

**PROJECT MANUAL FOR**

CITY OF TERRE HAUTE  
REA PARK CLUBHOUSE RENOVATIONS  
1115 E DAVIS DRIVE, TERRE HAUTE, IN 47802



**CITY OF TERRE HAUTE**  
*DUKE BENNETT, MAYOR*

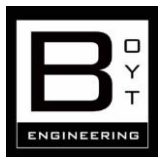


**T.H. PARKS & RECREATION DEPARTMENT**  
*EDDIE BIRD, EXECUTIVE DIRECTOR*  
*GORDON BRYAN, BOARD PRESIDENT*

**FRIENDS OF REA PARK**  
*DR. MIKE HARDING, PRESIDENT*  
*EARL ELLIOTT, VICE PRESIDENT*



**ARCHITECT:**  
SANDERS & ASSOCIATES INC.  
DANIEL E. SANDERS, AIA



**M/E/P ENGINEER:**  
BOYT ENGINEERING  
BENJAMIN BOYT, PE, MSME,  
MBA, CHC, LEED AP BD+C



**STRUCTURAL ENGINEER:**  
BRYANT ENGINEERING & CONSULTING INC.  
GRANT BRYANT, PE, MCE

**DATE PREPARED:**  
*September 6, 2023*

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- Appendix A. General Decision Number IN20230003, Wage Decision

The bid packets items A-W and Appendix A, are available at Rapid Reproductions, Inc. 129 S. 11<sup>th</sup> St. Terre Haute, IN Phone: 812-238-1681 or at [www.sandersandassocplanroom.com](http://www.sandersandassocplanroom.com).

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

- X. Bid Bond (AIA Document A310)
- Y. Standard form of Agreement Between Owner and Contractor (AIA Document A104)
- Z. Performance Bond and Payment Bond (AIA Document A312)
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- CC. Certificate of Insurance (AIA Document G715)
- DD. Contractor's Affidavit of Payment of Debts and Claims (AIA Document G706)
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- FF. Consent of Surety Company to Final Payment (AIA Document G707)
- GG. Proposal Request (AIA Document G709)

## INVITATION TO BID

The City of Terre Haute Board of Public Works will receive sealed bids for the renovation of the Rea Park Clubhouse at 1115 East Davis Drive in Terre Haute, Indiana until 9:00 AM on the 23rd day of October, 2023, at the office of the Board of Public Works, City Hall, 17 Harding Ave., 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 S. 7<sup>th</sup> Street Terre Haute, Indiana, 47807, (812) 232-5256, or at [www.Sandersandassocplanroom.com](http://www.Sandersandassocplanroom.com).

Plans and specifications will be available for distribution October 4, 2023. The plans and specifications must be purchased directly from Rapid Reproductions, 129 S. 11<sup>th</sup> St., Terre Haute, IN 47807, or online at [www.Sandersandassocplanroom.com](http://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 City of Terre Haute, 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.

The Contractor receiving the 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 site at 1115 East Davis Drive, Terre Haute, IN on Monday, October 16th 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 of completion for the project shall be 730 days after the Notice to Proceed. The City of Terre Haute 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: City of Terre Haute, Board of Public Works  
Rea Park Clubhouse Renovations  
Bid opening October 23, 2023 at 9:00 AM  
"Name and Address of Bidder"

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

Dated this 6<sup>th</sup> Day of September

## **INSTRUCTIONS TO BIDDERS**

### 1. SECURING DOCUMENTS

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

City of Terre Haute: Engineering Department  
City Hall, Room 200  
17 Harding Avenue  
Terre Haute, IN 47807

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

The bid packets, plans and specifications are available online at [www.sandersandassocplanroom.com](http://www.sandersandassocplanroom.com), or at Rapid Reproductions, Inc. 129 S. 11<sup>th</sup> 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 an 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 the 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 730 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 the City of Terre Haute 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 to 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 as follows:

- 1) Bid Security
- 2) Bid Form 96
- 3) Bid Form Attachment
- 4) Wage Scale Affidavit
- 5) E-Verify Affidavit
- 6) Non-Collusion Affidavits\*
- 7) EEO Certificates\*
- 8) Drug Free Work Place Certification\*
- 9) Anti-Lobbying Certificates\*
- 10) Non-Segregated Facilities\*
- 11) Proposed List of Subcontractors (Including Addresses and Phone Numbers)

The general contractor shall submit all the above items with their proposals.

\* 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 the Rea Park Clubhouse, 1115 East Davis Drive, Terre Haute, IN on Monday, October 16, 2023, at 10:00 AM local time.



## **BID FORM ATTACHMENT**

TO: CITY OF TERRE HAUTE BOARD OF PUBLIC WORKS  
17 HARDING AVENUE, TERRE HAUTE, IN 47807  
*REA PARK CLUBHOUSE RENOVATIONS*

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

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

**BID FORM**

**PROJECT: Rea Park Clubhouse Renovations**

\_\_\_\_\_  
COMPLETE CONSTRUCTION BID (IN WRITING)

\_\_\_\_\_  
(IN FIGURES)

-----  
Date \_\_\_\_\_, 2023

\_\_\_\_\_  
(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?

Table with 4 columns: Contract Amount, Class of Work, Completion Date, Name and Address of Owner. 4 empty rows.

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

Table with 4 columns: Contract Amount, Class of Work, Expected Completion Date, Name and Address of Owner. 4 empty rows.

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

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

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### 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.)*

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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.

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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.

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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.

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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.

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### 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.





**BID OF**

\_\_\_\_\_ *(Contractor)*

\_\_\_\_\_ *(Address)*

\_\_\_\_\_

**FOR**

**PUBLIC WORKS PROJECTS**

**OF**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

=====

Filed \_\_\_\_\_, \_\_\_\_\_

=====

Action taken \_\_\_\_\_

\_\_\_\_\_

=====

## SUPPLEMENTAL GENERAL CONDITIONS

1. *COPIES OF DOCUMENTS,*

2. *INSURANCE AND BONDS, ARTICLE 17, 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
  - b. \$2,000,000 for contracts OVER \$100,000
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 9.5 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 16.1, 16.2, 16.2.1, 16.2.2, 16.2.3*

OCCUPATIONAL SAFETY AND HEALTH ACTS:

Thee 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 15.3. 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 9.9, 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: \_\_\_\_\_

**WAGE SCALE AFFIDAVIT**

We \_\_\_\_\_

Do hereby certify that the wage rates, fringe benefits, classifications, and ratios submitted are inclusive of all contracts, memorandums of understanding (mou's), addendums, supplemental contracts, agreements or other understanding presently in effect. We also agree to notify the Indiana Department of Labor of any changes in contract, mou's, addendums or supplemental agreements that affect the wage rates, fringe benefits, classifications or ratios in anyway during the term of the contract within 14 days of said change.

\_\_\_\_\_  
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.*

**E-Verify Affidavit**

Pursuant to Indiana Code 22-5-1.7-11, the Contractor entering into a contract with the City is required to enroll in and verify the work eligibility status of all its newly hired employees through the E-Verify program. The Contractor is not required to verify the work eligibility status of all its newly hired employees through the E-Verify program if the E-Verify program no longer exists.

