 1. ASME PTC 25 - Pressure Relief Devices.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.
- C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
- D. Manufacturer's Installation Instructions: Submit mounting and support requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

- A. Conform to ASME Section VIII for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.
- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience or approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Products storage and handling requirements.
- B. Accept water heaters on site in original labeled cartons. Inspect for damage.
- C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for domestic water heater.

PART 2 PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS

- A. Manufacturers:
 - 1. Design Base: A.O. Smith as Scheduled on Drawings.
 - 2. Bradford White
 - 3. General Electric
 - 4. Patterson-Kelley Co.
 - 5. Rheem
 - 6. Substitutions: Division 01 - Product Requirements
- B. Type: Automatic, electric, vertical storage.
- C. Capacity:

1. Storage capacity: 50 gal.
 2. Heating element size: 4.5 kW.
 3. Number of heating elements: 2.
 4. Maximum working pressure: 150 psig.
- D. Tank: Glass lined welded steel, thermally insulated with minimum one inch thick insulation; encased in corrosion-resistant steel jacket with baked-on enamel finish.
- E. Controls: Automatic water thermostat with adjustable temperature range from 110 to 140 degrees F, flanged or screw-in ni-chrome elements, enclosed controls and electrical junction box.
1. Wire controls for double element units to single point electrical connection service disconnect switch, controlled so elements do not operate simultaneously.
 2. Initial setpoint: 120°F.
- F. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME temperature and pressure relief valve.
- G. Electrical Characteristics: In accordance with Section 26 05 03 and the following:
1. Voltage to match service available, single phase, 60 Hz.
- H. Disconnect Switch: Manual service disconnect switch adjacent equipment.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base diameter. Refer to Division 03.
- C. Connect domestic hot water and domestic cold water piping to supply and return water heater connections.
- D. Install the following piping accessories.
1. On supply outlet:
 - a. Thermometer.
 - b. Pressure gage.
 - c. Shutoff valve.
 2. On makeup water inlet:
 - a. Strainer.
 - b. Thermometer.
 - c. Shutoff valve.
- E. Install discharge piping from relief valves and drain valves to nearest clear water waste inlet with air gap per applicable Code.
- F. Install water heater trim and accessories furnished loose for field mounting.

Griffin Bike Park Clubhouse
Terra Haute, IN

G. Install electrical devices furnished loose for field mounting.

H. Install control wiring between water heater control panel and field mounted control devices.

3.2 SCHEDULES – See Drawings

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Lavatories.
 - 3. Sinks.
 - 4. Mop basin.
 - 5. Electric water coolers.

- B. Related Sections:
 - 1. Section 07 90 00 - Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
 - 2. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
 - 3. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
 - 4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

- B. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

- C. American Society of Mechanical Engineers:
 - 1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
 - 2. ASME A112.18.1 - Plumbing Fixture Fittings.
 - 3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
 - 4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
 - 5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
 - 6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
 - 7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit catalog illustrations of fixtures, sizes, utility sizes, trim, and finishes.

- C. Manufacturer's Installation Instructions: Submit special installation methods and procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists for owner use.

1.5 QUALITY ASSURANCE

- A. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish documentation of manufacturer warranty for plumbing fixtures.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 WATER CLOSETS

- A. Provided by and installed as donation to owner.
- B. Contractor shall confirm all connections and dimensions and provide rough-ins.

2.2 LAVATORIES

- A. Provided by and installed as donation to owner.
- B. Contractor shall confirm all connections and dimensions and provide rough-ins.

2.3 SINKS

- A. Design Base: as scheduled on Drawings.

2.4 ELECTRIC WATER COOLER - WALLMOUNT

- A. Manufacturers: Design Base: As scheduled on Drawings
 - 1. Elkay.
 - 2. Haws.
 - 3. Murdock.
 - 4. Substitutions: Per Division 01 requirements.
- B. Fountain:
 - 1. ARI 1010; Barrier-free, Chilled Water Dual-Height Wall Mount Fountain with bottle-filler.
 - 2. Wall-mount system with standard and handicapped/accessible fountains (dual hi/low). Electric water cooler with stainless steel component surfaces, anti-squirt bubbler with stream guard, automatic stream regulator, barrier-free push button, refrigerated with integral air cooled condenser and stainless steel grille.
 - 3. Capacity: 8 gpm of 50 degrees F water with inlet at 80 degrees F and room temperature of 80 degrees F.
 - 4. Electrical: cord and plug for connection to electric wiring system including grounding connector.
 - 5. Bottle filler feature.



2.5 SERVICE SINKS (MOP BASIN- MB)

- A. Manufacturers: Design Base: As scheduled on Drawings
 - 1. Fiat Model P-1 or FL-1
 - 2. Substitutions: Per Division 01 requirements.
- B. Bowl: 20 x 17 x 13 inch high white molded stone, floor mounted, with one inch wide shoulders, bumper guard, stainless steel strainer.
- C. Trim: ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
 - 1. 5 feet of 1/2 inch diameter plain end reinforced hose.
 - 2. Hose clamp hanger.
 - 3. Mop hanger.

2.6 LAVATORY INSULATION KIT

- A. Manufacturers:
 - 1. Design Base: IPS Corp; TruBro series.
 - 2. Plumberex; Handy Shield or Pro-eXtreme series.
- B. Product Description:
 - 1. Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.
 - 2. Enclosure: Alternative ADA compliant means may be provided and installed which consist of removable shroud, panels, or other enclosures at no further cost to owner.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify with Architectural drawings and details to identify all fixtures that must be ADA compliant and locate all rough-ins for new fixtures at final location and elevation to ensure ADA compliant access and height for final fixture use.
- C. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- D. Verify electric power is available and of correct characteristics.
- E. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.
- F. Confirm and coordinate rough-ins for fixtures provided and installed by others as a donation to owner.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- C. Install components level and plumb.

- D. Install and secure fixtures in place with wall supports or carriers and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.
- F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- G. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES

- A. Fixture Mounting Heights:
 - 1. Water Closet:
 - a. Standard: 15 inches to top of bowl rim.
 - b. Accessible: 18 inches to top of seat.
 - 2. Water Closet Flush Valves:
 - a. Standard: 11 inches min. above bowl rim.
 - b. Recessed: 10 inches min. above bowl rim.
 - 3. Urinal:
 - a. Standard: 22 inches to top of bowl rim.
 - b. Accessible: 17 inches to top of bowl rim.
 - 4. Lavatory:
 - a. Standard: 31 inches to top of basin rim.
 - b. Accessible: 34 inches to top of basin rim.
 - 5. Drinking Fountain:

- a. Child: 30 inches to top of basin rim.
- b. Standard Adult: 40 inches to top of basin rim.
- c. Accessible: 36 inches to top of spout.
- 6. Shower Heads:
 - a. Adult Male: 69.5 inches to bottom of head.
 - b. Adult Female: 64.5 inches to bottom of head.
 - c. Child: 58.5 inches to bottom of head.
- 7. Emergency Eye And Face Wash: Standard: 38 inches to receptor rim.
- 8. Emergency Shower: Standard: 84 inches to bottom of head.

B. Fixture Rough-In:

Fixture	Hot inches	Cold inches	Waste inches	Vent inches
Water Closet (Flush Valve):		1	4	2
Water Closet (Tank Type):		1/2	4	2
Lavatory:	1/2	1/2	1-1/2	1-1/4
Sink:	1/2	1/2	1-1/2	1-1/4
Mop Basin:	1/2	1/2	3	1-1/2
Electric Water Cooler:		1/2	1-1/4	1-1/4

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Equipment curbs.
6. Sleeves.
7. Mechanical sleeve seals.
8. Formed steel channel.
9. Support Piers.

B. Related Sections:

1. Division 3 - Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
2. Division 3 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Division 7 - Firestopping: Product requirements for firestopping for placement by this section.
4. Division 7 - Joint Protection: Product requirements for sealant materials for placement by this section.
5. Division 9 - Painting and Coating: Product and execution requirements for painting specified by this section.
6. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

- D. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- F. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
 - 5. UL - Fire Resistance Directory.
- G. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

1.3 SYSTEM DESCRIPTION

- A. Hangers & Supports for HVAC systems and equipment.
- B. Firestopping Materials: Comply with requirements of Division 7.

1.4 PERFORMANCE REQUIREMENTS

- A. Firestopping Materials: Comply with requirements of Division 7.

1.5 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with applicable authority AWS D1.1 for welding hanger and support attachments to building structure.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Division 1 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 1 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Division 1 - Product Requirements: Environmental conditions affecting products on site.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Division 1 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson Inc.
 - 2. Cooper B-Line.
 - 3. Creative Systems Inc.
 - 4. Flex-Weld, Inc.
 - 5. Globe Pipe Hanger Products Inc.
 - 6. Michigan Hanger Co.
 - 7. Superior Valve Co.
 - 8. Substitutions: Division 1 - Product Requirements.
- B. Hydronic Piping:
 - 1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, and MSS SP89 as applicable.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Hangers for Hot Pipe Sizes 2 to 5 inches: Carbon steel, adjustable, clevis.
 - 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
 - 7. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
 - 8. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 9. Vertical Support: Steel riser clamp.
 - 10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 11. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

12. Copper Pipe Support: Copper-plated, carbon steel ring.

C. Refrigerant Piping:

1. Conform to ASME B31.5; ASTM F708; MSS SP58; MSS SP69; MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron; Carbon steel. Adjustable swivel; split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated; carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:

1. Hilti Corp.
2. ITW Buildex and Illinois Tool Works, Inc.
3. National Pipe Hanger Corporation.
4. Unistrut, Tyco International, Ltd.
5. US Strut, Unitron Products, Inc.
6. Substitutions: Division 1 - Product Requirements.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl, PID, or EPDM; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

- A. See Section 230548 for Vibration Isolation and Seismic components and further information to meet seismic zone requirements at project location, as well as vibration isolation needs of the physical location of equipment in relation to occupied space noise level requirements.
- B. Equipment curbs shall be provided, fabricated or selected following manufacturer's recommendations and to ensure full perimeter support for applicable HVAC equipment. Connections shall be sealed, and all portions exposed to environmental air shall be fully insulated to meet applicable requirements of Section 230700.
- C. Equipment curbs shall be fully supported and anchored directly to structure where located on or inside building. Curbs on grade shall be anchored to threaded inserts but separated from direct contact with concrete housekeeping slab by raised framing, non-corroding gasket, spacers, snubbers, or rubber pads as described in Section 230548.
- D. All exterior ferrous materials exposed to weather shall be minimum G90 galvanized, powdercoated, or otherwise primed and finished per Division 09 requirements for exterior ferrous surfaces, to avoid corrosion.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- E. Sealant: Acrylic; refer to Division 7.

2.7 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Thunderline Link-Seal, Inc.
 - 2. NMP Corporation.
 - 3. Substitutions: Division 1 - Product Requirements.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems.

3. Midland Ross Corporation, Electrical Products Division.
4. Unistrut Corp.
5. Substitutions: Division 1 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.9 FIRESTOPPING & ACCESSORIES

A. Installation Accessories: Comply with requirements of Division 7.

2.10 SUPPORT PIER

A. Manufacturers:

1. Arlington Industries, Inc.; Roof-Topper series.
2. Cooper B-Line; Dura-Blok series.
3. Gastite; Pipe Pier series.
4. Roof Top Accessories; Keycurb series.
5. ERICO; Pipe Caddy series.
6. A Better Idea Inc.; E-Z Sleeper series.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. General:

1. Use fabricated supports for consistent method of running all piping and supporting any items run horizontally.
2. Material shall be non-corrosive and non-wood; fabricated of plastic, polymer, or composite.
3. Shall be designed with corrosion resistant factory provision for supports and securing equipment to each pier.

C. Accessories

1. Each support shall rest on separate housekeeping pad, sized larger than the pier base, compatible with the surface where installed. Where installed on a roof surface, this shall consist of a membrane or other pad of equivalent or compatible material. Where installed on grade, this shall consist of a concrete pad equal to similar walkway or stoop details.
2. Where multiple pipes or ducts are routed together in parallel, coordinate for mid-span piers to include roller-type piping support of width and support-base of width necessary to group piping while providing resilient positioning capable of allowing for expansion of each independent of others.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1 ASME B31.5 ASME 31.9 ASTM F708 MSS SP 58 MSS SP 69 MSS SP 89.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support vertical piping at every other floor.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping sheet lead packing between hanger or support and piping.

- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Refer to Division 9. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Division 3.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members formed steel channel steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.
- E. Provide housekeeping pads of concrete as noted above, minimum 12"x12", to support any piping piers required on grade.

3.6 LOW VELOCITY DUCT HANGERS AND SUPPORTS

- A. Hanger Minimum Sizes:
 - 1. Up to 30 inches wide: 1 inch x 16 gauge at 10 feet spacing.
 - 2. 31 inches to 48 inches wide: 1-1/2 inches x 16 gauge at 10 feet spacing.
 - 3. Over 48 inches wide: 1-1/2 inches x 16 gauge at 8 feet spacing.
- B. Horizontal Duct on Wall Supports Minimum Sizes:
 - 1. Up to 18 inches wide: 1-1/2 inches x 16 gauge or 1 inch x 1 inch x 1/8 inch at 8 feet spacing.
 - 2. 19 inches to 40 inches wide: 1-1/2 inches x 1-1/2 inches x 1/8 inch at 4 feet spacing.

3.7 PRIMING

- A. Prime coat exposed steel hangers and supports, ready for finish painting.
 - 1. Hangers and supports located in crawl spaces, pipe shafts and suspended ceiling spaces are not considered exposed.

3.8 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

- C. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.
- D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.9 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel plastic stainless steel escutcheons at finished surfaces.

3.10 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 7.

3.11 FIELD QUALITY CONTROL

- A. Division 1 - Quality Requirements: Requirements for inspecting, testing.
- B. Division 1 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.12 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.13 PROTECTION OF FINISHED WORK

- A. Division 1 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.14 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2 (Note 2)	9	11	1/2	1/2

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

C. Single Hanger Maximum Allowable Load:

STRAP:

1" X 22 ga. = 260 lbs.
1" x 20 ga. = 320 lbs.
1" x 18 ga. = 420 lbs.
1-1/2" X 16 ga. = 1100 lbs.

WIRE or ROD (Dia.)

12 ga. (0.106") = 80 lbs.
10 ga. (0.135") = 120 lbs.
1/4" = 270 lbs.
3/8" = 680 lbs.
1/2" = 1250 lbs.

Griffin Bike Park Clubhouse
Terra Haute, IN

$5/8'' = 2000 \text{ lbs.}$
 $3/4'' = 3000 \text{ lbs.}$

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vibration isolators.
 - 2. Ductwork lagging.

- B. Related Sections:
 - 1. Division 3 - Cast-In-Place Concrete: Execution requirements for placement of isolators in floating floor slabs specified by this section and product requirements for concrete for placement by this section.
 - 2. Division 7 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
 - 3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
 - 4. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
 - 5. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct sound attenuators specified for placement by this section.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

- B. American National Standards Institute:
 - 1. ANSI S1.8 - Reference Quantities for Acoustical Levels.

- C. American Society of Heating, Refrigerating and:
 - 1. ASHRAE Handbook - HVAC Applications.

- D. Sheet Metal and Air Conditioning Contractors':
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.

- B. Provide minimum static deflection of isolators for equipment or 0.25 inch.

1.4 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings:
 - 1. Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.
- C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.
- D. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

1.5 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of all equipment installed to execute the requirements of this Section.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA 300; ANSI S1.13; ARI 575; and ANSI S12.36 standards and recommendations of ASHRAE 68.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience or approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 1 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 1 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. BRD Noise & Vibration Control, Inc.
 - 2. California Dynamics Corporation
 - 3. Isolation Technology, Inc.
 - 4. Kinetics Noise Control, Inc.
 - 5. Mason Industries, Inc.
 - 6. Taylor Devices, Inc.
 - 7. Vibration Isolation
 - 8. Vibro-Acoustics
 - 9. VMC Group
 - 10. Substitutions: Division 1 - Product Requirements.
- B. Open Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- C. Restrained Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 5. Restraint: Furnish mounting frame and limit stops.
- D. Closed Spring Isolators:
 - 1. Spring Isolators:

- a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
- E. Restrained Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
- F. Spring Hanger:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators rubber hanger with threaded insert.
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- G. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
 - a. 30 durometer.
 - b. Minimum 1/2 inch thick.
 - c. Maximum loading 40 psi.
 - d. Height of ribs: not to exceed 0.7 times width.
 2. Configuration: Single layer. 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.
- H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.
- I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- J. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.

2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

2.2 DUCTWORK LAGGING

- A. Acoustic Insulation: Minimum 1-1/2" thick, 3 to 5 lb/cu ft density glass fiber or mineral wool insulation.
- B. Covering: Sheet material, plaster, or gypsum board with surface weight minimum 4 lb/sq ft.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 INSTALLATION

- A. Lag ductwork, where indicated by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.
- B. Attach ductwork to acoustic louvers with flexible duct connections.
- C. Install isolation for motor driven equipment.
- D. Install exterior equipment on grade with concrete housekeeping pad bases with perimeter sized a minimum of 6" larger than equipment, minimum 18" depth around full perimeter to frost line. See general work details for exterior concrete pads and stoops to follow similar means and materials.
- E. Bases: Set bases for 1 inch clearance between housekeeping pad and base.
- F. Adjust equipment level.
- G. Install spring hangers without binding.
- H. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- I. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- J. Provide pairs of horizontal limit springs on fans with more than 6.0-inch static pressure, and on hanger supported, horizontally mounted axial fans.

- K. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers to meet the seismic-rated zone at project location.
 - 1. All support for equipment shall be rated for the weight of that equipment and the seismic zone at project location.
 - 2. Provide each inertia base with minimum of four seismic snubbers located close to isolators.
 - 3. Snub equipment designated for post disaster use to 0.05-inch maximum clearance.
 - 4. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

- L. Support piping connections to isolated equipment resiliently to nearest flexible pipe connector and First three points of support.
 - 1. Select three hangers closest to vibration source for minimum 1.0-inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0-inch static deflection or 1/2 static deflection of isolated equipment.

3.3 FIELD QUALITY CONTROL

- A. Division 1 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Pipe Isolation Schedule: Isolated Distance from Equipment diameters: 120.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Pipe markers.
 - 4. Ceiling tacks.
 - 5. Labels.
 - 6. Lockout devices.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturers catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

- A. Division 1 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 1. Brady Worldwide, Inc.
 2. Brimar Industries, Inc.
 3. Craftmark Identification Systems.
 4. Safety Sign Co.
 5. Seton Identification Products.
 6. Substitutions: Division 1 - Product Requirements.

2.2 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter square.
- B. Metal Tags: Brass Aluminum Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter square with finished edges.
- C. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.
- D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame plastic laminated.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.

Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Heating/cooling valves: Blue.

2.6 LABELS

- A. Description: Aluminum Polyester Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

- A. Lockout Hasps: Anodized aluminum Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 9 for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with manufacturer's recommendations.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify air terminal units and radiator valves with numbered tags.