The undersigned, on behalf of the Contractor, being first duly sworn, deposes and states that the Contractor does not knowingly employ an unauthorized alien. The undersigned further affirms that, prior to entering into its contract with the City, the undersigned Contractor will enroll in and agrees to verify the work eligibility status of all its newly hired employees through the E-Verify program.

(Contractor): \_\_\_\_\_

By (Written Signature): \_\_\_\_\_

(Printed Name): \_\_\_\_\_

(Title): \_\_\_\_\_

**Important - Notary Signature and Seal Required in the Space Below**

STATE OF \_\_\_\_\_

SS:

COUNTY OF \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_,  
20 \_\_\_\_.

My commission expires: \_\_\_\_\_ (Signed) \_\_\_\_\_

a. Residing in \_\_\_\_\_ County, State of \_\_\_\_\_

**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

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Name

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Address

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City/State/Zip Code

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Telephone/Fax

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Name

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Address

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City/State/Zip Code

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Telephone/Fax

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City/State/Zip Code

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City/State/Zip Code

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Telephone/Fax

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Name

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Address

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City/State/Zip Code

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Telephone/Fax

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Trade

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President, Owner, Partner, Etc.

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Email

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Trade

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President, Owner, Partner, Etc.

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Email

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Trade

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President, Owner, Partner, Etc.

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Email

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Trade

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President, Owner, Partner, Etc.

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Email

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Trade

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President, Owner, Partner, Etc.

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Email

## 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.

"General Decision Number: IN20230003 06/02/2023

Superseded General Decision Number: IN20220003

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)(2)-(60).

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 \$16.20 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 2023.
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 \$12.15 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 2023.

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	01/06/2023
1	01/20/2023
2	02/10/2023
3	03/03/2023
4	04/07/2023
5	04/28/2023
6	05/12/2023
7	05/26/2023
8	06/02/2023

ASBE0018-003 06/01/2022

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).....	\$ 34.90	21.58
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

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ASBE0037-002 04/02/2021

GIBSON, POSEY, SULLIVAN, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (includes application of all insulating materials protective coverings, coatings an 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	21.89

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BOIL0374-002 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 38.53	32.20

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BRIN0001-001 06/01/2021

EVANSVILLE  
POSEY, VANDERBURGH and WARRICK COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 31.50	18.96
Marble, Tile & Terrazzo Finisher.....	\$ 21.10	15.08
Marble, Tile & Terrazzo Workers.....	\$ 27.50	15.20

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BRIN0004-012 06/01/2022

BLOOMINGTON  
OWEN COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 30.53	15.95
TERRAZZO FINISHER.....	\$ 21.18	10.27
TERRAZZO WORKER/SETTER.....	\$ 29.57	10.96
Tile & Marble Finisher.....	\$ 21.02	9.37
Tile, Marble Setter.....	\$ 34.84	16.47

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BRIN0005-001 09/21/2021

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.....	\$ 21.10	15.08
TERRAZZO.....	\$ 27.50	15.20
TILE and MARBLE FINISHER....	\$ 19.83	6.32
TILE, MARBLE, MOSAIC.....	\$ 27.50	15.20

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CARP0088-001 10/01/2022

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

	Rates	Fringes
Carpenters:		
Carpenters, Drywall Installers, Piledrivers.....	\$ 31.93	19.32
Millwright.....	\$ 33.06	24.32
Soft Floor Layers.....	\$ 28.85	18.63

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CARP0224-004 04/01/2023

POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
CARPENTER		
Carpenter.....	\$ 29.89	24.42
Piledriver.....	\$ 28.71	22.49

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CARP0224-005 04/01/2023

GREENE, GIBSON and SULLIVAN COUNTIES

	Rates	Fringes
CARPENTER		
Carpenter.....	\$ 29.88	24.38
Piledriver.....	\$ 28.71	22.45

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 CARP1080-002 04/01/2023

	Rates	Fringes
MILLWRIGHT		
ZONE 1		
POSEY, VANDERBURGH and		
WARRICK COUNTIES.....	\$ 32.27	25.54
ZONE 2		
GIBSON, GREENE AND		
SULLIVAN COUNTIES.....	\$ 30.97	27.50

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 ELEC0016-004 04/01/2023

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 41.43	18.54

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 ELEC0481-001 05/31/2022

PUTNAM COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 38.20	25.56

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 ELEC0538-002 01/01/2023

VERMILLION COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 37.31	23.15

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 ELEC0725-003 10/01/2022

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

	Rates	Fringes
ELECTRICIAN.....	\$ 40.00	21.96

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 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.

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ELEV003-002 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.

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ELEV0034-002 01/01/2023

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

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 55.30	37.335+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.

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ENGI0181-013 04/01/2022

GIBSON, POSEY, VANDERBURGH, and WARRICK COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP A.....	\$ 39.50	19.28
GROUP B.....	\$ 36.85	19.28

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.

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 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, Trolleys, 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.

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 IRON0022-003 06/01/2022

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

	Rates	Fringes
IRONWORKER.....	\$ 34.24	25.11

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.

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 IRON0103-003 04/01/2022

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 30.59	25.66

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\* LABO0204-002 06/01/2023

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.....	\$ 26.03	17.50
GROUP 2.....	\$ 26.78	17.50
GROUP 3.....	\$ 25.03	17.00

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; Kettlemen; 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 uniconrete 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.

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LAB00561-005 04/01/2022

GIBSON, POSEY, VANDERBURGH and WARRICK COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 26.47	17.55
GROUP 2.....	\$ 26.77	17.55
GROUP 3.....	\$ 27.97	17.55
GROUP 4.....	\$ 28.22	17.55

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

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 PAIN0156-002 04/01/2023

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
Painters:		
BRUSH & ROLLER.....	\$ 27.30	18.19
DRYWALL FINISHERS.....	\$ 27.55	19.19
SPRAY, SANDBLAST, POWER TOOLS, WATERBLAST & STEAM CLEANING.....	\$ 29.55	18.19

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

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 PAIN0197-002 06/01/2022

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

	Rates	Fringes
Painters:		
Brush & Roller.....	\$ 28.50	13.70
Drywall & Paper hangers (with tools).....	\$ 29.50	13.70
Sandblasting.....	\$ 30.50	13.70
Spray & Pot Man.....	\$ 29.00	13.70

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

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 PAIN1165-007 07/01/2022

GIBSON, POSEY, VANDERBURGH, WARRICK COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 30.87	18.43

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 PAIN1165-012 01/01/2022

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

VIGO COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 30.88	18.70
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PLAS0075-001 06/01/2017		

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

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.75	13.50
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PLAS0075-002 06/01/2017		

GREENE and SULLIVAN COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 28.50	13.50
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PLAS0566-001 04/01/2018		

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 26.30	16.91
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PLAS0692-001 06/01/2016		

AREA #46

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

	Rates	Fringes
PLASTERER.....	\$ 25.04	13.23
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PLUM0136-002 04/01/2023		

REMAINING COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 41.02	20.43
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PLUM0157-001 07/01/2022		

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

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 40.15	19.87
-----		
PLUM0440-001 06/04/2022		

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

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 41.60	18.99

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ROOF0106-001 04/01/2021

REMAINING COUNTIES:

	Rates	Fringes
Roofers:		
COMPOSITION.....	\$ 31.00	18.43
SLATE & TILE.....	\$ 30.80	16.52

---

ROOF0119-001 09/01/2022

PUTNAM COUNTY

	Rates	Fringes
Roofers:.....	\$ 28.80	12.79

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ROOF0150-002 07/01/2022

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

	Rates	Fringes
ROOFER.....	\$ 28.75	17.55

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SFIN0669-002 04/01/2023

	Rates	Fringes
SPRINKLER FITTER.....	\$ 43.36	26.71

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SHEE0020-018 07/01/2022

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

	Rates	Fringes
Sheet metal worker.....	\$ 38.08	22.79
HVAC Duct Work		

---

SHEE0020-019 07/01/2022

GIBSON, POSEY, VANDERBURGH, and WARRICK COUNTIES

	Rates	Fringes
Sheet metal worker.....	\$ 33.58	26.25
HVAC Duct Work		

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TEAM0135-006 04/01/2021

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

Rates Fringes

Truck drivers:

GROUP 1.....	\$ 30.40	.37+A
GROUP 2.....	\$ 30.90	.37+A
GROUP 3.....	\$ 31.10	.37+A
GROUP 4.....	\$ 31.25	.37+A
GROUP 5.....	\$ 31.75	.37+A

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, diseal 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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TEAM0215-005 04/01/2020

GIBSON, POSEY, VANDERBURGH AND WARRICK COUNTIES:

Rates Fringes

Truck drivers:

GROUP 1.....	\$ 23.43	19.15
GROUP 2.....	\$ 23.89	19.15
GROUP 3.....	\$ 24.11	19.15

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.

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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) (ii)).

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.

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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.

=====  
END OF GENERAL DECISIO"

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*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. 7<sup>th</sup> 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 44<sup>th</sup> 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 5<sup>th</sup> 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

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## 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 02060

### DEMOLITION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section includes:

1. Demolition and removal of building interiors and finishes.
2. This section includes requirements for submittal of:
  - a. Contractor's Waste Management and Recycling Plan prior to the commencement of the Work.
  - b. Contractor's quantitative reports for demolition waste materials generated by the Contractor, as a condition of approval of progress payments.

##### 1.2 DEFINITIONS

- A. Remove: Remove and legally dispose of items, except those identified for use in recycling, re-use, and salvage programs.
- B. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human or animal life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.
- C. Inert Fill: A permitted facility that accepts inert waste such as ceramic tile and quarry tile exclusively for the purpose of disposal.
  1. Inert Solids/Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete that does not contain hazardous substances or soluble pollutants at concentrations in excess of water-quality standards established by a regional water board and does not contain significant quantities of decomposable solid waste.
- D. Class III Landfill: A landfill that accepts non-hazardous materials such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A Class III landfill must have a solid waste facilities permit from the *governing state/local entity*.
- E. Demolition Waste: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The materials may include rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.

- F. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- G. Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
- H. Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.
- I. Solid Waste: All putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by State law.

### 1.3 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain property of [owner name], demolished materials shall become the Contractor's property and shall be removed, recycled, or disposed from Project site in an appropriate and legal manner.
  - 1. Arrange a meeting no less than ten (10) days prior to demolition with the *Owner or Owner's Representative* and other designated representatives to review any salvageable items to determine if *Owner* wants to retain ownership, and discuss Contractor's Waste Management and Recycling Plan.

### 1.04 SUBMITTALS

- A. Submittals for Construction Document phase:
  - 1. Qualification Data: For demolition firm.
- B. Submittals for Demolition phase:
  - 1. Proposed dust-control measures.
  - 2. Proposed noise-control measures.
  - 3. Schedule of demolition activities indicating the following:
    - a. Detailed sequence of demolition and removal work, including start and end dates for each activity.
    - b. Dates for shutoff, capping, and continuation of utility services.
- 4. If hazardous materials are encountered and disposed of, landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

5. Contractor's Waste Management and Recycling Plan:
  - a. Review Contract Documents and site conditions and estimate total Project C&D materials to be generated, names of landfills where Project C&D materials would normally be disposed of. Indicate types and quantities of materials under the Work that are anticipated to be feasible for on-site processing, and source-separation for re-use or recycling. Indicate procedures that will be implemented in this program to effect jobsite source-separation, such as, identifying a convenient location where dumpsters would be located, signage to identify materials to be placed in dumpsters, etc.,
  - b. Contact *Owner's Representative* for a list of local reuse and recycling organizations and companies.
  - c. Prior to commencing the Work, Contractor's Waste Management and Recycling Plan. Submit in format provided (Section 02060A). Waste Management and Recycling Plan must include, but not be limited to, the following:
    - Contractor's name and project identification information;
    - Procedures to be used;
    - Materials to be re-used and recycled;
    - Estimated total quantities of materials generated in Project;
    - Names and locations of landfills, re-use and recycling facilities/sites;
  - d. Contractor's Waste Management and Recycling Plan must be approved by *Owner's Representative* prior to the Start of Work.
  - e. Contractor's Waste Management and Recycling Plan will not otherwise relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
6. Contractor's Reuse, Recycling, and Disposal Report
  - a. Submit Contractor's Reuse, Recycling, and Disposal Report on the form provided (Section 02060B) with each application for progress payment. Failure to submit the form and its supporting documentation will render the application for progress payment incomplete and delay progress payments. If applicable, include manifests, weight tickets, receipts, and invoices specifically identifying the Project for re-used and recycled materials:
    - On-site crushing of asphalt and concrete for use off-site;
    - Reuse of building materials or salvageable items;
    - Source-separated recycling facilities;
    - Mixed debris recycling facilities;
    - Recycling of material, including soils, as landfill alternative daily cover;
    - Delivery of soils or mixed inerts to an inert landfill or other use;
    - Disposal of soils or other materials at a landfill or transfer station;
    - Other (describe)
  - b. Contractor's Reuse, Recycling, and Disposal Report must quantify all materials generated in the Work, disposed in Class III Landfills, or diverted

from disposal through recycling. Indicate zero (0) if there is no quantity to report for a type of material. As indicated on the form:

- Report disposal or recycling either in tons or in cubic yards: if scales are available at disposal or recycling facility, report in tons; otherwise, report in cubic yards. Report in units for salvage items when no tonnage or cubic yard measurement is feasible.
- Indicate locations to which materials are delivered for reuse, salvage, recycling, accepted as daily cover, inert backfill, or disposal in landfills or transfer stations.
- Provide legible copies of weigh tickets, receipts, or invoices that specifically identify the project generating the material. Said documents must be from recyclers and/or disposal site operators that can legally accept the materials for the purpose of re-use, recycling, or disposal:

*Indicate project title, project number, progress payment number, name of company completing the Contractor's Report and compiling backup documentation, the printed name, signature, and daytime phone number of the person completing the form, the beginning and ending dates of the period covered on the Contractor's Report, and the date that the Contractor's Report is completed.*

7. At Project closeout:

- a. Record drawings: Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

#### 1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage a licensed demolition contractor and an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.