- K. Tag automatic controls, instruments, and relays. Key to control schematic.
- L. Identify piping, concealed or exposed, with plastic pipe markers plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- M. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot (spacing).
- N. Identify ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- O. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Testing adjusting, and balancing of air systems.
 - 2. Measurement of final operating condition of HVAC systems.
- B. Related Sections:
 - 1. Section 23 09 23 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.
 - 2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.2 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. Natural Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- D. Testing Adjusting and Balancing Bureau:
 - 1. TABB - International Standards for Environmental Systems Balance.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
- C. Test Reports: Indicate data on forms prepared following AABC MN-1 National Standards for Total System Balance; ASHRAE 111; NEBB Report; TABB Report; forms containing information indicated in Schedules.
- D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Submit draft copies of report for review prior to final acceptance of Project.

- F. Furnish report in bound manual, complete with table of contents page and index, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of flow measuring or balancing equipment and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance; ASHRAE 111; NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems; or TABB International Quality Assurance program.
- B. Prior to commencing Work, ensure current calibration of each instrument to be used.

1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years' experience or certified by AABC, NEBB or TABB.
- B. Perform Work under supervision of 3rd party Certified Test and Balance personnel.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 1 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 SEQUENCING

- A. Division 1 - Summary: Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.9 SCHEDULING

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Schedule and provide assistance in final adjustment and test of any life safety, smoke or fume evacuation system, or laboratory exhaust systems with Authority Having Jurisdiction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify systems are complete and operable before commencing work. Verify the following:
 - 1. Systems are started and operating in safe and normal condition.
 - 2. HVAC control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.

3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus 10 percent or minus 5 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to spaces.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Division 1 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.

- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
- H. Check and adjust systems within six months of substantial completion and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Make air flow rate measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain:
 - 1. Space temperatures within 2 degrees F.
 - 2. Minimal objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.6 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Thermostats and Controls.
 - 2. Air Inlets and Outlets.
 - 3. Air Filters.
 - 4. Fans.
 - 5. HVAC Equipment.
- B. Report Forms
 - 1. Title Page:

- a. Name of Testing, Adjusting, and Balancing Agency
- b. Address of Testing, Adjusting, and Balancing Agency
- c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
- d. Project name
- e. Project location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- i. Project altitude
- j. Report date
2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
4. Controls – Proper Operation Test Sheet:
 - a. Equipment controlled (all)
 - b. Setpoint adjusted, proper response – cooling (where applicable)
 - c. Setpoint adjusted, proper response – heating
 - d. Occupancy schedule or manual activation – unit properly activated in occupied mode.
 - e. Graphic display on BAS including floorplan, space, and equipment links for each.
5. Air Distribution Test Sheet:
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
 - j. Percent of design air flow
6. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP and kW
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore

7. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
8. Condenser/Heatpump Unit:
 - a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual
 - h. Compressor Operation
9. Air Moving Equipment:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual
 - g. Return air flow, specified and actual
 - h. Outside air flow, specified and actual
 - i. Total static pressure (total external), specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM
10. Supply/Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
11. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number

- e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
12. Duct Traverse:
- a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
13. Duct Leak Test:
- a. Description of ductwork under test
 - b. Duct design operating pressure
 - c. Duct design test static pressure
 - d. Duct capacity, air flow
 - e. Maximum allowable leakage duct capacity times leak factor
 - f. Test apparatus
 - 1) Blower
 - 2) Orifice, tube size
 - 3) Orifice size
 - 4) Calibrated
 - g. Test static pressure
 - h. Test orifice differential pressure
 - i. Leakage
14. Motorized Damper Data:
- a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Control Input, Auto/Manual
 - f. Control response, position, operation
15. Heating Unit:
- a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual
 - h. Air flow, specified and actual
 - i. Fan motor RPM
 - j. Describe control type, settings, and proper response.

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END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC piping insulation
2. HVAC ductwork insulation, jackets, and accessories.

B. Related Sections:

1. Division 7 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 9 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

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17. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
 18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 19. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 20. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 21. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
 22. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 23. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
 24. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction
 25. ASTM E136 - Standard Test Method for Behavior of Material in a Vertical Tube Furnace at 750°C (1382°F)
 26. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
 27. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems
 28. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
1. ASHRAE Design Fundamentals Handbook.
 2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. International Code Council
1. ICC-ES AC101 - Acceptance Criteria for Grease Duct Enclosure Assemblies
- D. International Standards Organization:
1. ISO 6944-85 - Fire Resistance Tests – Ventilation Ducts
- E. National Fire Protection Association (NFPA)
1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
1. SMACNA HVAC Air Duct Leakage Test Manual
 2. SMACNA Phenolic Duct Construction Standards
 3. SMACNA HVAC Duct System Design Manual.
 4. SMACNA HVAC Duct Construction Standard - Metal and Flexible.
- G. Underwriters Laboratories Inc.:
1. UL-181 - Standard for Safety Factory-Made Air Ducts and Air Connectors
 2. UL-723 - Surface Burning Characteristic of Building Materials
 3. UL 1978 - Standard for Safety for Grease Ducts.
- H. Sheet Metal and Air Conditioning Contractors’:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Physical properties, performance criteria, and product limitations.
 2. Preparation instructions and recommendations.
 3. Storage and handling requirements and recommendations.
 4. Installation methods.
 5. Product description, thermal characteristics, list of materials and thickness for each application, location used.
- C. Manufacturer's Installation Instructions:
 1. Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Source Responsibility:
 1. Provide primary materials from a single manufacturer.
 2. Secondary and accessory materials by other manufacturers shall be approved for compatibility by the primary manufacturer.
- B. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 450 50 in accordance with ASTM E84.
- C. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- E. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years' experience approved by manufacturer.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 1 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish manufacturer warranty for man-made fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.
 - 3. Johns Manville.
 - 4. 3M.
 - 5. Owens-Corning.
 - 6. Unifrax.
 - 7. Substitutions: Division 1 - Product Requirements.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Armacell, LLC. Armaflex.
 - 3. Nomaco. K-flex.
 - 4. Substitutions: Division 1 - Product Requirements.
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
 - 1. Dow Chemical Company.

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2. Substitutions: Division 1 - Product Requirements.

D. Manufacturers for Extruded Polystyrene Insulation Products:

1. Dow Chemical Company.
2. Substitutions: Division 1 - Product Requirements.

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.23 at 75 degrees F.
 2. Operating Temperature Range: 0 to 850 degrees F.
 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil with self-sealing adhesive joints.
 4. Jacket Temperature Limit: minus 20 to 150 degrees F.
- B. TYPE P-2: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.23 at 75 degrees F.
 2. Operating Temperature Range: 0 to 850 degrees F.
- C. TYPE P-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Operating Temperature Range: 0 to 650 degrees F.
 3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
 4. Jacket Temperature Limit: minus 20 to 150 degrees F.
- D. TYPE P-4: ASTM C612; semi-rigid, fibrous glass board noncombustible. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Operating Temperature Range: 0 to 650 degrees F.
- E. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.
- F. TYPE P-6: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.30 at 75 degrees F.
 2. Maximum Service Temperature: 300 degrees F.
 3. Operating Temperature Range: Range: Minus 58 to 300 degrees F.
- G. TYPE P-7: ASTM C534, Type I, flexible, non-halogen, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Maximum Service Temperature: 250 degrees F.
 3. Operating Temperature Range: Range: Minus 58 to 250 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Refrigerant Pipe Covering System:
 - 1. Manufacturers:
 - a. DiversiTech; Speedichannel system.
 - b. Rectorseal; Fortress system.
 - c. Coverguard; Adjustable Cover system.
 - d. Airex; eFlexGuard system.
 - e. Inaba Denko America; Slimduct RD.
 - 2. Product Description: ASTM D1785, molded system of covers and fittings, paintable.
 - 3. Where colors are available, manufacturers standard selection shall be submitted to Architect for final selection.
- B. PVC Plastic Pipe Jacket:
 - 1. Product Description: ASTM D1785, One-piece molded type fittings and sheet material, off-white color.
 - 2. Thickness: 20 mil.
 - 3. Connections: Brush on welding adhesive Tacks Pressure sensitive color matching vinyl tape.
- C. ABS Plastic Pipe Jacket:
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - 2. Minimum service temperature: -40 degrees F.
 - 3. Maximum service temperature of 180 degrees F.
 - 4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
 - 5. Thickness: 30 mil.
 - 6. Connections: Brush on welding adhesive.
- D. Aluminum Pipe Jacket:
 - 1. ASTM B209.
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Smooth Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide;
- E. Stainless Steel Pipe Jacket:
 - 1. ASTM A240/A240M OR ASTM 666 Type 302 304 316 stainless steel.
 - 2. Thickness: 0.010 inch thick.
 - 3. Finish: Smooth. Corrugated.
 - 4. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

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- D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum stainless steel jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

2.5 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
 - 1. Thermal Conductivity: 0.29 at 75 degrees F.
 - 2. Maximum Operating Temperature: 250 degrees F.
 - 3. Density: 1.0 pound per cubic foot.
- B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied all service facing reinforced aluminum foil facing metalized polypropylene scrim kraft facing meeting ASTM C1136, Type II.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Density:
 - a. Concealed locations; 3.0 pounds per cubic foot.
 - b. Exposed locations; 5.0 pounds per cubic foot.
- C. TYPE D-3: ASTM C612, Type IA or IB, rigid or semi-rigid glass fiber, no facing.
 - 1. Thermal Conductivity: 0.25 at 75 degrees F.
 - 2. Density: 2.25 pounds per cubic foot.
 - 3. Maximum Air Velocity: 4,000 feet per minute.
 - 4. Only substitute this product when separate vapor barrier facing or jacket is applied.
- D. TYPE D-6: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Service Temperature Range: Range: Minus 58 to 180 degrees F.
- E. TYPE D-7: ASTM C534, Type II, flexible, closed cell elastomeric insulation, factory laminated with aluminum sheet or white thermoplastic rubber membrane for exterior applications.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Service Temperature Range: Range: Minus 58 to 180 degrees F.
- F. TYPE D-9: UL-181 listed Class 1 Air Duct - Rigid fiber-free phenolic ductboard, NFPA 90A and NFPA 90B compliant.
 - 1. Manufacturers:

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- a. Kingspan Insulation; KoolDuct series Air Duct Board.
- b. ThermaDuct; ThermaDuct, ThermaRound, InspiraIR, Floval.
- c. Substitutions: Per Division 01 requirements for preapproval submission prior to bid.
2. CFC/HCFC free, low Ozone Depletion Potential (ODP), fiber-free rigid thermoset phenolic insulation core faced with minimum 1 mil low vapor permeability aluminum foil, reinforced with glass scrim for both airside and external jacketing.
3. ASTM E84 or UL 723 tested for less than 25/50 flame/smoke spread.
4. Nominal Density: 3.4 to 3.75 pcf.
5. Closed Cell Content: minimum 90 percent
6. Compressive Strength: Minimum 25 psi at 10 percent compression.
7. Air Leakage: SMACNA Air Leakage Class 3.
8. Mean Air Velocity: Maximum 5000 fpm with all joints sealed.
9. Design Pressures:
 - a. Positive Pressure: Maximum 4 inch w.g.
 - b. Negative Pressure: Maximum -3 inch w.g.
10. Temperature Range: Internal air temperature range -4F to 176F deg F during continuous operation, inside ducts or ambient surrounding temperature.
11. Thermal Conductivity: 0.15 at 75 degrees F per ASTM C518.
12. Thermal Resistance, Wall Thickness and R-Value:
 - a. R-6 @7/8 inch thick.
 - b. R-8 @1-3/16 inch thick.
 - c. R-12 @1-25/32 inch thick.
 - d. Installed thickness: Shall be selected to meet Energy Code required R-value for the application, equivalent to comparable insulation wrap used over rigid metal duct.
13. Fittings:
 - a. In accordance with SMACNA Phenolic Duct Construction Standards, or the ASHRAE Design Fundamentals Handbook Chapter 35, or the SMACNA HVAC Duct Systems Design Manual.
14. Support and Coupling Systems:
 - a. Per Section 230529 or manufacturer's approved systems compliant with listing and application.
15. Access doors.
 - a. Fabricated from the same materials and methods and sealed to ensure a continuous vapor barrier and insulation level.
16. Fabrication materials:
 - a. Sealant: Silicone with VOC content of 250 g/L or less.
 - b. Tape: 181A compliant pressure-sensitive reinforced aluminum foil tape imprinted with manufacturer, UL markings, and date. Minimum Width: 3 inch. Water, mold, and mildew resistant.
 - c. Gaskets: self-adhesive.

2.6 DUCTWORK INSULATION JACKETS

- A. Membrane Duct Jacket:
 1. ASTM D4637; Type I, EPDM; non-reinforced, 0.045 inch thick, 48-inch-wide roll; white color, fully coated self-adhesive or equivalent field applied compatible adhesive.
- B. Aluminum Duct Jacket:
 1. ASTM B209; Thickness (min): 24 gauge nominal thickness sheet.
 2. Joining: Longitudinal slip joints and laps.

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3. Fittings (min): 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
4. Metal Jacket Bands: 3/8-inch-wide aluminum or stainless steel.

C. PVC Plastic Duct Jacket:

1. ASTM D1785; Thickness (min): 15 mil thick sheet material, white or off-white color.

D. Coated Steel Jacket:

1. Aluminum zinc alloy coated sheet steel.
2. ASTM B209; Thickness (min): 24 gauge nominal thickness sheet.
3. Joining: Longitudinal slip joints and laps.

2.7 DUCTWORK INSULATION ACCESSORIES

- A. Adhesive: Compatible with insulation. Waterproof, ASTM E162 fire-retardant type.
- B. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12 inch centers.
- C. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- D. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- E. Adhesives: Compatible with insulation.
- F. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping, and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces:
 1. Locate insulation and cover seams in least visible locations.
 2. Provide jacketing where required.
 3. Prepare entire installation for finish painting.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section Division 7 for penetrations of assemblies with fire resistance rating greater than one hour.

- C. Piping Systems Conveying Fluids Below Ambient Temperature:
1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 2. Where exposed exterior to building and within 8 feet of finished floor where exposed in building interior, provide and install rigid jacketing or equivalent covering system for protection.
 - a. Furnish insulation with factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips.
 - b. Secure field-applied jackets per manufacturer's listing or installation instructions, with all penetrations sealed to maintain vapor barrier.
 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - a. Finish with equivalent vapor retarder and covering system for protection to match adjacent pipe.
- D. Glass Fiber Board Insulation:
1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Polyisocyanurate Foam Insulation Extruded Polystyrene Insulation:
1. Wrap elbows and fitting with vapor retarder tape.
 2. Seal butt joints with vapor retarder tape.
- F. Hot Piping Systems less than 140 degrees F:
1. Where exposed exterior to building and within 8 feet of finished floor where exposed in building interior, provide and install rigid jacketing or equivalent covering system for protection.
 - a. Furnish insulation with factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips.
 - b. Secure field-applied jackets per manufacturer's listing or installation instructions, with all penetrations sealed to maintain vapor barrier.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - a. Finish with equivalent vapor retarder and covering system for protection to match adjacent pipe.
 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- G. Hot Piping Systems greater than 140 degrees F:
1. Where exposed exterior to building and within 8 feet of finished floor where exposed in building interior, provide and install rigid jacketing or equivalent covering system for protection.
 - a. Furnish insulation with factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips.

- b. Secure field-applied jackets per manufacturer's listing or installation instructions, with all penetrations sealed to maintain vapor barrier.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - a. Finish with equivalent vapor retarder and covering system for protection to match adjacent pipe.
 - b. Insulate flanges and unions at equipment.
- H. Inserts and Shields:
 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- I. Insulation Terminating Points:
 1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
 3. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- J. Closed Cell Elastomeric Insulation:
 1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- K. High Temperature Pipe Insulation:
 1. Install in multiple layers to meet thickness scheduled.
 2. Attach each layer with bands. Secure first layer with bands before installing next layer.
 3. Stagger joints between layers.
 4. Finish with canvas jacket.
- L. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting PVC jacket and fitting covers ABS jacket and fitting covers aluminum jacket stainless steel jacket.
- M. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum stainless steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

- N. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
- O. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.
- P. Heat Traced Piping Exterior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum stainless steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.
- Q. Prepare pipe insulation and jacketing that is exposed in occupied spaces for finish painting. Refer to Division 9.

3.3 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Fire Barrier Duct Wrap applications;
 - 1. Product shall be installed per manufacturer's listing to ensure code compliance as an alternative to fire shaft enclosure.
 - 2. Install to thickness required to allow zero clearance to combustibles throughout the enclosure system.
 - 3. Fire Barrier Duct Wrap shall be permanently fastened with stainless steel banding, and/or with equivalent rows of weld pins (impaling or cup head style) as noted in listing for proper installation methods.
- C. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor retarder jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting aluminum jacket.
- F. External Glass Fiber Duct Insulation:
 - 1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
 - 2. Secure insulation without vapor retarder with staples, tape, or wires.

3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. External Elastomeric Duct Insulation:
1. Adhere to clean oil-free surfaces with full coverage of adhesive.
 2. Seal seams and butt joints with manufacturer's recommended adhesive.
 3. When application requires multiple layers, apply with joints staggered.
 4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
 5. Lift ductwork off trapeze hangers and insert spacers.
- H. Duct and Plenum Liner:
1. Adhere insulation with adhesive for 90 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
- I. Rigid Preinsulated Duct:
1. Fabricate, install, and support per manufacturer's listing and instructions.
 2. Seams shall be fully adhered or sealed to achieve UL 181 listing requirements, gasketed, framing shall be mechanically fastened and sealed.
 3. Pressure sensitive tape, UL approved, minimum 2-1/2" width with compatible adhesive, to meet UL listing.
 4. Thickness shall be selected to meet insulation R-value required for the application by the Energy Code adopted at project location.
 5. Coordinate with Section 233100 requirements.
- J. Kitchen Exhaust Ductwork:
1. Cover duct by wrapping with insulation using overlap method checkerboard overlap method butt joint with collar method.
 2. Overlap seams of each method by 3 inches.
 3. Attach insulation using steel banding or by welded pins and clips.
 4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.
- K. Ducts Exterior to Building:
1. Install insulation according to external duct insulation paragraph above.
 2. Provide external insulation with vapor retarder and jacket; either with factory laminated outdoor jacket finished as specified in this Section or with caulked aluminum jacket
 3. Caulk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.
 4. Any portion of exterior ductwork that is run below serviceable access for equipment in a walk/access area shall receive rigid insulation, with a minimum 3/4" thick marine treated plywood applied on top of insulation prior to installation of jacketing. Any such section of

horizontal ductwork where walking/standing may be required to access equipment panels or components shall be provided with rigid galvanized steel cap suitable for walking and rated for 250 lb load, sloped to drain rain/water.

- L. Prepare duct insulation for finish painting. Refer to Division 9.

3.4 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

Dimensions and thicknesses shown are for reference; final installation must meet the actual insulation value required by the energy conservation Code (e.g. IECC) adopted at project location.

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Refrigerant Suction	P-5,6 or 7	All sizes	R4: 1.0
Refrigerant Hot Gas	P-5,6 or 7	All sizes	R4: 1.0

B. Ductwork Insulation Schedule:

Dimensions and thicknesses shown are for reference; final installation must meet the actual insulation value required by the energy conservation Code (e.g. IECC) adopted at project location.

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Supply Ducts (externally insulated) Thickness indicated is installed thickness.	D-1,2,3,6 or 7	R8: 2.0
Return Ducts (externally insulated) Thickness indicated is installed thickness.	D-1,2,3,6 or 7	R2: 0.5
ANY DUCTWORK IN A MECHANICAL ROOM SHALL HAVE VINYL, PLASTIC, OR ALUMINUM SHIELD TO THE HEIGHT OF 8 FOOT AFF ON EXTERNAL SURFACE OF DUCTWORK.		