C. Pre-demolition Conference: Conduct conference at Project site.

1. Review the environmental goals of this Project with Contractors, subcontractors, and waste haulers and make a proactive effort to increase awareness of these goals among all labor forces on site.

#### 1.06 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of Work.

B. Storage or sale of removed items or materials on-site will not be permitted without advance written approval from *Owner's Representative*.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### 3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition and recycling required.
- C. Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
  - 1. Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.
- D. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

### 3.02 PREPARATION

- A. As part of the project scope, the Contractor shall prepare all drawings, documents, and applications and shall obtain all government agency approvals and permits required for demolition activities.
- B. Conduct demolition operations and remove C&D materials to ensure minimum interference with roads, streets, walks, and other adjacent occupied and utilized facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or utilized facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
  - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
    - a. Maintain temporary protection to people at exterior areas of the existing building where decorative medallion removal work is being done.
  - 2. Protect existing site improvements, appurtenances, and landscaping that are designated to remain in place.
- D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings to be demolished and adjacent buildings to remain.

1. Strengthen or add new supports when required during progress of demolition.

### 3.03 EXPLOSIVES

- A. Explosives: Use of explosives will not be permitted.

### 3.04 ENVIRONMENTAL CONTROLS

- A. Comply with federal, state and local regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment and noise pollution.

- B. Protection of Natural Resources: Preserve the natural resources within the project boundaries or restore to an equivalent condition.

1. Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.
  - a. Temporary Construction: Remove indications of temporary construction facilities, such as haul roads, work areas, structures, stockpiles or waste areas.
2. Water Resources: Comply with applicable regulations concerning the direct or indirect discharge of pollutants to underground and natural surface waters.
  - a. Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.
    - i. Store and service construction equipment at areas designated for collection of oil wastes.
3. Dust Control, Air Pollution, and Odor Control: Prevent creation of dust, air pollution and odors.
  - a. Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
  - b. Store volatile liquids, including fuels and solvents, in closed containers.
  - c. Properly maintain equipment to reduce gaseous pollutant emissions.
4. Noise Control: Perform demolition operations to minimize noise.
  - a. Repetitive, high level impact noise will be permitted only between the hours of 8:00 a.m. and 6:00 p. m. Repetitive impact noise on the property shall not exceed the following dB limitations:

<u>Sound Level in dB</u>	<u>Time Duration of Impact Noise</u>
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

- b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements of this Contract.
- c. At least once every five successive working days while work is being performed above 55 dB noise level, measure sound level for noise exposure due to the demolition. Measure sound levels on the 'A' weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves

at buildings, measurements may be taken three to six feet in front of any building face. Submit the recorded information to the State noting any problems and the alternatives before mitigating actions.

5. Salvage, Re-Use, and Recycling Procedures

- a. Identify re-use, salvage, and recycling facilities: Contact *Owner's Representative* to obtain a list of local reuse organizations and C&D recycling companies.
- b. Develop and implement procedures to re-use, salvage, and recycle demolition materials, based on the Contract Documents, the Contractor's Waste Management and Recycling Plan, estimated quantities of available materials, and availability of recycling facilities. Procedures may include on-site recycling, source-separated recycling, salvage, and/or mixed debris recycling efforts.
- c. Identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility.
- d. Source-separate new construction, excavation and demolition materials including, but not limited to the following types:
  - Asphalt
  - Concrete, Concrete Block, Concrete Masonry Units (CMU), Slump Stone (Decorative Concrete Block), and Rocks
  - Asphalt Concrete
  - Paper: Bond, Newsprint, Cardboard, Paper, Packing Materials, and Packaging
  - Cement Fiber Products: Shingles, Panels, Siding
  - Paint
  - Rigid Foam
  - Glass
  - Plastics
  - Carpet and Carpet Padding
  - Beverage Containers
  - Insulation
  - Gypsum Board
  - Porcelain Plumbing Fixtures
  - Fluorescent Light Tubes: per Department of Toxic Substances Control Regulations
  - Green Materials (i.e. tree trimmings and land clearing debris)
  - Metal (ferrous and non-ferrous)
  - Red Clay Brick
    - Soil
    - Wood, Clean Dimensional Wood, Pallet Wood
    - Sheet Wood: Plywood, Oriented Strand Board (OSB), Particle Board
    - Other materials as appropriate
- e. Develop and implement a program to transport loads of mixed (commingled) demolition materials that cannot be feasibly source separated to a mixed materials recycling facility [whenever available].

6. Disposal Practices and Waste Hauling



- a. Legally transport and dispose of materials that cannot be delivered to a source-separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.
- b. Use a permitted waste hauler or Contractor's trucking services and personnel. To confirm valid permitted status of waste haulers, contact the *state or local waste management agency*.
- c. Become familiar with the conditions for acceptance of new construction, excavation and demolition materials at recycling facilities, prior to delivering materials.
- d. Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.
- e. Do not burn, bury or otherwise dispose of rubbish and waste materials on project site.

7. Re-Use and Donation Options

- a. Implement a re-use program to the greatest extent feasible. Options may include:

- \_\_\_\_\_

8. Revenue

- a. Revenues or other savings obtained from recycled, re-used, or salvaged materials shall accrue to Contractor unless otherwise noted in the Contract Documents.
- b. Remove and transport C&D materials in a manner that will prevent spillage on adjacent surfaces, streets, and areas or dust being emitted into the atmosphere.
- c. Clean adjacent streets of dust, dirt, and C&D materials caused by demolition operations. At the end of each work day, return adjacent areas to condition existing before start of demolition.

3.05 DEMOLITION

A. Building Demolition: Demolish buildings completely and remove from the site. Use methods required to complete Work within limitations of governing regulations and as follows:

- 1. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- 2. Demolish concrete and masonry in sizes that will be suitable for acceptance at recycling or disposal facilities.
- 3. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- 4. Break up and remove concrete slabs on grade in small sizes, suitable for acceptance at recycling or disposal facilities, unless otherwise shown to remain.
- 5. Remove all disconnected, abandoned utilities on site.

- B. Below-Grade Construction: Demolish foundation walls and other below-grade construction, as follows:
  - 1. Completely remove below-grade construction, including foundation walls and footings.
  - 2. Break up and completely remove below-grade concrete slabs, in small sizes, suitable for acceptance at recycling or disposal facilities.
  - 3. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations to street level with satisfactory soil materials.
- C. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

### 3.06 HANDLING OF DEMOLISHED MATERIALS

- A. General: Promptly re-use, salvage, recycle, or dispose of demolished materials. Do not allow demolished materials to accumulate or be stored on-site for more than **15** days.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off *Owner's* property and legally reuse, salvage, recycle, or dispose of materials.

**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 02520

### ASPHALTIC PAVING AND SURFACING

#### PART ONE - GENERAL

##### 1.01 WORK INCLUDED

- A. The Contractor shall furnish all material, equipment, tools, and labor necessary to contract and test all paving and surfacing work as specified and as shown on the Drawings and includes, but not necessarily limited to:
- (1) Existing paving removal;
  - (2) Mineral aggregate base course;
  - (3) Asphalt surfacing materials;
  - (4) Placing asphaltic concrete;
  - (5) Flood test;
  - (6) Parking stall stripes, and painting of handicapped symbols.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Excavating, Filling, and Grading Section 02200

##### 1.03 SUBMITTALS

- A. Certifications:
- (1) Submit certifications from plant producing bituminous mixtures that binder course and surface course meet specified standards.

##### 1.04 REFERENCE STANDARDS

- A. Indiana State Highway standard specifications, adopted 1978, referred herein as the "STD. SPECS."

##### 1.05 CONFLICTS

- A. In the event of any conflicts between the Contract Documents and Referenced Standard Requirements the more stringent, higher cost and quality requirement shall be included in the Bid.

## 1.06 PLANT ACCEPTANCE

- A. Bituminous mixtures for paving shall be produced in a plant approved by a recognized public agency.
- B. Prior to placing bituminous mixtures, submit to the architect for approval the name of the plant proposed for use and the name of approving agencies.

## 1.07 TESTING

- A. Testing of bituminous paving and base course shall be as specified in "STD. SPECS", Section 400.
- B. Report shall include sample number, location in the work, percent compaction, and other pertinent data.
- C. One test shall be made for each layer of base course for every 10,000 square foot of area or portion thereof placed in one day.
- D. When directed by architect, test specimens of binder and surface course shall be cut from finished work with a core drill, diameter approximately 4 inches. Four specimens shall be taken from each days run. Holes caused by removal of specimens shall be refilled immediately with bituminous material meeting these specifications and compacted and finished to the satisfaction of the architect. Testing will be by the owner's testing lab but shall be coordinated with the assistance of the contractor.

## 1.08 SAMPLES

- A. At least 15 days prior to beginning work, the contractor shall submit to the architect a sample of any materials required by the architect.

## PART TWO - PRODUCTS

### 2.01 MATERIALS

- A. All materials shall comply with the Specifications and Standards for each specific product involved as specified and shown in the plans.

### 2.02 EQUIPMENT

- A. Compacting equipment shall be self propelled tandem rollers having a minimum weight of ten tons, except that hand-held vibrator compactors may be used in areas not accessible to rollers when specially approved by the Architect.
- B. Paving equipment shall be spreading, self propelled asphalt paving machines capable of maintaining line, grade, and the minimum surface thickness specified.
- C. All other equipment used shall be of the type and size that meet all the requirements specified by the "STD. SPECS."

### 2.03 SUBGRADE MATERIALS

- A. All earthwork is specified elsewhere in Division 2.

### 2.04 COARSE AGGREGATE

- A. Coarse aggregates shall conform to the applicable provisions of "STD. SPECS", Section 903.20 and shall be of gradation No. 53 and No. 2.

### 2.05 PRIMER

- A. Primer shall conform to grade as set forth in Section 408 of the "STD. SPECS."

### 2.06 BINDER COURSE MATERIALS

- A. Aggregates and mineral fillers shall be dried and materials thoroughly mixed in correct proportions with bituminous to produce a homogenous in which liquid asphalt is distributed uniformly throughout the mixture.
- B. Bituminous material shall conform to the applicable provisions of "STD. SPECS", Section 400 and shall be asphalt cement, grade AC 85-100 conforming to article 402 or 403.

### 2.07 SURFACE COURSE MATERIAL

- A. Aggregate shall be of crushed stone or crushed gravel or sand free from adherent films. Surface course mixture shall be graded to conform to Class A or B Article 903.02 or the "STD. SPECS."
- B. Bituminous material shall conform to the applicable provisions of "STD. SPECS", Section 400 and shall be asphalt cement, grade HC85-100.

### 2.08 OTHER MATERIALS

- A. All other materials not specifically described but required for proper and complete installation of the work in this Section, shall be as selected by the contractor subject to the approval of the architect.

### PART THREE - EXECUTION

3.01 Preparation of the sub-grade for paving shall comply with applicable portions of Section 207 of the "STD. SPECS."

#### 3.02 PREPARATION

- A. Contractor is to verify all dimensions, lengths, and elevations required to complete the work. Damaged areas from operations shall be graded and seeds as indicated elsewhere in the Specifications.

#### 3.03 BITUMINOUS PAVING

- A. Bituminous paving shall consist of aggregate base and bituminous surfacing of thickness indicated on the drawings.
- B. Base course shall be No. 53 Indiana Lime Stone placed in two 4" lifts and shall conform to applicable provisions of Section 303, "Compacted Aggregate Base."

**END OF SECTION**

## 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 03410**  
**STRUCTURAL PRECAST CONCRETE**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the performance criteria, materials, design, production, and erection of structural precast and precast, prestressed concrete for the entire project. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the structural precast and precast, prestressed concrete work shown on the Contract Drawings.
- B. This Section includes the following:
  - 1. Hollow-core slab units.
  - 2. Beams, columns, double tees.
  - 3. Walls, spandrels.
  - 4. Insulated, precast concrete units.
- C. Related Sections include the following:
  - 1. Section 04810 “Unit Masonry Assemblies” for inserts or anchorages required for slab connections.
  - 2. Section 05120 “Structural Steel” for furnishing and installing connections attached to structural-steel framing.
  - 3. Section 05500 “Metal Fabrications” for furnishing and installing loose hardware items.
  - 4. Section 07220 “Roof and Deck Insulation” for insulation to meet energy code.
  - 5. Section 07620 “Sheet Metal Flashing and Trim” for flashing receivers and reglets.
  - 6. Section 07920 “Joint Sealants” for elastomeric joint sealants and sealant backings between slab edges at exposed underside of floor and roof members and/or perimeter of members.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide structural precast concrete members and connections capable of withstanding design loads indicated within limits and under conditions indicated on Drawings.
  - 1. Dead Loads: **150 PSF**
  - 2. Live Loads: **100 PSF**
  - 3. Roof Loads: **20 PSF**

4. Basic Ground Snow Load: **20 PSF**
5. Concrete Topping Thickness: **4"**
6. Wind Loads: **N/A**
7. Seismic Loads: **N/A**
8. Project Specific Loads: **N/A**
9. Design structural precast concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain structural precast concrete deflections within limits of ACI 318 (ACI 318M).
10. Thermal Movements: Provide for thermal movements noted.
  - a. The precast system design shall consider the maximum seasonal climatic temperature change.
  - b. In plane thermal movements of individual members directly exposed to the sun shall consider a temperature range of -10°F - 110°F.
  - c. Member connection design shall consider through thickness thermal gradients as appropriate.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength.
- C. Shop (Erection) Drawings:
  1. Detail fabrication and installation of structural precast concrete units including connections at member ends and to each adjoining member.
  2. Indicate locations, plan views, elevations, dimensions, shapes, and cross sections of each unit, openings, support conditions and types of reinforcement, including special reinforcement.
  3. Indicate aesthetic intent including joints, rustications or reveals, and extent and location of each surface finish.
  4. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
  5. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
  6. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
  7. Include and locate openings larger than 10 in (250 mm). Where additional structural support is required for openings include header design.
  8. Coordinate and indicate openings and inserts required by other trades.
  9. Indicate location of each structural precast concrete member by same identification mark placed on unit.
  10. Indicate relationship of structural precast concrete members to adjacent materials.