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC commissioning description.
 - 2. HVAC commissioning responsibilities.

- B. Related Sections:
 - 1. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: For requirements and procedures concerning testing, adjusting, and balancing of mechanical systems.
 - 2. Section 23 33 00 - Air Duct Accessories: Product requirements for ductwork test holes.

1.2 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE Guideline 1 - The HVAC Commissioning Process.

- B. Building Commissioning Association:
 - 1. BCA - Commissioning Handbook.

- C. National Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Building Systems Commissioning.

- D. Testing Adjusting and Balancing Bureau:
 - 1. TABB - Commissioning Manual.

1.3 COMMISSIONING DESCRIPTION

- A. HVAC commissioning process includes the following tasks:
 - 1. Testing and startup of HVAC equipment and systems.
 - 2. Equipment and system verification checks.
 - 3. Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.
 - 4. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
 - 5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
 - 6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
 - 7. Provide operation and maintenance information and record drawings to Commissioning Authority for review, verification, and organization, prior to distribution.
 - 8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.

9. Provide training for systems specified in this Section with coordination by Commissioning Authority.
- B. Equipment and Systems to Be Commissioned:
 1. New HVAC systems that were installed under this Contract.
- C. The following is a partial list of equipment that may be included in this HVAC Commissioning:
 1. Split system air conditioning units.
 2. Fans.
 3. Testing, Adjusting and Balancing work.
- D. Perform seasonal function performance tests for the following equipment and systems:
 1. Heating equipment during heating season.
 2. Cooling equipment during cooling season.

1.4 COMMISSIONING SUBMITTALS

- A. Division 01 - Commissioning: Requirements for commissioning submittals.
- B. Draft Forms: Submit draft of system verification form and functional performance test checklists.
 1. Include each input to each system controller.
 2. Include each sub-system operation or response required to complete each mode of operation described in the Sequence of Operations.
- C. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified. Contractor may use AABC or similar recognized industry forms as guidelines.
- D. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- C. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with BCA ASHRAE Guideline 1 NEBB TABB requirements.
- B. Maintain one copy of each document on site.

1.7 COMMISSIONING RESPONSIBILITIES

- A. Equipment or System Installer Commissioning Responsibilities:

1. Attend commissioning meetings.
2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
4. Provide instructions and demonstrations for Owner's personnel.
5. Ensure subcontractors perform assigned commissioning responsibilities.
6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
8. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
15. Perform verification checks and startup on equipment and systems as specified.
16. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
17. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
18. Conduct HVAC system orientation and inspection.

B. Temperature Controls Installer - Commissioning Responsibilities:

1. Attend commissioning meetings.
2. Review design for ability of systems to be controlled including the following:
 - a. Confirm proper hardware requirements exist to perform functional performance testing.
 - b. Confirm proper safeties and interlocks are included in design.
 - c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
 - d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
 - e. Confirm sensors selected are within device ranges.
 - f. Review sequences of operation and obtain clarification from Architect/Engineer.
 - g. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.

- h. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
 3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
 4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
 5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
 6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of Division 23 equipment Sections.
 7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
 8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
 9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
 10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.
- C. Testing, Adjusting, and Balancing Agency - Commissioning Responsibilities:
 1. Attend commissioning meetings.
 2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes.
 - a. Repeat sample of up to 10 percent of measurements contained in testing, adjusting, and balancing report or as indicated in commissioning plan, as requested by Commissioning Authority.
 3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.8 COMMISSIONING MEETINGS

- A. Division 01 - Commissioning: Requirements for commissioning meetings.
- B. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9 SCHEDULING

- A. Division 01 - Administrative Requirements; Construction Progress Schedule: Requirements for scheduling.
- B. Prepare schedule indicating anticipated start dates for the following:
 1. Piping system pressure testing.
 2. Piping system flushing and cleaning.
 3. Ductwork cleaning.
 4. Ductwork pressure testing.
 5. Equipment and system startups.

6. Automatic temperature control system checkout.
 7. Testing, adjusting, and balancing.
 8. HVAC system orientation and inspections.
 9. Operation and maintenance manual submittals.
 10. Training sessions.
- C. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.
- D. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum conditions of occupancy or use.

1.10 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.
- B. Notify Commissioning Authority in advance of the following:
1. Scheduled equipment and system startups.
 2. Scheduled automatic temperature control system checkout.
 3. Scheduled start of testing, adjusting, and balancing work.
- C. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps as required to meet performance requirements as scheduled.
- B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.
- C. Install replacement sheaves and belts as required to obtain system performance, as scheduled.
1. Provide documentation to Commissioning Authority of original and final equipment sizes and characteristics.
- D. Install test holes in ductwork and plenums where required for taking air measurements and as requested by Commissioning Authority to verify performance.
- E. Prior to start of functional performance test, install replacement filters in equipment as specified in individual section.

3.2 FIELD TESTS AND INSPECTIONS

- A. Seasonal Sensitive Functional Performance Tests:
 - 1. Test heating equipment at winter design temperatures.
 - 2. Test cooling equipment at summer design temperatures with fully occupied building.
 - 3. Participate in any testing delayed beyond Substantial Completion to test performance at peak seasonal conditions.

- B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

- C. Occupancy Sensitive Functional Performance Tests:
 - 1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.
 - 2. Participate in testing delayed beyond Final Completion to test performance with actual occupancy conditions.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sequence of operation for all scheduled HVAC equipment and systems.
- B. Related Sections:
 - 1. Division 23 – Applicable equipment Sections.

1.2 REFERENCES

- A. ALL MECHANICAL WORK SHALL BE PERFORMED COMPLIANT WITH THE LATEST AND MOST CURRENT EDITION OF THE FOLLOWING STANDARDS AND CURRENTLY ADOPTED CODES AT PROJECT LOCATION; INCLUDING, BUT NOT LIMITED TO:
 - 1. ASHRAE 62, 90.1, AND 55.
 - 2. SMACNA.
 - 3. LOCAL AND STATE REQUIREMENTS.
 - 4. OWNER GUIDES.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate mechanical system controlled and control system components.
 - 1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
 - 2. Coordinate submittals with information requested in other Sections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS

2.1 EQUIPMENT CONTROLS

- A. As scheduled on Drawings and specified in the associated Equipment Section.
- B. Provide all accessories, sensors, and components necessary to accomplish the Sequence of Operations as noted herein for fully functioning system(s).

PART 3 EXECUTION

3.1 GENERAL

- A. Coordinate with electrical trade for associated work and power circuits and components to all equipment for fully functioning systems with overcurrent protection matching nameplate data from all manufacturers of all equipment.
- B. All equipment of similar type shall be initially programmed or set to the same setpoints and schedules, as applicable; final setpoints shall be coordinated with the owner.
 - 1. Provide programmable thermostat including Occupied/Unoccupied period control of Outside Air Damper for each equipment serving occupied spaces.
 - a. Ensure motorized actuator is powered and required components are installed to control open position to that selected/determined during Test and Balance task to meet the scheduled Occupied period Ventilation air volume.
 - 2. Provide relay/diodes/power-packs, etc. as needed for control of equipment triggered by other systems, such as fans controlled by lighting circuits of multiple spaces.
 - 3. Provide standard thermostat for auxiliary equipment and that serving unoccupied spaces such as server closets and supplementary heating.
- C. Temperature Setpoints (adjustable, programmable schedule):
 - 1. Cooling:
 - a. Occupied: 72 deg F
 - b. Un-Occupied: 75 deg F
 - c. Upon exceeding setpoint, activate Cooling mode.
 - 2. Heating:
 - a. Occupied: 70 deg F
 - b. Un-Occupied: 65 deg F
 - c. Upon exceeding setpoint, activate Heating mode.
- D. Humidity Setpoint: 55% RH maximum.
 - 1. Upon exceeding setpoint, activate Dehumidification mode.

3.2 SPLIT SYSTEM

- A. Occupied Period – schedule or override button for timed (2-hour) period:
 - 1. Supply fan shall be activated and run continuously.
 - 2. Outside Air Damper shall have motorized actuator open OA damper to occupied setpoint position.
 - 3. Unit shall have heating or cooling mode automatically activated based on Occupied space temperature setpoint.
 - 4. Bi-polar ionization emitter system shall be activated.
- B. Unoccupied Period – scheduled.
 - 1. Supply fan shall be activated only upon call for heating or cooling.
 - 2. Outside Air Damper shall remain closed.
 - 3. Unit shall have heating or cooling mode automatically activated based on Unoccupied space temperature setpoint.

- C. Heating Mode (all-electric)
 - 1. Refrigerant system shall be activated in heating mode, and staged where so scheduled, to meet setpoint.
 - 2. Backup: when outside ambient temperature falls below manufacturer's setpoint to deactivate dX heating, backup electric resistance section shall be automatically initiated and staged or modulated, as applicable, to meet set point.
- D. Cooling Mode
 - 1. Refrigerant system shall be activated, and staged where so scheduled, to meet setpoint.
- E. Dehumidification Mode
 - 1. Refrigerant system shall be activated and staged or modulated to meet Relative Humidity setpoint. Allow temporary setpoint adjustment of up to 3 deg F below cooling setpoint.

3.3 FANS

- A. Ventilation Control:
 - 1. (EF-1) Toilet Exhaust Fan shall be activated automatically by occupancy based switched lighting circuit serving the space shown, as indicated on Schedule or Drawings.

END OF SECTION

SECTION 23 31 01

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes ducts and related work
 - 1. Duct Materials.
 - 2. Flexible ducts.
 - 3. Spiral round ducts.
 - 4. Ductwork fabrication.
 - 5. Duct cleaning.

- B. Related Sections:
 - 1. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
 - 2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
 - 3. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - 3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 5. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 - 6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 7. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 8. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
 3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Fibrous Glass Duct Construction Standards.
 2. SMACNA - HVAC Air Duct Leakage Test Manual.
 3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/8 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 2. Duct layout, indicating pressure classifications and sizes in plan-view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
 3. Fittings.
 4. Reinforcing details and spacing.
 5. Seam and joint construction details.
 6. Penetrations through fire rated and other walls.
 7. Terminal unit, coil, and humidifier installations.
 8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- C. Product Data: Submit data for factory fabricated duct systems.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings.
- C. Test Reports: Indicate pressure tests performed.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- C. Maintain temperatures during and after installation of duct sealant.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish manufacturer warranty for fabricated duct systems.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet; lock-forming quality; minimum 24 gauge thickness.
 - 1. Sheet material shall have a minimum G60 zinc coating in conformance with ASTM A90/A90M.
 - 2. Where exposed in mechanical spaces or subject to damp area locations, minimum G90 zinc coating shall be used.
- B. Steel Ducts: ASTM A1008/A1008M; ASTM A1011/A1011M; ASTM A568/A568M.
- C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.
- D. Stainless Steel Ducts: ASTM A240/A240M or ASTM A666, Type 304 or 316 as applicable.
- E. Fasteners: Rivets, bolts, or sheet metal screws.
- F. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCT CONNECTIONS

- A. IFD-A: Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 2. Maximum Velocity: 4000 fpm.
 3. Temperature Range: -10 degrees F to 160 degrees F.
 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

***** OR *****

- B. IFD-B: Product Description: Black polymer film supported by helical-wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
1. Pressure Rating: 4 inches wg positive and 0.5 inches wg negative.
 2. Maximum Velocity: 4000 fpm.
 3. Temperature Range: -20 degrees F to 175 degrees F.
 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

***** OR *****

- C. IFD-C: Product Description: Multiple layers of aluminum laminate supported by helical wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
1. Pressure Rating: 10 inches wg positive and 1.0 inches negative.
 2. Maximum Velocity: 4000 fpm.
 3. Temperature Range: -20 degrees F to 210 degrees F.
 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

***** OR *****

- D. IFD-D: Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 2. Maximum Velocity: 4000 fpm.
 3. Temperature Range: -20 degrees F to 210 degrees F.
 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

***** OR *****

- E. IFD-E: Product Description: UL 181, Class 0, interlocking spiral of aluminum foil; fiberglass insulation; polyethylene or aluminized vapor barrier film.
1. Pressure Rating: 8 inches wg positive or negative.
 2. Maximum Velocity: 5000 fpm.
 3. Temperature Range: -20 degrees F to 250 degrees F.
 4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.3 INSULATED SEMI-RIGID DUCT AND CONNECTIONS

- A. SRD-A: Product Description; Semi-Rigid Duct, UL 181, Class 1, constructed with interior liner of round corrugated steel or aluminum with exterior fiberglass insulation and vinyl film vapor barrier.

1. Pressure Rating: 10 inches wg positive or negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -20 degrees F to 210 degrees F.
4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.
5. Furnish each flexible duct section with integral clamping devices for connection to round or oval fittings.
6. Join each flexible duct section to main trunk duct through sheet metal fittings. Construct fittings of galvanized steel and equip with factory installed volume damper having positive locking regulator. Provide fittings installed in lined ductwork with insulation guard.

B. Due to rigid formability and maintained cross sectional area, semi-rigid formable ducts using this type may extend to double the length otherwise allowed for “flexible” duct connections without the typical requirement for using the next-larger standard diameter, and may take the place of an equivalent cross-sectional area of rectangular duct, for branch takeoffs only.

2.4 SINGLE WALL SPIRAL ROUND DUCTS (concealed)

A. Manufacturers:

1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.
5. Substitutions: Division 1 - Product Requirements

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24

D. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22

2.5 SINGLE WALL SPIRAL FLAT OVAL DUCTS (concealed)

A. Manufacturers:

1. McGill AirFlow Corporation
2. Semco Incorporated
3. Tangent Air Corp
4. Spiral Mfg. Co., Inc.
5. Substitutions: Division 1 - Product Requirements.

- B. Product Description: Machine made from round spiral lockseam duct constructed of galvanized steel; rated for 10 inches wg pressure.
- C. Joints: Either fully welded or bolted flange with gasket material in accordance with manufacturer's recommendations.
- D. Construct duct minimum 24 gauge; where greater than 24 inches in major axis, minimum 22 gauge.
- E. Construct fittings with minimum 20 gauge; where greater than 24 inches in major axis, minimum 18 gauge.

2.6 DOUBLE WALL SPIRAL INSULATED ROUND DUCTS (exposed)

- A. Manufacturers:
 - 1. McGill AirFlow Corporation
 - 2. Semco Incorporated
 - 3. Tangent Air Corp
 - 4. Spiral Mfg. Co., Inc.
 - 5. Substitutions: Division 1 - Product Requirements.
- B. Product Description:
 - 1. Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1-inch-thick insulation, perforated inner wall.
 - 2. External surface primed and ready for finish painting per Division 09 requirements.
- C. Construction:
 - 1. Duct minimum 24 gauge; where greater than 24 inches in diameter, minimum 22 gauge.
 - 2. Fittings minimum 20 gauge; where greater than 24 inches in diameter, minimum 18 gauge.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.2 FABRICATION

- A. CASING FABRICATION
 - 1. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.
 - 2. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.
- B. DUCTWORK FABRICATION

1. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
2. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
3. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
5. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
6. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.
7. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
 - a. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
 - b. Do not provide sealing products not bearing UL approval markings.

3.3 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Flexible duct connections shall not exceed 6 feet in total length.
 1. Where total developed length must exceed 6 feet due to construction or obstructions, use next-size larger diameter; no longer than 12 feet in total length.
 2. Where direction change includes flexible duct connection, support entire portion of direction change with rigid support system to ensure cross-sectional area is not reduced by crimping.
- C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.
- E. Install ducts on appropriate hangers and supports secured direction from structure.
- F. Use double nuts and lock washers on threaded rod supports.
- G. Connect flexible ducts to metal ducts with adhesive plus mechanical fasteners.
- H. Exhaust Outlet Locations; unless otherwise noted:
 1. Minimum Distance from Property Lines: 3 feet.

- 2. Minimum Distance from Building Openings: 3 feet.
- 3. Minimum Distance from Outside Air Intakes: 10 feet.

- I. Support all ducts directly from structure with seismic-rated hanging system per Section 230529. Where exposed in occupied spaces; all hardware and support items shall be either stainless steel or coated with corrosion resistant primer per Division 09 requirements and prepared for Finish Painting.

- J. For ductwork exposed in occupied spaces; surface shall be coated with corrosion resistant primer per Division 09 requirements and prepared for Finish Painting.
 - 1. For ductwork exposed in occupied spaces, including shop areas and classrooms, all Supply, Return, Exhaust, particulate/dust removal, and fume removal ductwork shall be coated with corrosion resistant primer per Division 09 requirements and prepared for Finish Painting.
 - 2. For outdoor ductwork exterior to the building, protect ductwork, ductwork supports, linings and coverings from weather; prime all ferrous materials and components, including fasteners ready for weatherproof coating or covering.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

- B. Connect air terminal units air outlets and inlets to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.5 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Final cleaning.

- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.6 TESTING

- A. Pressure/leak test entire main trunk before duct insulation is applied or ductwork is concealed.
 - 1. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
 - 2. Maximum Allowable Leakage: In accordance with ICC IECC.

3.7 SCHEDULES

- A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel, Aluminum
Supply (System with Cooling Coils)	Galvanized Steel, Aluminum

Griffin Bike Park Clubhouse
Terra Haute, IN

Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply	1-inch wg regardless of velocity.
Return and Relief	1/2-inch wg regardless of velocity.
General Exhaust	1/2-inch wg regardless of velocity.
Particulate or Fume Exhaust	1-inch wg regardless of velocity.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Back-draft dampers.
 - 2. Duct access doors.
 - 3. Dynamic fire dampers.
 - 4. Volume control dampers.
 - 5. Flexible duct connections.
 - 6. Duct test holes.

- B. Related Sections:
 - 1. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
 - 2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

- B. ASTM International:
 - 1. ASTM E1 - Standard Specification for ASTM Thermometers.

- C. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

- D. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

- E. Underwriters Laboratories Inc.:
 - 1. UL 555 - Standard for Safety for Fire Dampers.
 - 2. UL 555C - Standard for Safety for Ceiling Dampers.
 - 3. UL 555S - Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers duct access doors and duct test holes.

- C. Product Data: Submit data for shop fabricated assemblies and hardware used.

- D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
 - 1. Fire dampers including locations and ratings.
 - 2. Smoke dampers including locations and ratings.
 - 3. Backdraft dampers.
 - 4. Flexible duct connections.
 - 5. Volume control dampers.
 - 6. Duct access doors.
 - 7. Duct test holes.
- E. Product Data: For fire dampers smoke dampers combination fire and smoke dampers submit the following:
 - 1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
 - 2. Indicate materials, construction, dimensions, and installation details.
 - 3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- F. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of access doors test holes
- C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

- A. Dampers tested, rated and labeled in accordance with the latest UL requirements.
- B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 1 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Product Requirements: Product storage and handling requirements.

- B. Protect dampers from damage to operating linkages and blades.
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- D. Storage: Store materials in a dry area indoor, protected from damage.
- E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 COORDINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work where appropriate with building control Work.

1.11 WARRANTY

- A. Division 1 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Carnes
 - 2. Greenheck.
 - 3. Nailor
 - 4. Titus
 - 5. Ruskin.
 - 6. United Enertech
 - 7. Substitutions: Division 1 - Product Substitution Requirements.