11. Indicate locations and details of joint treatment.
  12. Indicate areas receiving toppings and magnitude of topping thickness.
  13. Indicate estimated cambers for floor slabs receiving cast-in-place topping.
  14. Indicate multiple wythe connection devices.
  15. Indicate shim sizes and grouting sequence.
  16. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Architect and submit design calculations and Shop Drawings. Do not affect the appearance, durability or strength of members when modifying details or materials. Maintain the general design concept when altering size of members and alignment.
- D. Provide handling procedures, erection sequences, and for special conditions provide temporary bracing and shoring plan.
- E. Comprehensive engineering design signed and sealed by a qualified professional engineer responsible for its preparation licensed in Indiana.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer, fabricator and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Welding Certificates: Copies of certificates for welding procedure specifications (WPS) and personnel certification.
- C. Material Test Reports for aggregates: From an accredited testing agency, indicating and interpreting test results for compliance with requirements indicated.
- D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
1. Cementitious materials.
  2. Reinforcing materials and prestressing tendons.
  3. Admixtures.
  4. Bearing pads.
  5. Structural-steel shapes and hollow structural sections.
  6. Insulation.
  7. Other components specified in Contract Documents with applicable standards.
- E. Field quality-control testing reports: By third party inspection service certifying the installed product(s) meet project requirements.

#### 1.6 QUALITY ASSURANCE

- A. Erector Qualifications: A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the jobsite. Submit a current Certificate of Compliance furnished by PCI designating qualification in Category S1 (Simple Structural Systems). **OR** A precast concrete erector a minimum of 2 years of experience in structural precast concrete work comparable to that shown and specified in not less than three projects of similar scope, who has retained a PCI Certified Field Auditor, at erector's expense, to conduct a field audit of a project in the same category as this Project prior to start of erection. Submits Erectors' Post Audit Declaration.
- B. Erector Certification: A precast concrete erector with erecting organization and all erecting crews Certified and designated, prior to beginning work at project site, by PCI's Certificate of Compliance to erect Category S1 (Simple Structural Systems).
- C. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in producing structural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.
1. Assumes responsibility for engineering structural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
  2. Professional Engineer Qualifications: A professional engineer licensed in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of structural precast concrete that are similar to those indicated for this Project in material, design, and extent. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C1 – Precast Concrete Products or C2 – Prestressed Hollow-Core and Repetitive Products.
  3. Has sufficient production capacity to produce required members without delaying the Work.
  4. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification(s) can not be re-established in a timely manner, causing project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.
  5. Is registered with and approved by authorities having jurisdiction.
- D. Testing Agency Qualifications: An independent accredited testing agency, qualified according to ASTM C 1077 and ASTM E 329, to conduct the testing indicated.
- E. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete," applicable to types of structural precast concrete members indicated.

- F. Quality-Control Standard: For manufacturing procedures and testing requirements and quality control recommendations for types of members required, comply with PCI MNL 116, “Manual for Quality Control for Plants and Production of Structural Concrete Products.”
  - 1. Comply with camber and dimensional tolerances of PCI MNL 135, “Tolerance Manual for Precast and Prestressed Concrete Construction.”
- H. Product Options: Drawings indicate size, profiles and dimensional requirements of precast concrete members and are based on the specific types of members indicated. Other fabricators’ precast concrete members complying with requirements may be considered. Refer to Division 1 Section “Substitutions.”
- I. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel”; AWS D1.4/D1.4M, “Structural Welding Code – Reinforcing Steel”; and AWS D1.6/D1.6M, “Structural Welding Code-Stainless”.
- J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01310 “Project Management and Coordination.”

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all structural precast concrete members in such quantities and at such times to assure compliance with the agreed upon project schedule and setting sequence to ensure continuity of installation.
- B. Handle and transport members in a manner to avoid excessive stresses that could cause cracking or other damage.
- C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, staining, and to control cracking, distortion, warping or other physical damage.
- D. Unless otherwise specified or shown on Shop Drawings, store members with dunnage across full width of each bearing point.
- E. Place stored members so identification marks are clearly visible, and units can be inspected.
- F. Place dunnage of even thickness between each member.
- G. Lift and support members only at designated points indicated on the Shop Drawings.

#### 1.8 SEQUENCING



- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

## **PART 2 – PRODUCTS**

### **2.1 FABRICATORS**

- A. Fabricators: Subject to compliance with requirements, certified by PCI (Precast/Prestressed Concrete Institute).

### **2.2 FORM MATERIALS**

- A. Forms: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.
  - 1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

### **2.3 REINFORCING MATERIALS**

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, or ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, or ASTM A 1064/A 1064M, flat sheet.
- F. Epoxy-Coated-Steel Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.
- G. Supports: Use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

### **2.4 PRESTRESSING TENDONS**

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand or ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, 7-wire, low-relaxation strand (including supplement).

- B. Unbonded Post-Tensioning Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), 7-wire, low-relaxation strand with corrosion inhibitor conforming to ACI 423.7, with polypropylene tendon sheathing. Include anchorage devices.
- C. Prestressing Strand: ASTM A 910/A 910M, Grade 270 (Grade 1860), uncoated, weldless, 2-and 3-wire, low relaxation strand.
- D. Post-Tensioning Bars: ASTM A 722/A 722M, uncoated high strength steel bar.

## 2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or III.
  - 1. For surfaces exposed to view in finished structure, use same type, brand, and mill source throughout the precast concrete production.
- B. Supplementary Cementitious Materials
  - 1. Fly Ash: ASTM C 618, Class C or F with maximum loss on ignition of 3%.
  - 2. Metakaolin: ASTM C 618, Class N.
  - 3. Silica Fume: ASTM C 1240 with optional chemical and physical requirements.
  - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normalweight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse, non-reactive aggregates complying with Class 1N. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- E. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. Water-Reducing and Accelerating Admixture ASTM C494/C 494M, Type E.
  - 5. High Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 7. Plasticizing Admixture for Flowable Concrete: ASTM C 1017/C 1017M.
  - 8. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M

## 2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M
- B. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with the minimum mechanical properties of PCI MNL 116, Table 3.2.3.
- C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- D. Malleable Iron Castings: ASTM A 47/A 47M. Grade 32510 or 35028.
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M
- G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or C.
- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or C (ASTM F 568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A 563/A 563M, Grade A); and flat, unhardened steel washers (ASTM F 844).
- K. High-Strength Bolts and Nuts: ASTM A193/A193M, Grade B5 or B7, ASTM A 325/A 325M, or ASTM A 490/ A 490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A 563/A 563M) and hardened carbon-steel washers (ASTM F 436/F 436M).
- L. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust –inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

## 2.7 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
  - 1. Lubricate threaded parts of stainless-steel bolts with an anti-seize thread lubricant during assembly.

- C. Stainless-Steel Headed Studs: ASTM A 276, with minimum mechanical properties for studs as indicated under MNL 116, Table 3.2.3.

## 2.8 BEARING PADS AND OTHER ACCESSORIES

- A. Provide one of the following bearing pads for structural precast concrete members as recommended by precast fabricator for application:
  1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D 2240, minimum tensile strength 2250 psi (15.5 MPa) per ASTM D 412.
  2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 3000 psi (20.7 Mpa) with no cracking, splitting or delaminating in the internal portions of the pad.
  3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer according to ASTM D 2240. Conforming to Division II, Section 18.10.2 of AASHTO LRFD Bridge Design Specifications or Military Specification, MIL-C-882E.
  4. Frictionless Pads: Polytetrafluoroethylene (PTFE), glass-fiber reinforced, bonded to stainless or mild-steel plates, or random-oriented, fiber-reinforced elastomeric pads, of type required for in-service stress.
  5. High-Density Plastic: Multimonomer, nonleaching, plastic strip capable of supporting loads with no visible overall expansion.
  6. Hardboard: AHA A135.4, Class 1, tempered hardboard strips, smooth on both sides.
- B. Reglets: Reglets and flashing are specified in Section 07620 "Sheet Metal Flashing and Trim" felt or fiber filled face opening of slots covered.
- C. Erection Accessories: Provide clips, hangers, high density plastic or steel shims, and other accessories required to install structural precast concrete members.
- D. Welding Electrodes: Comply with AWS standards for steel type and/or alloy being welded.

## 2.9 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144, or ASTM C 404. Mix at ratio of 1 part cement to 2 ½ to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content of grout less than 0.06 percent chloride ion by weight of cement when tested in accordance with ASTM C 1218/C 1218M.

- B. Nonshrink Grout: Premixed, prepackaged ferrous and non-ferrous aggregate shrink-resistant grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application with a 30-minute working time. Water-soluble chloride ion content of grout less than 0.06 percent chloride ion by weight of cement when tested in accordance with ASTM C1218/C1218M.
- C. Epoxy-resin grout: Two-component mineral-filled epoxy-resin: ASTM C 881/C 881M of type, grade, and class to suit requirements.

## 2.10 INSULATED PANEL ACCESSORIES

- A. Expanded-Polystyrene Board Insulation: ASTM C 578, Type XI, 0.70 lb/ft<sup>3</sup>(12kg/m<sup>3</sup>), square edges; with thickness of 2".
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type X, 1.30 lb/ft<sup>3</sup>(21kg/m<sup>3</sup>); square edges; with thickness of 2".
- C. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation complying with ASTM C 591; Grade 1, or ASTM C 1289 Type I, 1.8 lb/ft<sup>3</sup>(29kg/m<sup>3</sup>); square edged; unfaced; with thickness of 2".
- D. Wythe Connectors: Glass-fiber in vinyl-ester polymer OR Polypropylene pin, manufactured to connect wythes of precast concrete panels.
  - 1. Provide holes in insulation for connector placement at least 4 in. (100 mm) and no more than 12 in. (0.30m) from edges of member or openings.

## 2.11 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
  - 1. Limit use of fly ash to 35 percent replacement of portland cement by weight; granulated blast-furnace slag to 50 percent of portland cement by weight; and metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at structural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested in accordance with ASTM C 1218/C 1218M.
- D. Normalweight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normalweight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 5000 psi (34.5 Mpa) minimum.

2. Release Strength: as required by design.
  3. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Lightweight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
1. Compressive Strength (28 Days): 5000 psi (34.5 Mpa) minimum.
  2. Release Strength: as required by design.
  3. Density (Unit Weight): Calculated equilibrium density of 115 lb/ft.<sup>3</sup> (1842 kg/m<sup>3</sup>), plus or minus 5 lb/ft.<sup>3</sup> (80 kg/m<sup>3</sup>) adjusted to plus or minus 3 lb/ft.<sup>3</sup> (48 kg/m<sup>3</sup>), when tested in accordance with ASTM C 567.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mixture Adjustments: Concrete mixture design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

## 2.12 FORM FABRICATION

- A. Form: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and detensioning operations. Coat contact surfaces of forms with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain forms to provide completed structural precast concrete members of shapes, lines, and dimensions indicated in Contract Documents, within fabrication tolerances specified.
1. Edge and Corner Treatment: Uniformly chamfered or as built-in on standard forms.

## 2.13 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in members unless approved by Architect.
1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, hangers, and other hardware shapes for securing precast concrete members to supporting and adjacent construction.
- C. Cast-in reglets, slots, and other accessories in structural precast concrete members as indicated on Contract Drawings.
- D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Engineer's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
  - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
  - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Locate and support reinforcement by plastic tipped or corrosion resistant metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
  - 3. Place reinforcing steel and prestressing tendons to maintain at least  $\frac{3}{4}$  in. (19 mm) minimum concrete cover. Provide cover requirements in accordance with ACI 318 (ACI 318M) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
  - 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces in accordance with ACI 318 (ACI 318M) and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs.
- G. Prestress tendons for structural precast concrete members by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
  - 1. Delay detensioning or post-tensioning of precast prestressed concrete members until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under the same conditions as concrete member.
  - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
  4. Recess strand ends and anchorages exposed to view a minimum of 1 inch (25 mm), fill with non-metallic, non-shrink mortar and sack rub surface. Coat or spray the inside pocket surfaces with a bonding agent before installing mortar.
  5. Protect strand ends and anchorage not exposed to view with bitumastic, zinc-rich or epoxy paint.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete members.
1. Place backup concrete to ensure bond with face-mixture concrete.
- J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
1. Place self-consolidating concrete without vibration in accordance with PCI TR-6 “Interim Guidelines for the Use of Self-Consolidating Concrete.” If face and backup concrete is used, ensure adequate bond between concrete mixtures.
- K. Comply with PCI MNL 116 procedures for hot and cold-weather concrete placement.
- L. Identify pickup points of precast concrete members and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast concrete member on a surface that will not show in finished structure.
- M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure members until compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of final product.

#### 2.14 INSULATED PANEL CASTING

- A. Cast, screed and consolidate bottom concrete wythe supported by form.
- B. Place insulation boards, abutting edges and ends of adjacent boards. Stagger end joints between rows to minimize cold joints. Stagger joints of insulation layers one-half board apart. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer’s written instructions.
- C. Cast and screed top wythe and apply required finish.



- D. Maintain temperature below 150 deg. F (65 deg. C) in bottom cast concrete wythe.

## 2.15 FABRICATION TOLERANCES

- A. Fabricate structural precast concrete members of shapes, lines and dimensions indicated, so each finished member complies with PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

## 2.16 FINISHES

- A. Commercial (Structural) Finishes
  - 1. Commercial Grade: Remove fins and protrusions larger than 1/8 inch (3 mm) and fill holes with a diameter larger than 1/2 inch (13 mm). Rub or grind ragged edges. Faces shall be true, well-defined surfaces. Air holes, water marks, and color variations are acceptable. Allowable form joint offsets are limited to 3/16 in. (5mm).
- B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish, float finish, if required. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. No major imperfections, honeycombing, or defects are permitted.
- C. Apply roughened surface finish in accordance with ACI 318 (ACI 318M) to precast concrete members that will receive concrete topping after installation.