2.2 BACK-DRAFT DAMPERS

- A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized steel, or extruded aluminum.
 - 1. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges.
 - 2. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin.
 - 3. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1-inch thick insulation with sheet metal cover.
 - 1. Less than 12 inches square, secure with sash locks.
 - 2. Up to 18 inches Square: Furnish two hinges and two sash locks.
 - 3. Up to 24 x 48 inches: Three hinges or 'piano' hinge, and two compression latches.
 - 4. Larger Sizes: Furnish 'piano' hinge.
 - 5. Sash Lock or Compression Latch.
 - a. Access panels with sheet metal screw fasteners are not acceptable.

2.4 DYNAMIC FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555.
- B. Fire Resistance: time rating equal to or greater than that of the partition protected.
- C. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.
- D. Construction:
 - 1. Integral Sleeve Frame: Minimum 20 gage roll formed galvanized steel.
 - 2. Blades:
 - a. Style: Curtain type.
 - b. Action: Spring or gravity closure upon fusible link release.
 - c. Material: Minimum 24 gage roll formed, galvanized steel.
 - 3. Closure Springs: Type 301 stainless steel, constant force type, if required.
- E. Fusible Link Release Temperature: 165 degrees F
- F. Mounting: Vertical or horizontal as indicated on Drawings.
- G. Duct Transition Connection, Damper Style:
 - 1. A style - rectangular connection, frame and blades in air stream.
 - 2. B style - rectangular connection, blades out of air stream, high free area.
 - 3. G style - A style connection, grille mounting tabs at end of sleeve for grille.
 - 4. CR style - round connection, sealed.
 - 5. CO style - oval connection, sealed.
 - 6. R style - round connection, blades in air stream, non-sealed.
 - 7. LR style - round connection, blades out of air stream, non-sealed.
 - 8. LO style - oval connection, non-sealed.
- H. Finish: Mill galvanized.

2.5 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, or as indicated on Drawings.
- B. Pressure Independent:
 - 1. Manufacturer
 - a. Design Base: Mestek AIR-YNX series.
 - b. Arrow
 - c. Air Balance
 - d. Cesco Products
 - e. L&D
 - f. Substitutions: Per Division 01 requirements.
 - 2. Pressure independent airflow regulator device, inline with duct or branch takeoff for supply, return, or exhaust duct to regulate air flow automatically based on a specified operating differential pressure range set by the installer.
- C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
 - 1. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings.
 - a. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings.
 - b. Furnish closed end bearings on ducts having pressure classification over 2" WG.
- D. Position Indicator:
 - 1. Furnish locking, indicating (or quadrant) regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount with standoff mounting brackets, bases, or adapters for visual confirmation and access for adjustment without disturbing insulation.
 - 3. Where rod lengths exceed 30 inches, furnish regulator at both ends.

2.6 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Minimum 2 inches wide.
 - 3. Metal: Minimum 3 inch wide, 24 gage galvanized steel
- C. Leaded Vinyl Sheet: Minimum 0.55-inch-thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.7 DUCT TEST HOLES

- A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify rated walls are ready for fire damper installation.
- C. Verify ducts and equipment installation are ready for accessories.
- D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.
- C. Access Doors: Install access doors at the following locations and as indicated on Drawings:
 - 1. Spaced every 50 feet of straight duct.
 - 2. Upstream of each elbow.
 - 3. Upstream of each reheat coil.
 - 4. Before and after each duct mounted filter.
 - 5. Before and after each duct mounted coil.
 - 6. Before and after each duct mounted fan.
 - 7. Before and after each automatic control damper.
 - 8. Before and after each fire damper smoke damper combination fire and smoke damper.
 - 9. Downstream of each VAV box.
 - 10. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.
- D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated on Drawings. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
 - 1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE DAMPER.
- E. Install temporary duct test holes where indicated on Drawings and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- F. Install fire dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
 - 1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
 - 2. Install dampers square and free from racking with blades running horizontally.
 - 3. Do not compress or stretch damper frame into duct or opening.

Griffin Bike Park Clubhouse
Terra Haute, IN

4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 DEMONSTRATION

- A. Division 1 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Recessed Ceiling exhaust fans.

B. Related Sections:

1. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for resilient mountings and snubbers for fans for placement by this section.
2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
3. Section 26 05 03 - Equipment Wiring Connections: Execution and product requirements for connecting equipment specified by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:

1. AMCA 99 - Standards Handbook.
2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. ASTM International:

1. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:

1. UL 705 - Power Ventilators.
2. UL 1004: Standards for Safety, parts 1, 3, and 7 for Rotating Electrical Machines, thermally and electronically protected motors.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
- C. Product Data: Submit data on each type of fan and include accessories; fan curves with specified operating point plotted for ducted fans; power; RPM; sound power levels for both fan inlet and outlet at rated capacity for indoor fans in occupied spaces; electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Location: As-built mechanical plan indicating actual installed location of each fan.
- C. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- C. ETL-certified.
- D. UL Compliance:
 - 1. UL 705: UL listed and labeled, designed, manufactured, and tested.
 - 2. UL 1004: Standards for Safety, parts 1, 3, and 7 for Rotating Electrical Machines, thermally and electronically protected motors, as applicable.
- E. Balance Quality: Conform to AMCA 204.
- F. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

1.6 QUALIFICATIONS

- A. Manufacturer:
 - 1. Company specializing in manufacturing products specified in this section with minimum three years' experience.
 - 2. ISO 9001-certified.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience or approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Deliver product in original, undamaged packaging with labels intact. Products shall be new and free from defects.
- C. Protect fans and all components from weather and construction dust, stored in a secure dry location until installation.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for commercial exhaust fans.

1.11 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.
- B. Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
- C. Perform work without removing fans from service during building normal occupied hours.
- D. Furnish service and maintenance of fans for one year from Date of Substantial Completion.
 - 1. Examine each fan and all components at end of service and maintenance period. Clean, adjust, and lubricate equipment and report condition of each fan to owner.
- E. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.
 - 1. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.12 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one set of spare replacement belts for each belt driven fan.

PART 2 PRODUCTS

2.1 GENERAL – EXHAUST FANS

- A. Manufacturers:
 - 1. Acme Engineering and Manufacturing Corp.
 - 2. Broan/NuTone
 - 3. Carnes
 - 4. Greenheck Corp.
 - 5. Loren Cook Company
 - 6. Panasonic
 - 7. Penn-Barry Ventilation
 - 8. Twin City (Equal).
 - 9. Substitutions: Division 01 - Product Requirements.

2.2 CEILING EXHAUST FANS (EF-1)

- A. Design Base; Greenheck Corp., SP-B Series.
- B. Configuration: Recessed mount in ceiling, attached cover with grille opening for flush appearance, serviceable from below.
- C. Centrifugal Fan Unit:
 - 1. Sones: 1.2 nominal.
 - 2. Direct driven centrifugal with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral inlet and outlet duct collar.
- D. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection, mounted on rubber-shear isolators.
- E. Performance: See Schedule.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify support framing, housekeeping pads, penetration sleeves, and other rough-in general construction items are properly installed and dimensions are as required by manufacturer.

3.2 PREPARATION

- A. Furnish pads, curbs, frames, and adapters as necessary for installation.

3.3 INSTALLATION

- A. Secure fans with corrosion resistant fasteners.

- B. Suspended and Cabinet Fans:
 - 1. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
 - 2. Anchor fans directly to structure above, with vibration isolation, using mechanical support system rated for the seismic zone at the project location per Section 230548.
 - C. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings, where not factory installed.
 - D. Install safety screen where inlet or outlet is exposed in the space.
 - E. Install backdraft dampers on discharge of exhaust fans and as indicated on Drawings.
 - F. Install outlet louver or weather cap finished to match building trim color, with pest screen, where outlet is exposed to the exterior of the building.
- 3.4 MANUFACTURER'S FIELD SERVICES
- A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.
- 3.5 CLEANING
- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
 - B. Vacuum clean all portions of system and inside of fan cabinet at completion.
- 3.6 DEMONSTRATION
- A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.
 - B. Demonstrate fan operation and maintenance procedures.
- 3.7 PROTECTION OF FINISHED WORK
- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
 - B. Do not operate fans for until ductwork is clean, and fan has been test run under observation.
- 3.8 SCHEDULES - As indicated on Drawings.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Diffusers.
 - 2. Grilles.
 - 3. Louvers.
- B. Related Sections:
 - 1. Section 09 90 00 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
 - 2. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

- A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Acutherm
 - 2. Carnes
 - 3. Hart and Cooley
 - 4. Metal*Aire
 - 5. KRUEGER
 - 6. Nailor
 - 7. Thermal Products Corp.
 - 8. TUTTLE & BAILEY
 - 9. Price
 - 10. Titus
 - 11. Substitutions: Per Division 1, shall be approved by engineer prior to bid.

2.2 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, adjustable pattern, stamped, multi-core Square and rectangular, adjustable pattern, multi-louvered diffuser to discharge air in 360 degree one way two-way three-way four-way pattern with sector baffles where indicated.
- B. Frame: Surface mount Snap-in Inverted T-bar Spline type. In plaster ceilings, furnish plaster frame and ceiling frame.
- C. Fabrication: Aluminum with baked enamel finish to match ceiling panels.
- D. Accessories: Radial opposed-blade Butterfly Combination splitter damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- E. Thermally Activated:

1. Where scheduled, provide diffuser with wax-piston automatic airflow regulator to close off supply air once mechanical setpoint is achieved in the space.
2. Provide model with automatic changeover from cooling mode to heating mode, with separate setpoint for each, accessible from below.

2.3 PERFORATED FACE CEILING DIFFUSERS

- A. Type: Perforated face with fully adjustable pattern and removable face.
- B. Frame: Surface mount Snap-in Inverted T-bar Spline type. In plaster ceilings, furnish plaster frame and ceiling frame.
- C. Fabrication: Aluminum frame and baked enamel finish to match ceiling panels.
- D. Accessories: Radial, opposed-blade, Butterfly, or Combination splitter damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.4 CEILING SLOT DIFFUSERS

- A. Type: Continuous 1/2 inch-wide slot, number of slots as scheduled wide, with adjustable vanes for left, right or vertical discharge; integral ceiling fire damper where installed in fire rated ceiling assembly.
- B. Fabrication: Aluminum extrusions with factory clear lacquer or powder-coated white.
- C. Frame: 1-1/4-inch margin with concealed support clips for Accessible Ceiling Tile grid mounting and gasket mitered end border.
- D. Plenum: Integral, galvanized steel, insulated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify inlet and outlet locations.
- C. Verify ceiling systems are ready for installation.

3.2 INSTALLATION

- A. Select type of diffuser based on Drawing, location, application, notes and schedules. Size neck or connection point and branch duct based on airflow indicated.
- B. Install diffusers to ductwork with airtight connection.

- C. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00.
- D. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Section 09 90 00.
- E. Do not locate air registers, diffusers or grilles in floors of toilet or bathing rooms.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.4 SCHEDULES – See Drawings

END OF SECTION

SECTION 23 40 00

HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Disposable panel filters.
 - 2. Filter frames and housings.
 - 3. Electronic Bi-Polar Ionization Emitter Systems.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for wiring products for placement by this section.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 850 - Commercial and Industrial Air Filter Equipment.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- C. Military Standardization Documents:
 - 1. MIL MIL-STD-282 - Filter Units and Related Products: Performance-Test Methods.
- D. Underwriters Laboratories Inc.:
 - 1. UL 586 - High-Efficiency. Particulate, Air Filter Units.
 - 2. UL 867 - Electrostatic Air Cleaners.
 - 3. UL 900 - Air Filter Units.
 - 4. UL 2998 - Zero Ozone Emissions.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to ARI 850 Section 7.4.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- C. Product Data: Submit data on filter media, filter performance data, dimensions, and electrical characteristics.

- D. Manufacturer's Installation Instructions: Submit assembly and change-out procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish one-year complete parts and labor warranty for air cleaning devices.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one complete set of all disposable panel filters for all equipment.
- C. Furnish laminated list, indicating each equipment with a filter, by tag ID shown on drawings and matching engraved nameplate on equipment, with type and exact size of each filter panel used by that equipment.

PART 2 PRODUCTS

2.1 DISPOSABLE MEDIA PANEL FILTERS

- A. Media: UL 900 Class 2, pleated fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive, wire or poly mesh supported to maintain shape of pleats.
 - 1. Nominal Size: Each filter size selected per unit to ensure full airflow scheduled, efficient duct transition from return duct to unit connection, and to allow insertion of panel filter at industry-standard, readily available sizes.

2. Thickness:
 - a. Construction (temporary): 1 inch
 - b. Completion: Thickness based on application and equipment.
- B. Performance Rating:
 1. Face Velocity: 500 fpm
 2. Initial Resistance: Max 0.15-inch wg

2.2 ELECTRONIC BI-POLAR IONIZATION EMITTER SYSTEMS

- A. Manufacturers:
 1. Global Plasma Solutions.
 2. Bioclimatic; Aerotron/IGD series.
 3. Nu-Calgon; iWave series.
 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Assembly: Recognized 3rd party listed UL 867 corrosion-proof assembly containing electronic emitters and associated surfaces. System shall be UL 2998 tested for safe performance.
 1. Electronic Emitters: Independently supported and nested per manufacturer's proprietary design and layout, ionizing section or components with appropriately spaced grounded and charged ionizing elements in the air stream.
 2. Electrical Power Supply: Self-contained, pre-wired rectifying or similar unit to convert line-voltage power available at equipment, to the required voltage and characteristics (e.g. DC) for ionization; including any required overload protection, on-off switch or disconnect, visual indicators of operating status, and controls.
 3. Safety Accessories: Manufacturer's safety components shall function per listing for any appropriate conditions.

2.3 FILTER BOX FRAMES AND HOUSINGS

- A. Split-System Air Handlers:
 1. Provide and install 4" filter box assembly upstream of return air base or equipment inlet, with tool-less access door, arranged for easy filter replacement with no obstructions.
 2. Exact model shall be selected by contractor to meet performance and airflow requirements as Scheduled on Drawings.
- B. Filter frames:
 1. Supporting structures of 16 gage galvanized steel or extruded aluminum T-section construction with necessary gaskets between frames and walls.
 2. Standard Sizes: For interchange ability of filter media; for panel filters, select size of filter box for commonly available replaceable pleated filter media.
 - a. Box shall accept disposable pleated filter panels of 1" through 4" thick.

2.4 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: In accordance with Section 26 05 03 and the following:

1. Voltage, phase, and circuit ampacity for power supplied to electronic components shall be coordinated between trades to ensure proper wiring per manufacturer's wiring diagrams and installation instructions.
 2. Where sub-system defined or required by this Section is supplied by the equipment served, coordinate all electrical support work with manufacturer's wiring diagrams and installation instructions and provide all required components and wiring necessary to ensure proper code-compliant and fully functioning systems at no further cost to owner.
- B. Disconnect Switch: Factory mount at equipment.

PART 3 EXECUTION

3.1 INSTALLATION - FILTERS

- A. Construction: Install 1-inch-thick disposable type filter during entire period of construction. Change/replace as necessary based on need and field-observed loading to protect equipment.
1. Do not operate fan system until temporary filters are in place.
- B. Substantial Completion: Replace temporary filters used during construction and testing, with clean set.
1. Split System equipment (Indoor Fan-powered Furnaces) shall have supply fan motors selected for appropriate Static Pressure handling to ensure Scheduled airflows for equipment and ductwork system and 50% loading of final filters installed at substantial completion, which shall be MERV-12.
- C. Install filter box assembly with felt, rubber, or neoprene gaskets to prevent passage of unfiltered air around filters.

3.2 INSTALLATION – BI-POLAR IONIZATION

- A. Construction: Install bi-polar emitter system in equipment noted, sized and selected to match equipment physical size, scheduled cfm, and layout, per manufacturer's recommendations.
1. Install emitters downstream of final filters, and upstream of coils, where possible.
 2. Coordinate with electrical trade for all line-voltage power requirements.
 3. Emitter system shall be activated at all times unit is running.
- B. Substantial Completion: Fully clean all emitter surfaces to ensure peak performance.

END OF SECTION

SECTION 23 54 01

SPLIT SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Forced air heatpump furnaces with refrigerant coils, electric resistance backup heating, and outdoor heatpump units.
 - 2. Electronic Air Cleaners.
 - 3. Controls.

- B. All mechanical work is to be performed to ASHRAE codes including but not limited to 62, 90.1, and 55, SMACNA latest edition, and to all local and state requirements and applicable owner requirements.

- C. Related Sections:
 - 1. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ductwork and duct liner specified by this section.
 - 2. Section 23 33 00 - Air Duct Accessories: Execution requirements for flexible duct connections specified by this section.
 - 3. Section 23 40 00 - HVAC Air Cleaning Devices: Product requirements for air cleaning for equipment specified by this section.
 - 4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - 2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
 - 3. ARI 520 - Positive Displacement Condensing Units.
 - 4. ARI 610 - Central System Humidifiers.

- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
 - 2. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
 - 3. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

- C. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.

- D. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

- E. Underwriters Laboratories Inc.:
 - 1. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical.
- F. United States Department of Energy:
 - 1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittals procedures.
- B. Product Data: Submit rated capacities, efficiencies, weights, required clearances, and location and size of field connections, accessories, electrical nameplate data, and wiring diagrams.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Installation Instructions: Submit rigging, assembly, and installation instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and connections.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, service instructions, installation instructions, maintenance and repair data, and parts listing.

1.5 QUALITY ASSURANCE

- A. Furnace Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with applicable DOE, ANSI, and UL standards.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience or approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept furnaces, humidifiers, electronic air cleaners, heatpumps/condensing units and controls on site in factory packaging. Inspect for damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install condensing unit foundation pad when ground is frozen or muddy.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for heatpumps.

1.11 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of furnace and accessories for one year from Date of Substantial Completion.
- C. Include systematic examination, adjustment, and lubrication. Repair or replace parts whenever required. Use parts produced by manufacturer of original equipment.

1.12 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one filter for each furnace per Section 234000.

PART 2 PRODUCTS

2.1 ELECTRIC FURNACES

- A. Manufacturers:
 - 1. Daikin
 - 2. Carrier
 - 3. Lennox.
 - 4. Substitutions: Division 01 - Product Requirements.
- B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, refrigerant coil section, backup resistance heating section, controls, air filter, and accessories; wired for single power connection with control transformer or with terminals for secondary electrical power connection where furnace and backup resistance heat are separated circuits.
 - 1. Air Flow Configuration: As indicated on Drawings.
 - 2. Refrigeration: Refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan, interconnecting piping.
 - 3. Heating: Heatpump mode of refrigeration circuit.

- a. Backup heating: Electric resistance.
- 4. Accessories:
 - a. Electronic air cleaner.
- C. Cabinet: Steel with baked enamel finish, easily removed and secured access-doors, internal insulation of all portions of unit exposed to conditioned air, with liner protection.
- D. Supply Fan: Centrifugal type resiliently mounted with direct drive motor.
- E. Motor: NEMA MG 1; multi-tap speed selection or variable speed as Scheduled, with volume set during Test and Balance and to meet Sequence of Operations.
- F. Electric Heater, backup:
 - 1. Helix wound bare nichrome wire heating elements arranged in incremental stages or SCR variable control, with porcelain insulators.
 - 2. Heater stages in sequence with factory pre-determined delay between heating stages.
 - 3. High limit temperature control shall de-energize heating elements, automatic reset.
 - 4. Supply fan starts simultaneously with or before electric elements are energized and continue operating until thermostat is satisfied or until outlet air temperature reaches factory safety setting.
- G. Air Filters:
 - 1. Per Section 234000.
 - 2. Provide 4" filter box assembly upstream of return air base or equipment inlet, with tool-less access door, arranged for easy filter replacement with no obstructions.
 - 3. Construction: Install disposable filter during work.
 - 4. Completion: Install final filter as specified.
- H. Performance:
 - 1. Refer to Furnace Schedule.
- I. Electrical Characteristics: In accordance with Section 26 05 03 and manufacturer's nameplate data for each circuit.
 - 1. Disconnect Switch: Where not factory provided, mount switch on or near equipment to disable furnace for servicing.

2.2 HEATPUMP/CONDENSING UNITS

- A. Standard series supplied with furnace noted above, compliant with Scheduled requirements and the following:
 - 1. Construction and Ratings: SEER/EER as Scheduled on Drawings.
 - a. Ratings shall always meet or exceed currently adopted Energy Code at project location; Testing: ASHRAE 15, ARI 210/240; UL 207 as applicable.
 - 2. Compressor: ARI 520; hermetic, resiliently mounted integral with condenser, with positive lubrication, motor overload protection and drier. Furnish time delay control to prevent short cycling.
 - 3. Secure mechanical anchoring to housekeeping pad.
- B. Refrigeration Accessories:

1. Filter Drier, high-pressure switch (manual reset), low-pressure switch (automatic reset), service valves and gage ports and thermometer well (in liquid line).
 2. Furnish thermostatic expansion valves.
 3. Furnish refrigerant piping, factory cleaned, dried, pressurized and sealed.
 4. Insulated liquid and hot gas lines (both) for entire length between units.
 - a. All portions of insulated refrigerant piping exposed inside the building within 8' AFF shall receive PVC jacketing for protection.
 - b. All portions of insulated refrigerant piping exposed to exterior shall receive UV resistant jacketing.
 - c. See Section 230700.
- C. Air Cooled Condenser: ARI 520; aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
1. Rated cooling output: As Scheduled.
 2. Furnish equipment scheduled as Heatpump units with appropriate reversing valves and controls.
- D. Refrigeration Operating Controls: tied to control of indoor air handler to ensure proper mode of operation to fulfill Sequence of Operations requirements.
- E. Electrical Characteristics: In accordance with Section 26 05 03 and manufacturer's nameplate data for each circuit.
1. Disconnect Switch: Mount switch adjacent equipment, final connection shall be liquid tight flexible conduit.

2.3 ELECTRONIC AIR CLEANERS

- A. Provide and install Bi-Polar Ionization Emitter sized and selected to match unit, per Section 234000.

2.4 CONTROLS

- A. Manufacturers:
1. Design Base: Programmable thermostat or unit controller provided as standard by approved manufacturer of equipment where capable of complete functions as detailed on Drawings and Sequence of Operations indicated in Section 230993.
 2. Carrier
 3. Ecobee
 4. Honeywell
 5. Nest
 6. Substitutions: Division 01 - Product Requirements.
- B. Programmable Controls: Low voltage; appropriate signals and interface to control furnace heating system, compressor and condenser fan, supply fan and associated components as an assembled system; with termination and response for sensors as required fulfilling all functions of the specified Sequence of Operations for controlled equipment.
- C. Electric solid state microcomputer based thermostat or unit controller shall include:
1. Sensor(s), integral and remote, as noted or required by Sequence of Operations.
 2. Automatic switching from heating to cooling.

3. Occupied/Unoccupied scheduling for each day of week, to include control of Outside Air and space temperature setpoints.
4. Minimum of four separate scheduled periods of occupancy status and temperatures for each day.
5. Instant manual override of Occupied mode to activate OA and change setpoint for timed period, typically up to 2 hours. Generally momentary pushbutton or touchscreen activation.
6. Selection features including degree F or degree C display, 12 or 24-hour clock, remote sensor, fan On-Auto.
7. Battery replacement without program loss.
8. Display:
 - a. Time of day and Day of week.
 - b. Actual room temperature.
 - c. Programmed temperature setpoint.
 - d. System mode indication: Occupied/Unoccupied, Heating, Cooling, Fan.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify building is ready for installation of units and openings are as indicated on Drawings.

3.2 INSTALLATION

- A. Install furnace air handler unit at approximate location indicated on Drawings.
 1. Where provided as a separate section for field installation, install cased coil evaporator unit sealed and fastened to furnace.
 2. Where vertical, install on return air base fabricated to support weight of unit, to match full size of unit inlet, with direct connection of 4" filter box assembly per Section 234000.
 3. Pipe drain for each item as noted on manufacturer's installation instructions, from cooling coils etc. to nearest clear water waste receptacle (floor drain or sanitary hub-drain connection) for the purpose, coordinated with Plumbing trade. Ensure condensate drain connection, p-trap, and slope to intended routing for piping are oriented and configured to ensure no serviceable access or filter components are impeded.
 4. Connect system return ductwork to return air section or filter-box assembly with flexible duct connection.
 5. Connect system supply ductwork to equipment outlet with flexible duct connection.
- B. Mount air cooled condenser-compressor/heatpump package on concrete or composite housekeeping pad, level, to maintain manufacturer's clearance and servicing requirements on all sides.
 1. Install refrigeration systems in accordance with ASHRAE 15. Insulate all refrigerant piping.
- C. Connect units to disconnect switches, ensure electric power circuits match manufacturer nameplate data.
- D. Provide, install, and connect all controls, sensors, and components to units and ensure proper function and response for each.

1. Install control components supplied with equipment and provide control wiring between all sensors and equipment.
2. Install control wiring between unit controller/thermostat, indoor unit, and outdoor unit for a complete operational system.

3.3 FIELD SERVICES

- A. Division 01 - Quality Requirements: Requirements for field services.
- B. Furnish initial start-up, testing, adjusting, balancing, and provide all servicing during first year of operation, including routine servicing and checkout.

3.4 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.
- C. Install new filters in units at Substantial Completion per Section 234000.

3.5 DEMONSTRATION

- A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate to owner's representative all facets of unit operation, controls programming, and routine maintenance.

3.6 SCHEDULES: See Drawings.

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes electrical connections to equipment.
- B. Related Sections:
 - 1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 ABBREVIATIONS

- A. OCPD; Overcurrent protection device.

1.4 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configuration, and construction.
- C. Manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Submittal procedures.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.6 COORDINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

- E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 DIRECT CONNECT

- A. Final connection to required disconnect at equipment, from rigid homerun raceway system, shall be by flexible conduit for seismic compliance.
 - 1. See Section 260533.
- B. Disconnect switch, where not factory installed:
 - 1. See Section 262819.
 - 2. Fused type where OCPD is greater than nameplate MOP.
 - 3. Non-fused type where circuit characteristics match nameplate data of equipment.

2.2 CORD AND PLUGS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
- C. Cord Construction: Type SO or SJO as applicable for use; multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.

- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
 - 1. No branch circuits shall share a common grounded (neutral) conductor.
 - 2. Branch circuits routed in a common conduit or raceway and sharing a bonding (fault-current) conductor shall have that bonding conductor sized per NEC requirements for the largest circuit.

3.3 ADJUSTING

- A. Division 1 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.4 EQUIPMENT CONNECTION SCHEDULE

- A. Direct-Connected Equipment:
 - 1. Electrical Connection:
 - a. Equipment: provide field-installed disconnect switch where not integral with equipment being connected and overcurrent device is not within line-of-sight per NEC.
 - b. Indoor: Flexible conduit or whip.
 - c. Outdoor: Liquid-tight flexible conduit.
 - 2. Voltage, circuit ampacity, and OCPD as required by factory nameplate of installed equipment.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable, conduit and tubing, surface raceway, boxes, wiring devices, wiring connectors, and connections.
- B. Related Sections:
 - 1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.
 - 2. Division 31 – Trenching & Backfill requirements.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
 - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

- A. Wiring Products:
 - 1. Solid or stranded conductor for feeders and branch circuits 10 AWG and smaller.
 - 2. Stranded conductors for control circuits.
 - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
 - 4. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
 - 5. 8 AWG conductors for 20 ampere, 120 volt branch circuits longer than 150 feet.
- B. Wiring Methods:
 - 1. Concealed Dry Interior Locations: Building wire, Type THHN/THWN insulation, in raceway; nonmetallic-sheathed cable where NEC compliant for the application, armored cable, or metal clad cable.
 - 2. Exposed Dry Interior Locations: Building wire, Type THHN/THWN/XHHW insulation, in raceway or metal wiremold.
 - 3. Above Accessible Ceilings: Building wire, Type THHN/THWN insulation, in raceway; armored cable, or metal clad cable.
 - 4. Wet or Damp Interior Locations: Building wire, Type THHN/THWN/XHHW insulation, in raceway, direct burial cable, rated/listed armored cable or metal clad cable.

5. Exterior Locations: Building wire, Type THHN/THWN/XHHW; direct burial insulation, in raceway, service-entrance cable. Equipment connections; liquid-tight flexible metal clad cable.
6. Underground Locations: Building wire, Type THHN/THWN/XHHW or direct burial insulation, in raceway.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper; 75C for service/feed conductors, 60C per NEC for all equipment and branch loads 100A and below.
 1. When aluminum conductor is substituted by Contractor for copper conductor; Contractor shall size conductors to match circuit requirements for conductor ampacity and voltage drop.
 2. Aluminum substitution only allowed for service/feed conductors, and only with Owner consideration and Engineer pre-approval.
- B. Raceway and boxes are located as indicated on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- C. Raceway Components:
 1. Underground More than 5 feet outside Foundation Wall: Provide thin wall non-metallic conduit rated for direct burial. Provide cast metal boxes or nonmetallic hand hole.
 2. Underground Within 5 feet from Foundation Wall: Provide thin wall non-metallic conduit rated for direct burial. Provide cast metal or nonmetallic boxes.
 3. In or Under Slab on Grade: Provide thin wall non-metallic conduit rated for direct burial. Provide cast or nonmetallic metal boxes.
 4. Outdoor Locations, Above Grade: Provide rigid steel conduit or thick wall (Schedule-80) non-metallic conduit rated for outdoor UV exposure, threaded fittings. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
 5. In Slab Above Grade: Provide electrical metallic tubing or conduit. Provide sheet metal boxes.
 6. Wet and Damp Locations: Provide thick or thin wall non-metallic conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
 7. Concealed Dry Locations: Provide electrical metallic tubing conduit. MC-cabling or similar factory connect system where NEC compliant and listed for the application. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
 8. Exposed Dry Locations: Provide intermediate metal conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
 9. Lighting Connections: Provide 1/2 inch flexible metal conduit. Provide sheet-metal boxes. Provide sheet metal boxes. Provide hinged enclosure for large pull boxes

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.6 COORDINATION

- A. Division 1 - Administrative Requirements: Requirements for coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Product Description: Single conductor insulated wire.
- B. Conductor:
 - 1. Equipment or branch conductors: Copper.
 - 2. Service Entry or Panel Feed conductors:
 - a. Copper for sizes smaller than 4/0 AWG;
 - b. Copper or aluminum (with listed connections and methods) for sizes 4/0 AWG and larger.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation and Terminal Temperature Rating:
 - 1. 60°C for all branch and equipment circuits less than 100 Amp capacity.
 - 2. 75°C for all other circuits unless otherwise noted.
 - 3. 90°C for service or feed circuits where all terminations are so rated.

2.2 NONMETALLIC-SHEATHED CABLE

- A. Conductor: Copper. Maximum size 2 AWG.
- B. Insulation Voltage Rating: 600 volts.

2.3 DIRECT BURIAL CABLE

- A. Conductor: Copper for sizes smaller than 4/0 AWG; copper or aluminum for sizes larger than 4/0 AWG.
- B. Insulation Voltage Rating: 600 volts.
- C. When UF cable is to be installed as non-metallic sheathed cable, insulation Temperature Rating: 90 degrees C.

2.4 SERVICE ENTRANCE CABLE

- A. Conductor: Copper for sizes smaller than 4/0 AWG; copper or aluminum for sizes larger than 4/0 AWG.
- B. Insulation Voltage Rating: 600 volts.

- C. Insulation: Type USE, SE, USE-2, XHHW-2, RHH, RHW-2 as applicable.

2.5 ARMORED CABLE

- A. Product Description:
 - 1. Armor Material: Steel.
 - 2. Armor Design: Interlocked metal tape or Corrugated tube.
- B. Conductor: Copper.
 - 1. Must include separate bonding conductor.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 75 degrees C.

2.6 METAL CLAD CABLE

- A. Product Description:
 - 1. Armor Material: Steel.
 - 2. Armor Design: Interlocked metal tape or Corrugated tube.
- B. Conductor:
 - 1. Must include separate insulated bonding conductor.
 - 2. Copper, stranded, including current carrying conductors and equipment bonding conductor.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 75 degrees C.
- E. Jacket: Where required by application.
- F. MC-PCS: Metal Clad cable – Power Control Signal.
 - 1. Metal Clad cables containing copper conductors for power, along with a jacketed twisted pair used for control wiring used for control of the device or circuit being powered (e.g. lighting dimming).

2.7 SURFACE METAL RACEWAY

- A. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway, with manufacturer's standard enamel finish.
 - 1. Furnish manufacturer's standard accessories; match finish on raceway.
 - 2. Device boxes shall be "finish" type for surface mount with no exposed unused knock-outs.

2.8 WIRING CONNECTORS

- A. Permitted types:
 - 1. Split Bolt Connectors
 - 2. Solderless Pressure Connectors
 - 3. Spring Wire Connectors
 - 4. Compression Connectors

- B. Use connector type listed for the application.

2.9 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
- B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Route raceway and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
 - 1. Adjust box location up to 10 feet prior to rough-in when required to accommodate intended purpose.
 - 2. Do not install flush mounting box back-to-back in walls; install boxes with minimum 24 inches separation.
- D. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- E. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.
- F. Special Techniques - Cable:
 - 1. Protect exposed cable from damage.
 - 2. Support cables above accessible ceiling, using spring metal clips or, metal, or plenum-rated plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
 - 3. Use suitable cable fittings and connectors.

- G. Special Techniques - Direct Burial Cable:
 - 1. Trench and backfill for direct burial cable installation. Install warning tape along entire length of direct burial cable, within 3 inches of grade.
 - 2. Use suitable direct burial cable fittings and connectors.
- H. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 - 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
 - 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - 7. Terminate aluminum conductors with tin-plated, aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
 - 8. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- I. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- J. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- K. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- L. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

- A. Where not otherwise stated:
 - 1. For ungrounded current carrying conductors of wire sizes 10 AWG and smaller, install wire with insulation of the colors below. For wire sizes 8 AWG and larger, identify wire either with insulation of these colors or equivalently colored tape at terminals, splices and boxes, in accordance with the following:
 - a. 120/240V/1PH — black, red.
 - 2. For Grounded (neutral) current carrying conductors of wire sizes 10 AWG and smaller, install wire with insulation of the colors below. For wire sizes 8 AWG and larger, identify wire either with insulation of these colors or equivalently colored tape at terminals, splices and boxes, in accordance with the following:
 - a. 120/240V/1PH - White.
 - b. When two or more neutrals are located in one conduit, individually identify each with proper circuit number or equivalent NEC-compliant method.
 - c. No branch circuits shall share a common grounded (neutral) conductor.

- B. Branch and Feeder Circuit Conductors:
 - 1. Install three or four wire home runs with each phase uniquely color coded as noted above.
 - 2. Where conductors are not available or contractor selects to use alternate identification, conductor insulation for ungrounded conductors shall be black. Contractor shall uniquely color code each phase with listed electrical tape fully wrapped around each conductor within 3 inches of each termination or splice, where accessible and visible for identification, using the above general color coding plan.

- C. Bonding (fault current) Conductors:
 - 1. For 6 AWG and smaller: Green.
 - 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

END OF SECTION

SECTION 26 05 22

MANUFACTURED CABLING ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes prefabricated flexible cables, distribution units, and cable accessories for system of wiring using manufactured wiring assemblies.
 - 1. Such flexible cable assemblies may be used in any accessible (i.e. above accessible ceilings) areas, where permissible by Code and local municipal AHJ.
- B. Related Sections:
 - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Receptacle and wall switch outlets.
 - 2. Section 26 27 26 - Wiring Devices: Convenience receptacles and wall switches.
 - 3. Section 26 51 00 - Interior Lighting: Fixture connector assemblies.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate distribution box, switch box, outlet, and cable layout and branch circuit configuration.
- C. Product Data: Submit catalog data for each cable type and for each fitting and accessory.

1.4 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of cable assemblies and branch circuits.

1.5 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 COORDINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Furnish luminaire connectors to luminaire manufacturer for factory installation.

PART 2 PRODUCTS

2.1 MANUFACTURED WIRING ASSEMBLIES

- A. Manufacturers:
 - 1. Approved lighting fixture manufacturers (see schedule).
 - 2. AMP Inc.
 - 3. Hubbell Wiring Devices
 - 4. Siemens Co.
 - 5. Substitutions: Must be pre-approved by Engineer prior to bid per Division 1 requirements.
- B. Product Description: Factory assembled cable assemblies with appropriate connector on each end, with lengths and circuit configurations as required to meet circuit requirements on Drawings
- C. Switching Unit Assemblies: Cable assembly with pigtail on one end. Furnish cables configured for 3-way and 4-way switches, or continuous hot legs, where required.
- D. Dimming Unit Assemblies:
 - 1. Cable assembly with pigtail on one end. Furnish cables configured for 3-way and 4-way switching or continuous hot legs, where required.
 - 2. Cable may include control conductors (e.g. twisted pair) within the metal clad cabling assembly dedicated to the lighting system, fixture, or circuit that is being powered.
- E. Convenience Receptacle Unit Assemblies: ~6 ft long cable assembly with 6 inch pigtail or quick-connect on one end. Furnish cables configured to match device type.
- F. Luminaire Connector Assemblies: ~6 ft long cable assembly with 6 inch pigtail or quick-connect on one end.
- G. Luminaire Connector Assemblies: Connector suitable for mounting in luminaire body knockout.

2.2 DISTRIBUTION UNITS

- A. Product Description: Boxes suitable for terminating building wiring system raceways and making connections to integral receptacles; circuit configuration as indicated on Drawings.

2.3 ACCESSORIES

- A. Furnish manufacturer's standard accessories, including cable extenders, distribution tees, and switching assemblies.

2.4 CORD REELS

- A. Design Base: as indicated on Drawings.
- B. Manufactured cabling assembly consisting of spring-return core unit, frame suitable for mounting to surface identified on Drawings, with position-retention and pull-attachment at end for user convenience.
- C. Cabling shall be of gauge rated for current ampacity of dedicated circuit as identified on Panel Schedules for that circuit; typically minimum #12 AWG stranded, with insulation equivalent to SO for environment where installed and listed for tension use.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Support cable by means of straps and clamps, directly from structure. Do not support from ceiling suspension system or other piping or duct systems.
- B. Arrange cable to avoid interference with access to other Work.
- C. Install each cable with 10 percent slack length.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rod electrodes.
 - 2. Wire.
 - 3. Mechanical connectors.
 - 4. Exothermic connections.

- B. Related Sections:
 - 1. Division 3 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.
 - 2. Division 9 - Access Flooring: Grounding systems for access flooring.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

- C. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

- A. Grounding systems use the following elements as grounding electrodes:
 - 1. Metal underground water pipe.
 - 2. Metal building frame.
 - 3. Concrete-encased electrode.
 - 4. Rod electrode.
 - 5. Plate electrode.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms maximum.

1.5 SUBMITTALS

- A. Division 1 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground.

1.6 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 1 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.10 COORDINATION

- A. Division 1 - Administrative Requirements: Requirements for coordination.
- B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. Erico, Inc.
 - 2. O-Z Gedney Co.
 - 3. Thomas & Betts, Electrical.
 - 4. Substitutions: Preapproval prior to bid per Division 1 - Product Requirements.
- B. Material: Copper-clad steel or Copper.
 - 1. Diameter: Minimum 5/8 inch.
 - 2. Length: Minimum 10 feet.

2.2 WIRE

- A. Material: Stranded or solid Copper.
- B. Foundation Electrodes: Minimum 4 AWG.
- C. Grounding Electrode Conductor: Copper conductor, bare, sized for service per NEC.
- D. Bonding Conductor: Copper conductor, bare or insulated (green), sized for circuit per NEC.
- E. Equipment Grounding conductors with all feeders and branch circuits shall be insulated, sized for circuit per NEC.

2.3 MECHANICAL CONNECTORS

- A. Manufacturers:
 - 1. Erico, Inc.
 - 2. ILSCO Corporation.
 - 3. O-Z Gedney Co.
 - 4. Panduit
 - 5. Thomas & Betts, Electrical.
 - 6. Substitutions: Preapproval prior to bid per Division 1 - Product Requirements.
- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
 - 1. Burndy
 - 2. Copperweld, Inc.
 - 3. ILSCO Corporation
 - 4. O-Z Gedney Co.
 - 5. Thomas & Betts, Electrical

6. Substitutions: Preapproval prior to bid per Division 1 - Product Requirements.
- B. Product Description: IEEE Std 837-2002 compliant; Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

- A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 INSTALLATION

- A. Install a minimum of three (3) rod electrodes spaced 10' apart near service disconnect location as indicated on Drawings, and at or near supplemental grounding locations as required by state or local codes or manufacturer's requirements for specific facility or equipment installation.
 1. Install additional rod electrodes to achieve specified resistance to ground.
- B. Install grounding and bonding conductors concealed from view.
 1. Install Grounding Electrode Conductor and connect to reinforcing steel in foundation footing as well as metal services to existing building per Code requirements.
 2. Electrically bond steel together between service and existing as well as new construction.
- C. Connections: Grounding system components and building elements to be bonded shall be connected to Conductors using Exothermic connections.
 1. Exceptions:
 - a. Mechanical (bolted) connections may be used where above grade and accessible.
 - b. Permanent mechanical embossed crimp connections may be made at any location above or below grade, accessible or concealed, only where fitting and system used to create bond are IEEE Std 837-2002 compliant and UL 467 Listed.
- D. Equipment Grounding/Bonding Conductor: Install separate, insulated conductor within each feeder circuit raceway. Terminate each end on suitable lug, bus, or bushing.

- E. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- F. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.
- G. Install ground grid under access floors as indicated on system installation instructions.
- H. Accomplish bonding of electrical system by using insulated grounding/bonding conductor installed with feeders and branch circuit conductors in conduits.
 - 1. Size grounding conductors in accordance with NEC.
 - 2. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment.
 - 3. Ground raceway, enclosures, and boxes by means of grounding bushings at terminations with installed grounding/bonding conductor.
- I. Permanently attach equipment and grounding conductors prior to energizing equipment.
- J. A new Electrical Service entry is shown within the scope of this project:
 - 1. Install in accordance with IEEE recommendations.
 - 2. Install rod electrodes at locations nearest service entry and as noted. Install additional rod electrodes where required to achieve specified resistance to ground.
 - 3. Install continuous grounding using all underground metallic piping systems, including cold water system and building steel as grounding electrode. Where water piping is not available or is not metal, install artificial station ground by means of driven rods or buried electrodes.
 - 4. Install grounding electrode conductor and connect to reinforcing steel in foundation footing where present.
 - 5. Bond together metal siding not attached to grounded structure; bond to ground.
- K. Intersystem grounding/Bonding Tie: provide a copper intersystem tie buss with sufficient terminals to bond the service Grounding Electrode Conductor, panelboard grounding conductors, telephone, data, CATV, and all other system bonding conductors.

3.4 FIELD QUALITY CONTROL

- A. Comply with Division 1 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. When improper grounding is found on any receptacles, check all receptacles in entire project and correct. Perform retest.
- C. Perform ground resistance testing in accordance with IEEE 142.

1. Where greater than performance requirement maximum, install and bond one additional ground rod at approximate distance from nearest rod to match length of rod, and retest.
- D. Where a new Electrical Service entry is shown within the scope of this project:
1. Inspect and test in accordance with NETA ATS, except Section 4.
 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

B. Related Sections:

1. Division 3 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Division 7 - Firestopping: Product requirements for firestopping for placement by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Hangers and Supports shall be provided for all electrical equipment, compliant with seismic rating of the project location.
- B. Firestopping Materials:
 - 1. UL 263 and UL 1479; to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
 - 2. Comply with requirements of Division 7.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping Materials: Comply with requirements of Division 7.

1.6 SUBMITTALS

- A. Division 1 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 1 - Administrative Requirements: Pre-installation meeting.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

- A. Product Description: Mounting hole and screw closure.

2.4 STEEL BRAIDED WIRE ROPE

- A. Uncoated galvanized, or stainless steel wire rope with listed hardware anchors, supports, and accessories for a complete system by one supplier.
- B. Size shall be selected based on manufacturer capacity ratings to meet that required by the seismic zone of the project location and the load to be supported.

2.5 SLEEVES

- A. Sleeves Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- B. Stuffing Fire-stopping Insulation: Glass fiber type, non-combustible.

2.6 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 7.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide precast inserts and preset inserts.
 - 2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.4 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 7 and installation requirements to meet UL listing and FM compliance for the application.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors to above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with firestopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

- A. Division 1 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

3.8 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

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3.9 PROTECTION OF FINISHED WORK

- A. Division 1 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 4. Section 26 05 53 - Identification for Electrical Systems.
 - 5. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code (NEC).
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- D. International Mechanical Code (IMC).
- E. Underwriters Laboratories (UL).
 - 1. UL-6A - Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
 - 2. UL-797A - Standard for Electrical Metallic Tubing - Aluminum and Stainless Steel

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground more than 5 feet outside Foundation Wall: Provide rigid steel conduit, intermediate metal conduit, plastic coated conduit, or thickwall nonmetallic conduit. Provide cast metal boxes or nonmetallic handholes as needed. Conduit from below-grade elbow to initial vertical section of conduit which penetrates finished grade (exterior to building) shall be Rigid Steel Conduit for impact protection.
- C. Underground within 5 feet from Foundation Wall: Provide rigid steel conduit, intermediate metal conduit, plastic coated conduit, or thickwall nonmetallic conduit. Provide cast metal or nonmetallic boxes as needed.
- D. In or Under Slab on Grade: Provide rigid steel conduit, intermediate metal conduit, plastic coated conduit, or nonmetallic conduit. Provide cast or nonmetallic metal boxes as needed.
- E. Outdoor Locations, Above Grade: Provide rigid steel or aluminum conduit, intermediate metal conduit or electrical metallic tubing. Provide cast metal pull and junction boxes.
- F. In Slab Above Grade: Provide rigid steel conduit, intermediate metal conduit, electrical metallic tubing or thickwall nonmetallic conduit. Provide cast, sheet metal, or nonmetallic boxes to match conduit.
- G. Wet and Damp Locations: Provide rigid steel or aluminum conduit, intermediate metal conduit, electrical metallic tubing, thickwall nonmetallic conduit, or nonmetallic tubing where NEC and IMC compliant with location. Provide cast metal or nonmetallic outlet, junction, and pull boxes to match conduit. Provide flush mounting outlet box in finished areas.
- H. Concealed Dry Locations: Provide rigid steel or aluminum conduit, intermediate metal conduit, electrical metallic tubing, thickwall nonmetallic conduit or nonmetallic tubing where NEC and IMC compliant with location. Provide sheet-metal boxes. Provide hinged enclosure for large pull boxes.
 - 1. MC cabling may be used where permissible by Code and with approval of local/municipal AHJ.
- I. Exposed Dry Locations: Provide rigid steel or aluminum conduit, intermediate metal conduit, electrical metallic tubing or thickwall nonmetallic conduit. Provide cast or sheet-metal boxes. Provide flush mounting or surface-mount 'finish' type outlet box in finished areas where recessed box for flush mounting cannot be installed. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

- A. Minimum raceway size: 3/4 inch unless otherwise specified.
- B. Minimum single pole switch-leg raceway size: 1/2 inch unless otherwise noted.

1.5 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
 - 1. Flexible metal conduit.
 - 2. Liquid-tight flexible metal conduit.
 - 3. Nonmetallic conduit.
 - 4. Flexible nonmetallic conduit.
 - 5. Nonmetallic tubing.
 - 6. Raceway fittings.
 - 7. Conduit bodies.
 - 8. Surface raceway.
 - 9. Wireway.
 - 10. Pull and junction boxes.
 - 11. Handholes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inch.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.8 COORDINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate installation of outlet boxes for all equipment to be connected.
- C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Carlon Electrical Products
 - 2. Cooper/B-Line.
 - 3. Hubbell Wiring Devices
 - 4. Thomas & Betts Corp.
 - 5. Walker Systems Inc.
 - 6. The Wiremold Co.
 - 7. Substitutions: Division 1 - Product Requirements.

2.2 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
 - 1. Stainless Steel: UL-6A
- B. Rigid Aluminum Conduit: ANSI C80.5, UL-6A.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.3 PVC COATED METAL CONDUIT

- A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil minimum thickness.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 FLEXIBLE METAL CONDUIT

- A. Product Description: Interlocked construction.
- B. Fittings: NEMA FB 1.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Product Description: Interlocked construction with PVC jacket.
- B. Fittings: NEMA FB 1.

2.6 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3; galvanized tubing.
 - 1. Stainless Steel or Aluminum: UL-797A.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron.

2.7 NONMETALLIC CONDUIT

- A. Product Description: NEMA TC 2; Schedule 40 thinwall applications, Schedule 80 for thickwall applications; PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.8 NONMETALLIC TUBING

- A. Product Description: NEMA TC 2; Schedule 40; PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.9 SURFACE METAL RACEWAY

- A. Design Base: Legrand; Wiremold.
- B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- C. Size: selected based on NEC fill capacity requirements for the application.
- D. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway. Color selected by Architect.

2.10 SURFACE NONMETAL RACEWAY

- A. Product Description: Plastic or Fiberglass channel with fitted cover, suitable for use as surface raceway.
- B. Finish: shall match coverplate or trim color as selected by Architect.
- C. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish matching raceway.

2.11 WIREWAY

- A. Product Description: General purpose, Oiltight and dust-tight, or Raintight type wireway to match application/location installed.
- B. Knockouts: Manufacturer's standard, field created as required.
- C. Cover: Hinged or Screw cover. Full gaskets where used in damp or wet location.
- D. Connector: Slip-in or Flanged.
- E. Fittings: Lay-in type with removable top, bottom, and side; captive screws drip shield.
- F. Finish: Rust inhibiting primer coating with enamel finish.

2.12 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel, or stainless steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, Furnish gasketed cover by box manufacturer. Furnish threaded hubs where exposed outdoors.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- E. Wall Plates for Unfinished Areas: Furnish gasketed cover.
- F. Weatherproof "While In Use" exterior boxes:
 - 1. Design Base: Arlington Model DVB1C.
 - 2. Construction:
 - a. NEC Section 406 compliant, UL listed.
 - b. Recessed/Semi-recessed box (in sleeve) type.
 - c. Extra-Duty cover.
 - d. Pest control blocking of cord openings when not in use.
 - e. Textured/paintable, neutral base color.

2.13 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 27 16.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type determined by location and application; flat-flanged, surface mounted junction box:
 - 1. Material: Galvanized cast iron or Cast aluminum.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside or inside flanged to match application, recessed cover box for flush mounting:
 - 1. Material: Galvanized cast iron Cast aluminum.
 - 2. Cover: Smooth Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "ELECTRIC".
- E. Fiberglass or Concrete composite Handholes: Die-molded, glass-fiber concrete composite hand holes:
 - 1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
 - 2. Cover: Glass-fiber concrete composite, weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Where surface mount raceway must be used due to solid or filled wall with no cavity for concealed, recessed raceway installation, install vertically from accessible ceiling area junction box to elevation of device and connect to device 'finish' box.
 - 1. Any horizontal surface raceway shall include 90-deg fittings and caps compatible with raceway as required to complete the intended installation.
 - 2. Where multi-channel raceway is required due to parallel runs of power and power-limited cabling, ensure channel dividers are continuous and maintained throughout entire raceway, boxes, and fittings.
- B. All flexible raceway methods shall be fully supported from structure above or clipped/secured to structural elements and shall not rest on or be supported by other systems.
- C. Any raceway routing shown is approximate location only unless dimensioned. Route to complete wiring system.
- D. Arrange raceway supports to prevent misalignment during wiring installation.
- E. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- F. Group related raceway; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional/future raceways.
- G. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- H. Do not attach raceway to ceiling support wires or other piping systems.
- I. Construct wireway supports from steel channel.

- J. Route exposed raceway parallel and perpendicular to walls.
- K. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- L. Where installing conduit in and under slab, route from point-to-point where possible.
 - 1. Maximum Size Conduit in slab above grade: 3/4 inch.
 - 2. Do not cross conduits in slab above grade larger than 1/2 inch.
- M. Maintain clearance between raceway and piping for maintenance purposes.
- N. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- O. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- P. Bring conduit to shoulder of fittings; fasten securely.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- R. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- S. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams.
- T. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- U. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control, and expansion joints.
- V. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- W. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- X. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- Y. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

- A. Where surface mount devices must be used due to solid or filled wall with no cavity for concealed, recessed (flush) installation, install 'finish' box (no knockouts, no 'backbox' allowed) at elevation of device.
- B. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings or as specified in section for outlet device.

- C. Adjust box location up to 8 feet prior to rough-in to accommodate intended purpose.
- D. Orient boxes to accommodate wiring devices oriented as specified in other Sections.
- E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- F. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- G. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- H. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- J. Install stamped steel bridges to fasten flush mounting outlet box where between-stud location is required.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Install steel channel fasteners for hung ceiling outlet box.
- M. Do not fasten boxes to ceiling support wires or other piping systems.
- N. Support boxes independently of conduit.
- O. Install gang box where more than one device is mounted together. Do not use sectional box.
- P. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with UL and FM requirements and, where specified, compliant with Division 7 Sections.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Division 1 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.

Griffin Bike Park Clubhouse
Terra Haute, IN

- C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Conduit markers.
 - 5. Underground Warning Tape.
 - 6. Lockout Devices.

1.2 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.

1.3 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Division 1 - Product Requirements: Environmental conditions affecting products on site.
- B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. 3M, Inc.
 - 2. Brady Worldwide, Inc.
 - 3. Brimar Industries, Inc.
 - 4. Craftmark Identification Systems
 - 5. Kolbi Pipe Markers Co.
 - 6. Marking Services Incorporated.
 - 7. Master Lock Company
 - 8. Safety Sign Co.
 - 9. Seton Identification Products
 - 10. Substitutions: Per Division 1; Product Requirements.

- B. Products of approved manufacturers to match system or device to be identified, using code or industry standard color schemes where applicable.

2.2 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

- B. Letter Size:
 - 1. 1/8 inch high letters for identifying individual equipment and loads.
 - 2. 1/4 inch high letters for identifying grouped equipment and loads.

- C. Minimum nameplate thickness: 1/8 inch.

2.3 LABELS

- A. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.4 WIRE MARKERS

- A. Description: Cloth tape, split sleeve, or tubing type wire markers.

- B. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

2.5 CONDUIT AND RACEWAY MARKERS

- A. Description: Nameplate fastened with straps, Nameplate fastened with adhesive, or Labels fastened with adhesive.

- B. Color:
 - 1. Medium Voltage System: Black lettering on white background.
 - 2. 480 Volt System: Black lettering on white background.
 - 3. 208 Volt System: Black lettering on white background.

- C. Legend:
1. Medium Voltage System: HIGH VOLTAGE.
 2. 480 Volt System: 480 VOLTS.
 3. 208 Volt System: 208 VOLTS.

2.6 UNDERGROUND WARNING TAPE

- A. Description: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

2.7 LOCKOUT DEVICES

1. Anodized aluminum or Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
 4. Secure nameplate to equipment front using rivets or adhesive.
 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 6. Install nameplates for the following:
 - a. Switchboards.
 - b. Panelboards.
 - c. Transformers.
 - d. Service Disconnects.
- C. Label Installation:
1. Install label parallel to equipment lines.
 2. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
 2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
 3. Install labels at data outlets identifying patch panel and port designation.
- E. Raceway Marker Installation:

1. Install raceway marker for each raceway longer than 6 feet.
 2. Raceway Marker Spacing: 20 feet on center.
 - a. Raceway may be identified by color-coded conduit (entire length) or by field painting by colored band on each conduit longer than 6 feet, with a band every 20 feet on center and on each side of every penetration.
 - b. Color: 480 Volt System: Blue. 208 Volt System: Yellow.
- F. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.
- G. Alarm Systems:
1. The branch circuit disconnecting means (Panel ID and Breaker #) serving each alarm control unit device or enclosure shall be permanently identified on each control unit.
 2. System circuit disconnecting means shall be permanently identified as to its purpose in accordance with the following:
 - a. "FIRE ALARM" for fire alarm systems; disconnecting handle or identification marking shall be red.
 - b. "EMERGENCY COMMUNICATIONS" for emergency communications systems; disconnecting handle or identification marking shall be red.
 - c. "FIRE ALARM/ECS" for combination fire alarm and emergency communications systems; disconnecting handle or identification marking shall be red.
 - d. "SECURITY ALARM" for intrusion/access control systems.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes work at distribution and branch circuit panelboards.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 5. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 6. NEMA PB 1 - Panelboards.
 - 7. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
- E. Underwriters Laboratories Inc.:
 - 1. UL 67 - Safety for Panelboards.
 - 2. UL 1283 - Electromagnetic Interference Filters.
 - 3. UL 1449 - Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Requirements for submittals.

- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Product Data: Submit catalog data showing specified features of standard products.

1.4 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents:
 - 1. Record actual locations of panelboards and record actual circuiting arrangements.
 - 2. Provide owner's record copy of all typewritten panel Directories.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

- A. Division 1 - Execution and Closeout Requirements; Requirements for maintenance products.
- B. Furnish two of each panelboard key. Panelboards keyed alike.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Eaton/Cutler-Hammer
 - 2. GE Electric Company
 - 3. Siemens Energy & Automation, Inc.
 - 4. Schneider Electric/Square D Company
 - 5. Substitutions: Division 1 - Product Requirements.

2.2 DISTRIBUTION PANELBOARDS

- A. Product Description: NEMA PB 1, circuit breaker type panelboard.
- B. Panelboard Bus:
 - 1. Copper current carrying components, ratings as indicated on Drawings.
 - 2. Furnish copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating unless otherwise noted. Contractor shall make final coordination with Utility available Fault Current:

- D. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- E. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
- F. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
- G. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated on Drawings.
- H. Enclosure: NEMA PB 1, Type 1 where indoor; Type 3R where outdoor.
- I. Cabinet Front: Surface door-in-door type, fastened with hinge, finished in manufacturer's standard enamel.

2.3 BRANCH CIRCUIT PANELBOARDS

- A. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
 - 1. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
 - 2. Minimum Integrated Short Circuit Rating:
 - a. 10,000 amperes RMS symmetrical for 240-volt panelboards.
 - 3. Enclosure: NEMA PB 1, Type 1 – where shown indoors; Type 3R – where shown outdoors.
 - 4. Cabinet Box: Manufacturer standard, design base 20 inches wide.
 - 5. Cabinet Front: Flush or Surface mount cabinet front to match location indicated on Drawings; with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard enamel.
- B. Molded Case Circuit Breakers:
 - 1. NEMA AB 1
 - 2. Bolt-on type thermal magnetic trip circuit breakers
 - 3. Common trip handle for all multi-pole breakers
 - 4. Listed as Type SWD for lighting circuits
 - 5. Listed as Type HACR for air conditioning equipment circuits
 - 6. Class A ground fault interrupter circuit breakers for circuits requiring GFCI protection and as indicated on Drawings.
 - 7. Arc Fault Circuit Interrupt breakers for circuits requiring AFCI protection and as indicated on Drawings.
 - 8. Do not use tandem circuit breakers.
- C. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting

current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.

PART 3 EXECUTION

3.1 INSTALLATION – NEW PANELBOARDS

- A. Install new breakers in available slots.
- B. Install panelboards in accordance with NEMA PB 1.1.
- C. Install panelboards plumb.
- D. Install recessed panelboards flush with wall finishes.
- E. Height for panelboard: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- F. Install filler plates for unused spaces in panelboards.
- G. Provide typed circuit directory for each panelboard within the scope of this project.
 - 1. Revise and reprint directory to reflect final circuiting changes to balance phase loads.
- H. Install engraved plastic nameplate for each panel per Section 260553.
- I. Install spare conduits out of each recessed panelboard to accessible location above ceiling or below floor as applicable to serve area covered by that panelboard.
 - 1. Minimum spare conduits: 4 empty
 - 2. Size: 1 inch.
 - 3. Identify each as SPARE.
- J. Ground and bond panelboard enclosure according to NEC and Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Division 1 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.
- D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.
- E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

- A. Division 1 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Measure steady state load currents at each panelboard feeder; rearrange single phase circuits in panelboard to balance phase loads to within 20 percent.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wiring devices - wall switches; wall dimmers; receptacles; multi-outlet assemblies; enclosed relays, and related device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 - 1. Submit manufacturer's catalog information showing dimensions, features, and configurations.
 - 2. Submit manufacturer's standard color availability to Architect for selection.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Cooper Wiring Devices
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Substitutions: Division 1 - Product Requirements.
- B. Color of device and cover plate as selected by Architect.
- C. Ratings: Match branch circuit voltage and load characteristics.

- D. Connection: standard back and side wired.
 - 1. Where a manufacturer's quick-connect system is used, such as Hubbell SNAPConnect, the same system/manufacturer shall be used consistently throughout project for each type of device.

2.2 SWITCHES

- A. General Requirements:
 - 1. Specification Grade, General Duty, AC only general-use.
 - 2. Color: to match existing or that selected by Architect for trim.
- B. AC only general-use toggle switch.
 - 1. Snap switch activation unless otherwise noted
 - 2. Body and Handle: Plastic with toggle/rocker handle.
 - 3. Indicator Light: Lighted handle type switch where indicated on Drawings.
- C. Occupancy Sensing Wall Switch:
 - 1. Design Base: SensorSwitch
 - 2. Sensitivity and time delay adjustments, LED indication of sensed movement. User adjustable time-delay, manual override pushbutton.
 - 3. Dual-technology device shall include:
 - a. Infrared motion/presence sensing for one type.
 - b. Acoustic/microphonics as the other type, to avoid false unoccupied/off signals regardless of obstructions.
- D. Momentary pushbutton type:
 - 1. Where and as noted on Drawings; for overriding relays.
- E. Key Switch type:
 - 1. Spade key type. Match non-key switch ratings.
- F. Pilot Lamp:
 - 1. Momentary contact rocker type, with integral pilot light.
- G. Dimmer; NEMA WD 1.
 - 1. "Universal" Line Voltage:
 - a. Design Base: Leviton 6674-P0 series.
 - b. Full-range line-voltage dimming for up to 600W incandescent and/or up to 150W dimmable LED and CFL lamps.
 - 2. Fixtures with 0-10VDC dimming control:
 - a. Design Base: Leviton IP710-LF.
 - b. Line Voltage supply, On/Off pushbutton control with integral power supply and sliding 0-10VDC output dimming signal to compatible lighting fixtures. Electronic solid-state dimmer/lighting controller for LED light engine equipped fixtures.
 - 3. Type: Compatible with fixture(s) to be controlled, or as indicated on Drawings.
 - 4. Level Control: Body and Handle: plastic with linear slide to retain level setting.
 - a. On/Off: Plastic pushbutton toggle.

2.3 WALL SWITCHES (LOW VOLTAGE)

- A. Product Description: NEMA WD 1, General-Duty, pushbutton switch.

- B. Configuration: Plastic body with modular faceplate by lighting control manufacturer to match layout of pushbutton(s) as indicated on Drawings and as Specified with lighting control system.
- C. Indicator: LCD screen or LED indicator backlight for each pushbutton to show activated circuit.

2.4 PROGRAMMABLE TIME SWITCH

- A. Manufacturers:
 - 1. Design Base: Leviton; VPT24-1PZ.
 - 2. Legrand; RT24.
 - 3. Pass & Seymour; RT24W
 - 4. Substitutions: Division 1 - Product Requirements.
- B. Product Description:
 - 1. NEMA WD 1, General-Duty, AC only general-use relay internal switching function with LCD display for programming use.
 - 2. Single gang, 24-hour programmable lighting control switch with integral timeclock for digital daily programming.
 - 3. Automatic lighting from dusk to dawn, selectable by owner.
 - 4. Capable of directly switching line voltage circuit at 277V.
 - 5. Provide quantity required to control all exterior lighting circuits scheduled or noted on Drawings, while maintaining manufacturer Amperage rating of device(s).
 - 6. Body: Plastic with “modular” switch format and matching coverplate.
 - 7. Accessories; Relay/Contactor:
 - a. Where more than one circuit, or one or more multi-pole circuits (e.g. 208-240V) are to be controlled, provide and install multi-pole relay or contactor with terminals for sufficient controlled poles for all circuit conductors required.
 - b. Programmable Timer Switch shall be used to control the activation coil. Where only 2-pole circuits are controlled, splice/extend nearest available convenience circuit to PTS for control power.

2.5 PUSHBUTTON PRESET TIMER SWITCH

- A. Manufacturers:
 - 1. Design Base: Leviton; LTB60-1LZ.
 - 2. GE: 15318
 - 3. Intermatic: E1215W
 - 4. Legrand/P&S: RT1W or RT2W
 - 5. Pass & Seymour
 - 6. Substitutions: Division 1 - Product Requirements.
- B. Product Description:
 - 1. NEMA WD 1, General-Duty, AC only general-use relay internal switching function with preset pushbuttons, each clearly labeled, to select countdown timer duration.
 - 2. Single gang, with preset countdown activation periods.
 - 3. Capable of directly switching line voltage circuit at 120/277V as applicable.
 - 4. Body: Plastic with “modular” switch format and matching coverplate.

2.6 RECEPTACLES

- A. Product Description: NEMA WD 1, Specification-grade, general-duty, general use receptacle. Each device shall be 3rd-Party listed for the application.
- B. Configuration: NEMA WD 6, type as indicated on Drawings.
- C. Convenience Receptacle:
 - 1. Single location, dedicated circuit; Type 5-20.
 - 2. Multiple outlet circuit; Type 5-15 or 5-20.
- D. USB Charger Receptacle:
 - 1. Design Base: Hubbell USB(15)X2W
 - a. White; adjust for other color as selected by Architect or owner requirements.
 - 2. Convenience duplex receptacle with integral low voltage charging circuitry with two (2) USB compliant outlet ports for devices to meet current industry standard requirements; with minimum 2.5Amps available current at each charging port, and visual indicator of status.
- E. GFCI Receptacle:
 - 1. Design Base: Hubbell GFRSR(20).
 - 2. Convenience duplex receptacle with integral ground fault circuit interrupter to meet current regulatory requirements, including GFCI Standard 943; with automatic monitoring of functionality, visual or audible indication of loss of protection, and ‘fail-to-off’ feature to disable device in case of incorrect wiring or loss of protection.
 - 3. Standard receptacle may be installed wherever a listed GFI type breaker is used to serve the entire circuit.
 - a. Identify at each protected receptacle with label indicating “GFCI Protected” per NEC labeling requirements.
- F. USB/GFCI Receptacle:
 - 1. Design Base: Hubbell USB15X2W.
 - a. Leviton GUSB2-W
 - 2. Meets requirements of both USB and GFCI devices above.
- G. Tamper Resistant (TR) Receptacle:
 - 1. Design Base: Hubbell DR(15)WHITR.
 - 2. Convenience receptacle with integral tamper resistant shutters to protect energized components from contact with foreign objects. Nylon face, standard or ‘decorator’ style to match other devices.
 - 3. Other types of receptacles needing Tamper Resistance to meet Code requirements shall be similarly selected to include that feature.

2.7 ENCLOSED RELAY DEVICES

- A. Design Base: Functional Devices “Relay In Box” (RIB) series.
- B. UL listed, NEMA 1 enclosed relay/contactors device, threaded hub connection for direct mounting on junction box. Separate entry for code-compliant cabling for voltage-limited cabling where applicable.
 - 1. Voltage of signal to match control device described on Drawings or other specified devices.

2. Voltage, amperage capacity, poles, and other characteristics shall be selected by Contractor to meet nameplate data for the installed equipment on the circuit(s) requiring relay control by this device, as shown or described in Project Documents.
3. Normally Closed/Normally Open, latching, plenum rating, LED status indicator, and other options shall be provided to match functional description or as necessary to meet requirements of standard Sequence of Operations for the equipment or circuit being controlled.
4. Relays/Contacts shall be rated for Continuous Duty and rated for minimum 5 million cycles (mechanical).
5. Where only 2-pole circuits are controlled, splice/extend nearest available convenience circuit for control power.

2.8 WALL PLATES

- A. Decorative Cover Plate:
 1. Typical staff, office, or private occupied spaces; Nylon.
 2. Public, athletic, student, or high abuse and where indicated in occupied spaces; Stainless Steel.
 3. Maintenance, storage, or unoccupied spaces with surface mounted devices in metal finish boxes; Galvanized Steel.
- B. Jumbo Cover Plate: Use “jumbo” size where needed to cover gaps not concealed by standard size coverplate.
- C. Weatherproof While-In-Use Cover: Gasketed, cast metal or Stainless steel plate with hinged device cover allowing space for plug and cord access with cover in closed position.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Select and install type of device or switch as noted on Drawings or as required by Code adopted at project location and acceptable to Authority Having Jurisdiction.

- B. Install Arc-Fault Circuit Interrupt device wherever such protection is required by Code (see NEC 406) but not provided at the panel via listed Overcurrent Device.
 - 1. Where standard outlets are protected by listed Overcurrent Device at panel, apply label/tag or use coverplate with factory visual indication that outlet is AFI Protected.
- C. Install Ground-Fault Circuit Interrupt device wherever such protection is required by Code (see NEC 406) but not provided at the panel via rated Overcurrent Device.
 - 1. Where standard outlets are protected by listed Overcurrent Device, apply label/tag or use coverplate with factory visual indication that outlet is GFI Protected.
- D. Install Tamper Resistant Receptacle wherever such protection is required by Code (see NEC 406.12), including all dwelling unit outlet locations in areas specified in NEC 210.52 and 550.13, all guest rooms and suites, child care and education facilities, business offices, corridors, waiting rooms, dormitories, and others noted in NEC 518.2, except those which are:
 - 1. More than 5½ ft above the floor.
 - 2. Part of a luminaire or appliance.
 - 3. Located within dedicated space for an appliance that in normal use is not easily moved from one place to another.
- E. Install devices plumb and level.
- F. Install switches with OFF position down.
- G. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- H. Do not share neutral conductor on load side of dimmers.
- I. Install receptacles with grounding pole on bottom.
- J. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- K. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- L. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- M. Connect wiring devices by wrapping solid conductor around screw terminal.
 - 1. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- N. Use jumbo size plates for outlets installed in masonry walls and where needed to conceal gaps in other areas.
- O. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and rough-in height of outlet boxes to obtain mounting heights as specified unless otherwise noted on drawings.

- B. Where not otherwise noted on Drawings:
 - 1. Install wall switch or dimmer 48 inches above finished floor.
 - 2. Install standard convenience receptacle 18 inches above finished floor.
 - 3. Install ADA-compliant convenience receptacle 24 inches above finished floor.
 - 4. Install convenience receptacle 6 inches above counter or back splash of counter.
- C. Coordinate requirements for programmable switches to ensure any additional components such as relays and/or contactors are provided, where circuit capacity dictates, for a complete and functional control system for the loads described and the equipment being switched.

3.5 FIELD QUALITY CONTROL

- A. Division 01 - Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 19
ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fusible and non-fusible enclosed switches.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 DEFINITIONS

- A. Overcurrent Protection Device (OCPD) – An overcurrent protection device protects the circuit by opening the device when the current reaches a value that will cause an excessive or dangerous temperature rise in conductors, and must have an interrupting rating sufficient for the maximum possible fault-current available on the line side terminals.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Eaton/Cutler-Hammer
 - 2. GE
 - 3. Hubbell Inc.
 - 4. Siemens Energy & Automation, Inc.
 - 5. Schneider Electric/Square D Company
 - 6. Westinghouse.
 - 7. Substitutions: Section 01 60 00 - Product Requirements.

2.2 OCPD FUSIBLE SWITCH ASSEMBLIES

- A. Product Description: NEMA KS 1, Type HD or GD, as required for the application, enclosed load interrupter knife switch with fuse clips. Handle lockable in OFF position.
- B. Fuse clips: Designed to accommodate NEMA FU 1, fuses of Class to match manufacturer's recommendations for equipment to be protected.
- C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
 - 3. Industrial Locations: Type 4X.
- D. Service Entrance:
 - 1. Unless otherwise noted on Drawings, Exterior Service Entry Fused Disconnect switch shall be provided and fused to match service capacity, with type and fuses selected to meet utility available SCCR requirements.
 - 2. Switches identified for use as service equipment are to be labeled for this application.
 - 3. Furnish solid copper neutral assembly and ground bar for service GEC.
 - 4. Switch all ungrounded conductors.
 - 5. Cabinet Front: Access door shall be sealed and allow opening only with service de-energized.
- E. Furnish switches with copper current carrying parts.
- F. Equipment OCPD fusible switch assemblies.
 - 1. Product Description: NEMA KS 1, Type GD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
 - 2. Fuse clips: Designed to accommodate NEMA FU 1, fuses of Class to match manufacturer's recommendations for equipment to be protected.

2.3 NON-FUSIBLE SWITCH ASSEMBLIES

- A. Product Description: NEMA KS 1, Type GD enclosed load interrupter knife switch. Handle lockable in OFF position.
- B. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
 - 3. Industrial Locations: Type 4k.
- C. Equipment non-fusible switch assemblies
 - 1. Product Description: NEMA KS 1, Type GD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
- D. Furnish switches with copper current carrying parts.

2.4 SWITCH RATINGS

- A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
- B. Short Circuit Current Rating: UL listed for minimum 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). Contractor shall make final selection based on confirmed SCCR required based on Utility available fault current.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Service Entrance:
 - 1. Where main Distribution panelboard or switchboard is indicated, include Main Circuit Breaker or equivalent Fused Switch for Service OCPD with type and fuses selected to meet utility available SCCR requirements.
 - a. Where MCB provide service OCPD, include exterior Service Entry Non-Fused Disconnect switch to match service capacity; NEMA-3R.
 - 2. Switches identified for use as service equipment shall be labeled for this application.
 - 3. Furnish solid copper neutral assembly and ground bar.
 - 4. Furnish solid copper neutral assembly and ground bar for service GEC.
 - 5. Switch all ungrounded conductors.
 - 6. Cabinet Front: Access door shall be sealed and allow opening only with service de-energized.
- B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.
- C. Height: 5 feet to operating handle.
- D. Install fuses for fusible disconnect switches.

- E. Install engraved plastic nameplates.
- F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
 - 2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.
- C. Product Data:
 - 1. Submit dimensions, ratings, and performance data.
 - 2. Submit color selection chart from manufacturer illustrating luminaire finish colors available, for final selection by Architect prior to order.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.6 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 INTERIOR LUMINAIRES

- A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Refer to Division 01 - Product Requirements for product options.

2.2 SOLID STATE LIGHTING FIXTURES

- A. Product Description:
 - 1. Electronic solid state (LED) lighting engine with integral ballast and heat rejection.
 - 2. Less than 20 percent THD.
 - 3. Dimmable using 0-10V signal or through direct communication with fixture where so scheduled or indicated on Drawings. Dimming devices and systems shall be selected for compatibility with fixtures or lamps installed.
 - 4. Delivered lumens and color temperature shall be as scheduled, and selected to match throughout any occupied space or sight-lines.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.
- B. Support luminaires larger than 2ft in any dimension independent of ceiling framing.
- C. Locate recessed ceiling luminaires approximately as indicated on Drawings; coordinate with other trades and adjust layout as required to maintain even light distribution and symmetrical pattern.
- D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Exposed Grid Ceilings:
 - 1. Support surface-mounted luminaires on grid ceiling directly from building structure
 - 2. Install auxiliary members spanning ceiling grid members to support surface mounted luminaires
 - 3. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Install clips to secure recessed grid-supported luminaires in place.

- I. Install wall-mounted luminaires at height as indicated on Drawings.
- J. Install accessories furnished with each luminaire.
- K. Connect luminaires to branch circuit outlets using flexible conduit, MC cabling, or manufactured quick-connect flexible whip.
- L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- M. Install specified lamps in each luminaire.
- N. Ground and bond interior luminaires in accordance with Section 26 05 26.
- O. Switching and dimming of multiple circuits serving general lighting for any single space shall illuminate that space evenly and symmetrically to comply with current Energy and related Code requirements.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- B. Lighting systems shall be tested to ensure proper calibration, adjustment, programming of controls, and operation.

3.3 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust luminaires as indicated on Drawings and to provide even illumination.

3.4 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Protecting finished work.
- B. Re-lamp luminaires having failed lamps at Substantial Completion.

3.6 SCHEDULES – As indicated on Drawings.

END OF SECTION

SECTION 26 52 00
EMERGENCY LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes emergency lighting units and exit signs.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SYSTEM DESCRIPTION

- A. Emergency lighting to comply with requirements.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit dimensions, ratings, and performance data.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one replacement battery for each battery type and size.

PART 2 PRODUCTS

2.1 EMERGENCY LIGHTING UNITS

- A. Manufacturers: As Scheduled on Drawings.
- B. Product Description: Self-contained emergency lighting unit.

- C. Battery:
 - 1. Nickel-cadmium or Nickel-Metal-Hydride type, unless otherwise scheduled or provided as standard by approved/scheduled manufacturer.
 - 2. Battery shall have sufficient capacity to operate for a minimum 90 minute period at full load.
- D. Battery Charger: Capacity sufficient to recharge discharged battery to full charge within twelve hours, with automatic load sensing to protect battery life.
- E. Lamps: solid state (LED) type.
- F. Remote Fixtures: Where scheduled or shown on Drawings, remote lamps of same manufacturer/supplier to match fixtures on unit shall be used unless otherwise indicated.
- G. Indicators: Lamps to indicate power and status.
- H. TEST switch: Initiates test mode using integral battery supply.
- I. SELF-DIAGNOSTIC function: Each unit shall include periodic electronic Code-Compliance automatic testing and indicate visually if a fault is discovered or if unit fails to successfully last 90 minutes of battery power under load.
- J. Input Voltage:
 - 1. Selected to match voltage of lighting circuit of space served.
 - 2. Extend unswitched (hot) leg of lighting circuit in space served by emergency lighting fixture, such that fixture shall automatically activate upon loss of power to the lighting circuit.

2.2 EXIT SIGNS

- A. Manufacturers: As Scheduled on Drawings.
- B. Product Description: Exit sign fixture.
- C. Housing: Material and construction to match design base fixture as scheduled, with illuminated face clearly indicating "EXIT" with colored letters on white background.
- D. Directional Arrows: Universal type for field adjustment.
- E. Mounting: To match wall (header) or ceiling (pendant) location as applicable or as shown on Drawings.
- F. Battery: Nickel-Cadmium or Nickel-Metal-Hydride type, with minimum 90 minute capacity.
- G. Battery Charger: Capacity sufficient to recharge discharged battery to full charge within twelve hours, with automatic load sensing to protect battery life.
- H. Lamps: solid state (LED) type.
- I. Input Voltage:

1. Selected to match voltage of lighting circuit of space served.
2. Extend unswitched (hot) leg of lighting circuit in space served by signage fixture.

2.3 EMERGENCY POWER SUPPLY

- A. Manufacturers:
 1. Design Base: Bodine.
 2. Cooper Industries
 3. General Signal Corp.
 4. Mule Emergency Lighting
 5. Substitutions: Division 01 - Product Requirements.
- B. Product Description: Emergency battery power supply suitable for installation in accessible compartment of luminaire indicated, OR remotely in accessible indoor above-ceiling location serving any fixture (indoor or outdoor) that may be scheduled for backup, but which has no factory provision for integral emergency battery components.
- C. Battery: Sealed Lead Calcium, Nickel-Metal Hydride, or Lithium-Ion type, rated for minimum 5-year service life and 90-minute emergency operation.
- D. Include TEST switch and AC ON indicator light, installed to be operable and visible from outside of assembled luminaire.

PART 3 EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned emergency lighting units, exit signs, lamps, and accessories.
- B. Extend existing emergency lighting and exit sign installations using materials and methods compatible with existing installations, or as specified.
- C. Clean and repair existing emergency lighting units and exit signs remaining or are to be reinstalled.

3.2 INSTALLATION

- A. Contractor shall carefully review actual project conditions and layout of egress paths with Architectural Drawings. Provide and install sufficient emergency egress lighting, and exit signs where required by Code and AHJ, for safe egress of minimum illuminance of 0.1 footcandle along all egress paths until reaching a Public Way, including but not limited to those fixtures shown on Drawings.
- B. Provide and install stand-alone emergency egress lighting power supply only when lighting fixture(s) serving egress requirements do not have factory backup option available or where contractor determines suitable and preferred for the location and application.

- C. Install suspended exit signs using pendants supported from swivel hangers. Install pendant length required to suspend sign at indicated height.
- D. Install surface-mounted emergency lighting units and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Install wall-mounted emergency lighting units and exit signs at height as indicated on Drawings.
- F. Install accessories furnished with each emergency lighting unit and exit sign.
- G. Connect emergency lighting units and exit signs to branch circuit outlets provided in Section 26 05 33 as indicated on Drawings.
- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.
- I. Install specified lamps in each emergency lighting unit and exit sign.
- J. Ground and bond emergency lighting units and exit signs in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each unit after installation and connection. Inspect for proper connection and operation.
- C. Lighting systems shall be tested to ensure proper calibration, adjustment, controls, and operation.

3.4 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust lamp fixtures.
- C. Position exit sign directional arrows as indicated on Drawings.

3.5 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Protecting finished work.
- B. Relamp emergency lighting units and exit signs having failed lamps at Substantial Completion.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes general work results for Communications systems.
- B. Contractor coordination with existing utilities.
- C. Premises rough-ins, pathways and infrastructure installation including firestopping where documented in the architectural, structural, mechanical, and electrical Drawings.
- D. Not In Contract:
 - 1. Cabling for Telephone & Data.
 - 2. Active equipment for Audio, television, media delivery, computers, servers, hubs, switches, head-end gear, wireless access points, software, patch cords, and other systems or portions of systems that are not part of the jack-to-rack infrastructure shown are outside of the scope of these Construction Bid Documents and are to be provided and installed by others under separate contract with owner, or by owner.
- E. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
 - 4. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

- A. Local city and county ordinances governing electrical work.
- B. Currently adopted edition of the following:
 - 1. National Electrical Code (NFPA 70)
 - 2. American National Standards Institute (ANSI)
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. Telecommunications Industries Association (TIA)
 - 5. Electronic Industries Association (EIA)
 - 6. Institute of Electrical & Electronics Engineers (IEEE)
 - 7. Underwriters Laboratories (UL)
 - 8. American Standards Association (ASA)
 - 9. Federal Communications Commission (FCC)
 - 10. Occupational Safety and Health Administration (OSHA)
 - 11. American Society of Testing Material (ASTM)
 - 12. Americans with Disabilities Act (ADA)
- C. In the event of conflicts, the more stringent provision shall apply.

1.3 SYSTEM DESCRIPTION

- A. Rough-in boxes and Raceway Infrastructure:
1. Contractor shall complete installation of the Telephone and Data wireway work indicated on the Drawings or as specified herein.
 - a. This includes back-boxes, conduit stubbed above ceiling to accessible space, and pull cable at each, as described on Drawings, ready for use by owner.
 - b. Firestopping Materials: Comply with requirements of Division 07.
 2. Utility, CATV, or other service providers will be responsible for all cabling, splitter hardware, final connections of branch cabling and components, provide all active gear, and provide terminal jacks as needed under separate contract with owner; all such work is Not In Contract (NIC).
 - a. Utility shall be responsible for providing bonding of components to existing Inter-System Bonding Tie (ISBT) buss, bonded to existing building GEC.

1.4 DEFINITIONS

- A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Communications work:
1. Provide: Furnish, install and test (if applicable) complete.
 2. Infrastructure: Conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.
 3. Work: Materials completely installed, including the labor involved. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.
 4. Drawings: Illustrations generally diagrammatic and showing the arrangement and location of pathways, outlets, support structures and equipment.

1.5 RESPONSIBILITY

- A. Slab: Where exact locations are required by equipment for routing below, stubbing-up, or terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the slab is poured.
- B. Materials, equipment or labor not indicated: That which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.
- C. Changes: The right is reserved for reasonable changes in locations of equipment indicated on Drawings prior to rough in at no further cost.
1. The Contractor shall not reduce the size or number of conduit or homeruns indicated on the Drawings without the written approval of the Engineer.
 2. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, at no further cost.

3. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at no further cost.
- D. Locations: The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.
- E. Verify the structural elements, ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.
- F. Coordinate all work of other trades and make necessary adjustments to avoid conflicts.
- G. Review all architectural drawings for coordination with furniture.
- H. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as "the Contractor shall," "shall be," "as indicated on the Drawings," "In accordance with," "a," "the" and "all are intended" shall be supplied by inference.

1.6 SUBMITTALS

- A. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items.
 1. Product Data:
 - a. Submit catalog data for each termination device, cable, and outlet device.
 - b. Details of all materials, equipment and systems to be furnished.
 - c. Submittals for individual systems and equipment assemblies that consist of more than one item or component for the system or assembly as a whole.
 - d. Any other details not included in the construction drawings.
 2. Contractor shall generate shop drawings. Modify reviewed and accepted shop drawings to include revisions based upon completion of work. Submit shop drawings with record drawings on hard copy.
 - a. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.
 - b. The approval of material, equipment, systems and shop drawings is a general approval subject to the Drawings, Specifications and verification of all measurements at the job. Approval does not relieve the Contractor from the responsibility of shop drawing errors. The Contractor shall carefully check and correct all shop drawings prior to submission for approval.

PART 2 PRODUCTS

2.1 TELECOMMUNICATIONS TERMINATION BACKBOARD

- A. By Others. Coordinate with owner.

2.2 ACCESSORIES

A. Tie Wraps and Velcro Straps

1. Backbone cables shall be fastened to support structures with tie wraps or self-securing straps (such as Velcro hook-and-loop or ratchet/jaw type).
2. Horizontal cables shall be fastened to support structures with Velcro straps.
 - a. Tie Wrap color shall be black; plenum-rated Tie-Wraps used in plenum locations shall be red or orange.
 - b. Strap color shall be black; plenum-rated straps used in plenum locations shall be red or orange.

B. C-Rings/D-rings

1. C-rings/D-rings shall be used on backboards to support cables, patch cords and cross-connect wire. C-rings/D-rings shall be made of high-strength, fire-retardant material with rounded edges to prevent damage to cable and wire insulation.

2.3 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 07.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install backboxes, pathways, pull cable in accordance with EIA/TIA standards.
- B. Install pull wire or polyethylene pulling string in each empty telephone conduit over 10 feet in length or containing bend.
- C. Supports:
1. Where J-hook or trapeze system is used to support cable bundles in limited clearance areas, all horizontal cables shall be supported at a maximum of 48 inch intervals.
 2. At no point shall any cable rest on nor be supported by acoustic ceiling grids, panels, light fixtures, ductwork, piping, or other systems.
 3. Coax cabling shall be routed as high as practicable, with supports anchored to top chord or adjacent structural walls, and routed through open structural elements.
 - a. Cables shall be installed and supported independently above all other systems.
 - b. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 4. Tie wraps or straps shall be installed around cables at intervals of 12" minimum.
 - a. Tie wraps shall secure cables to vertical supports may use an "X" pattern.
 - b. Do not over-cinch cables.
- D. Refer to Section 26 05 53 - Identification for labeling details.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.
 - 1. Work includes complete design, layout, and installation of Fire Alarm System.
- B. Related Sections:
 - 1. Division 08 - Door Hardware: Door closers, electric locks, electric releases; release from inside in case of fire egress.
 - 2. Division 21 - Fire-Suppression System when present (by Sprinkler Contractor); monitoring circuits required to be tied into Fire Alarm specified by this Section.
 - 3. Division 23 – HVAC; powered mechanical systems controls, actuators, sensors, controlled devices, and system signal interfaces; circuits, actuators, and equipment required to be tied into Fire Alarm specified by this Section.
 - 4. Section 26 05 19 - Electrical Power Conductors and Cables.
 - 5. Section 26 05 29 - Hangers & Supports.
 - 6. Section 26 05 33 - Raceway and Boxes.
 - 7. Section 26 05 26 - Grounding and Bonding.
 - 8. Section 26 05 53 - Identification.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 72 - National Fire Alarm Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system.
 - 1. Capability for digital connection to remote central monitoring station service.
- B. Contractor shall provide final layout by at least a NICET certified designer, compliant with NFPA and the local AHJ, for a fully functioning system meeting all requirements of the current Codes adopted at project location.
 - 1. Any related equipment indicated on Drawings is only illustrative of expected coverage for reference and is not intended as a complete design.
- C. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
 - 1. Local fire alarm signaling devices sound and display with march time signal.

2. Location of alarm indicates on fire alarm control panel and on remote annunciator panel.
3. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service.
4. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
5. Signal transmits by zone to release door hold-open devices.
6. Signal releases magnetic door hold opens.
7. Signal releases electric door locks.

D. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

E. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:

1. Visual and audible trouble alarm indicates by zone at fire alarm control panel and at remote annunciator panel.
2. Trouble signal transmits to remote station.

1.4 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required.
- C. Test Reports: Required.
- D. Manufacturer's Field Reports: Required.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of fire alarm equipment.
- C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.
- D. Certification: Submit final test certification as required from local fire department or AHJ.

1.6 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Contractor: NICET Certified designer, fire alarm installers certified or having completed manufacturer training for system to be installed.

1.8 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Where Manual Station break-glass rods are installed, provide a quantity of replacement rods equal to 10% (1 for every 10) of quantity installed.
- C. Furnish five keys of each type used for lockable enclosures, which shall all be keyed alike.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers
 - 1. Notifier
 - 2. Silent Knight
 - 3. Simplex
 - 4. Edwards
 - 5. Substitutions: per Division 1 requirements, must be approved by Engineer prior to bid.

2.2 FIRE ALARM CONTROL PANEL

- A. Product Description: Modular fire alarm control panel with wall-mounted enclosure.
 - 1. Fully addressable system by point.
- B. Power supplies:
 - 1. Adequate to serve control panel modules, remote detectors, remote annunciators, smoke dampers, relays, and alarm signaling devices.
 - 2. Include battery-operated emergency power supply with capacity for operating system in standby mode for 60 hours followed by alarm mode for 5 minutes.
 - 3. All remote detectors, annunciators, actuators, relays, and signaling devices shall be provided with appropriate power supplies sufficient for quantity installed, separate from main panel.
- C. System Supervision: Component or power supply failure places system in trouble mode.
- D. Remote Station Signal Transmitter:
 - 1. Monitoring Service is a separate arrangement directly with owner and is Not In Contract.
- E. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts for each detection zone or addressable device, as applicable, to provide accessory functions specified or indicated on Drawings.

- F. Furnish cabling to connect entire system including panels, power supplies, sensors, signals, and remote-device control circuits (such as Smoke Dampers) compatible with system topology for Fire Alarm System selected and equipment end devices installed by other trades.
- G. Indicating Appliance Circuits: Supervised march time signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.

2.3 REMOTE ANNUNCIATOR

- A. Product Description: Remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble.
- B. Mounting: Factory mount in flush surface wall-mounted enclosure at location coordinated with Owner and approved by the local AHJ.

2.4 MANUAL FIRE ALARM STATIONS

- A. Product Description: Manual double-action station with visual indicator of activation that cannot be immediately reset by public.
 - 1. Break-glass rod.
 - 2. Key-reset from activated position.
- B. Type: Compatible with system installed.
- C. Mounting: Semi-Flush Surface.
- D. Mounting:
 - 1. Semi-Flush where located in stud partition with concealed backbox and cabling.
 - 2. Surface mounted only where located on solid wall construction, in 'finish' style box served by matching metal surface-mount raceway.

2.5 SPOT HEAT DETECTOR

- A. Product Description: Combination rate-of-rise and fixed temperature, spot heat detector.
- B. Type: Compatible with system installed.
- C. Temperature Rating: 135 degrees F.
- D. Rate-of-Rise: 15 degrees F.
- E. Mounting:
 - 1. Semi-Flush where located in ceiling or stud construction with concealed backbox and cabling in plenum above.
 - 2. Surface mounted only where located on solid ceiling or other construction, in 'finish' style box served by matching metal surface-mount raceway.

2.6 CEILING SMOKE DETECTOR

- A. Product Description: NFPA 72, ceiling smoke detector with the following features:
 - 1. Adjustable or system providing automatically adjusting sensitivity.
 - 2. Plug-in base.
 - 3. Auxiliary relay contact where required for application.
 - 4. Dual-tech with fixed-temperature; Integral thermal element rated 135 degrees F.
 - 5. Visual indication of detector actuation.
 - 6. Comply with UL 268.
- B. Type: Compatible with system installed.
- C. Mounting:
 - 1. Semi-Flush where located in ceiling or stud construction with concealed backbox and cabling in plenum above.
 - 2. Surface mounted only where located on solid ceiling or other construction, in 'finish' style box served by matching metal surface-mount raceway.

2.7 DUCT-MOUNTED SMOKE DETECTOR

- A. Product Description: NFPA 72, photoelectric type with the following features:
 - 1. Auxiliary SPDT relay contact where required for connection to associated equipment.
 - 2. Key-operated normal-reset-test switch.
 - 3. Duct sampling extending width of duct.
 - 4. Visual indication of detector actuation.
 - 5. Duct-mounted housing.
 - 6. Comply with UL 268A.

2.8 ALARM LIGHT/VISUAL

- A. Product Description: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.

2.9 ALARM HORN

- A. Product Description: NFPA 72, interior fire alarm horn with the following features:
 - 1. Sound Rating: 87 dB at 10 feet.
 - 2. Combination: Where co-located with visual signal device, may be supplied as a combination horn/strobe meeting requirements of both paragraphs.

2.10 DOOR RELEASE

- A. Product Description: Magnetic door holder with integral diodes to reduce buzzing.
- B. Coil voltage: Low voltage with power supply, or line voltage available.

2.11 WIRE AND CABLE

- A. Product Description:

1. Non-power limited fire-protective signaling cable, copper conductor, 150 volt insulation rated 60 degrees C.
 2. Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.
- B. Cable Located Exposed in Plenums:
1. Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.
- C. Fire alarm circuit conductors have insulation color or code as follows:
1. Fire Alarm System addressable system cabling: Red.
 2. Power Branch Circuit Conductors: Black, red, white (neutral).
 3. Initiating Device Circuit: Black, red.
 4. Detector Power Supply: Violet, brown.
 5. Signal Device Circuit: Blue (positive), white (common/negative).
 6. Door Release: Gray, gray.
 7. Municipal Trip Circuit: Orange.
 8. Municipal Fire Alarm Loop: Black, white.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify products and systems receiving devices are ready for installation.
 1. Coordinate all locations such as mechanical equipment (such as those including integral Smoke Detectors), ductwork penetrations (Mechanical Drawings) of smoke-rated partitions (Architectural Drawings), Sprinkler risers, and other devices installed by other trades, where Fire Detection and Alarm system integration for Detection or Alarm notification is required.
 2. Ensure that all systems are fully functional and provided with compatible power, signals, and FACP support.

3.2 INSTALLATION

- A. Install Main FACP where shown on Drawings. Install one supervised remote annunciator at location approximately where shown on Drawings and/or as coordinated with Owner and approved by the local AHJ.
- B. Where required by manufacturer's wiring topology, mount end-of-line device box with last device or separate box adjacent to last device in circuit.
- C. Where fire suppression (sprinkler) riser is present, install monitoring of tamper and flow switches and coordinate with other trades to ensure proper detection circuit, voltage, etc for integration into Fire Alarm system.
- D. Unless otherwise specified or required by local AHJ:

1. Install manual station with operating handle 4 feet 6 inches feet above floor.
 2. Install audible and visual signal devices 7 feet 6 inches feet above floor.
- E. Install 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit.
 - F. Where required by system type; mount interface module or end-of-line device, in box or enclosure, where required by system topology (e.g. with last device or separate box adjacent to last device in circuit).
 - G. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
 - H. Connect conduit and wire to all components.
 - I. Automatic Detector Installation: Conform to NFPA 72.
 - J. Install engraved plastic nameplates for all panels and enclosures.
 - K. Ground and bond fire alarm equipment and circuits in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test in accordance with NFPA 72 and local fire department requirements.
- C. Obtain final certification as required from local fire department or AHJ and provide copy to Architect and owner with Closeout Submittals.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Division 01 - Quality Requirements: Manufacturer's field services.

3.5 DEMONSTRATION AND TRAINING

- A. Furnish hours of instruction each for two persons, to be conducted at project site with owner's representative.

END OF SECTION