## 2.17 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements. If using self-consolidating concrete also test and inspect according to PCI TR-6 “Interim Guidelines for the Use of Self-Consolidating Concrete” and ASTM C 1611/C 1611M, ASTM C 1712, ASTM 1610/1610M, and ASTM C 1621/C 1621M.
- B. In addition to PCI Certification, Owner will employ an accredited independent testing agency to evaluate structural precast concrete fabricator’s quality-control and testing methods.
  - 1. Allow Owner’s testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner’s testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- C. Strength of precast concrete members will be considered deficient if units fail to comply with ACI 318 (ACI 318M) concrete strength requirements.
- D. Testing: If there is evidence that strength of precast concrete members may be deficient or may not comply with ACI 318 (ACI 318M) requirements, fabricator shall employ an independent testing agency to obtain, prepare, and test cores drilled from

hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318/ACI 318M.

1. Test results shall be reported in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports shall include the following:
  - a. Project identification name and number.
  - b. Date when tests were performed.
  - c. Name of precast concrete fabricator.
  - d. Name of concrete testing agency.
  - e. Identification letter, name, and type of precast concrete member(s) represented by core tests; design compressive strength; type of failure; actual compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
  
- E. Patching: If core test results are satisfactory and precast concrete members comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
  
- F. Acceptability. Structural precast concrete members that do not comply with acceptability requirements in PCI MNL 116, including concrete strength, and manufacturing tolerances, are unacceptable. Chipped, spalled or cracked members may be repaired. Replace unacceptable units with precast concrete members that comply with requirements.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Furnish loose connection hardware and anchorage devices for precast concrete members to be embedded in or attached to the building structural frame or foundation before starting that Work. Provide locations, setting diagrams, templates and instructions for the proper installation of each anchorage device.

### **3.2 EXAMINATION**

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting precast concrete performance.
  
- B. Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.
  
- C. Contractor shall notify precast concrete erector that supporting cast-in-place concrete foundation and building structural framing has attained minimum allowable design

compressive strength or supporting steel or other structure is structurally ready to receive loads from precast concrete members prior to proceeding with installation.

### 3.3 ERECTION

- A. Install loose clips, hangers, bearing pads, and other accessories required for connecting structural precast concrete members to supporting members and backup materials.
- B. Erect structural precast concrete level, plumb and square within the specified allowable erection tolerances. Provide temporary structural framing, shoring and bracing as required to maintain position, stability, and alignment of members until permanent connections are completed.
  - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete members are being erected. Surface weld steel shims to each other to prevent shims from separating.
  - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
  - 3. Remove projecting lifting devices and use plastic patchcaps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
  - 4. Unless otherwise indicated provide uniform joint widths of  $\frac{3}{4}$  in. (19 mm).
  - 5. Provide and install headers of structural-steel shapes for openings larger than one slab width according to hollow-core slab fabricator's written recommendations.
- C. Connect structural precast concrete members in position by bolting, welding, grouting, or as otherwise indicated on approved Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
  - 1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
- D. Welding: Comply with applicable AWS D1.1/D1.1M, AWS D1.4/D1.4M and AWS D1.6/D1.6M requirements for welding, welding electrodes, appearance of welds, quality of welds, and methods used in correcting welding work.
  - 1. Protect structural precast concrete members and bearing pads from damage during field welding or cutting operations and provide noncombustible shields as required.
  - 2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS D1.1/D1.1M, D1.4/D1.4M or D1.6/D1.6M.
  - 3. Clean-weld-affected metal surfaces with chipping hammer followed by brushing or power tool cleaning and then reprime damaged painted surfaces in accordance with manufacturer's recommendations.
  - 4. Visually inspect all welds critical to precast concrete connections. Visually check all welds for completion and remove, reweld or repair all defective welds, if services of AWS-certified welding inspector are not furnished by Owner.

- E. At bolted connections, use upset threads, thread locking compound or other approved means to prevent loosening of nuts after final adjustment.
  - 1. Where slotted connections are used, verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
  - 2. For slip critical connections, one of the following methods shall be used to assure proper bolt pretension:
    - a. Turn-of-Nut – in accordance with AISC.
    - b. Calibrated Wrench – in accordance with AISC.
    - c. Twist-off Tension Control Bolt – meeting ASTM F 1852.
    - d. Direct-Tension Control Bolt – meeting ASTM F 1852.
  - 3. For slip critical connections, the method to be used and the inspection procedure to be used shall be approved by the Architect and coordinated with the inspection agency.
  
- F. Grouting or Dry-Packing Connections and Joints: Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout open spaces at keyways, connections and joints where required or indicated. Provide reinforcing steel where indicated. Retain flowable grout in place until it gains sufficient strength to support itself. Fill joints completely without seepage to other surfaces. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for at least 24 hours after initial set.
  - 1. Trowel top of grout joints on roofs smooth to prevent any unevenness that might interfere with placing of, or cause damage, to insulation and roofing. Finish transitions due to different surface levels not steeper than 1 to 12.
  - 2. At Hollow-Core Slab Ends (where shown on Drawings): Provide suitable end cap or dam in voids as required.
  
- G. Field cutting of precast, prestressed concrete members is not permitted without approval of the Engineer.
  
- H. Fasteners: Do not use drilled or power-actuated fasteners for attaching accessory items to precast, prestressed concrete members unless approved by Precast Engineer and Engineer of Record.

### 3.4 ERECTION TOLERANCES

- A. Erect structural precast concrete members level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135. Level out variations between adjacent members by jacking, loading, or any other feasible method as recommended by the fabricator and acceptable to the Architect.

### 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections and prepare reports:
  - 1. Erection of loadbearing precast concrete members.
  - 2. Field welds will be subject to visual inspections and dye penetrant or magnetic particle testing in accordance with ASTM E 165 or ASTM E 1444. Testing agency shall be qualified in accordance with ASTM E543.
  - 3. Testing agency will report test results promptly and in writing to Owner, Contractor, and Architect.
- B. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Erector's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.6 REPAIRS

- A. Repairs will be permitted provided structural adequacy, serviceability and durability of members and appearance are not impaired.
- B. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- C. Remove and replace damaged structural precast concrete members when repairs do not comply with specified requirements.

### 3.7 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete members after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
  - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
  - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

**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 04901

### MASONRY RESTORATION, CLEANING, & SEALANT

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. Work included: Extent of masonry restoration work as indicated on drawings and photos, including the following:
1. Tuckpointing of masonry joints.
  2. Final cleaning of masonry.
  3. Application of sealant to masonry and concrete surfaces.
- B. Related work described elsewhere:
1. Section 04100 – Mortar
  2. Section 05200 – Miscellaneous Metals
  3. Section 07620 – Flashing and Sheet Metal
  4. Section 07951 – Sealants

##### 1.02 QUALITY ASSURANCE

- A. Restoration Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable masonry restoration projects and employing personnel skilled in the restoration processes and operations indicated.
- B. Repointing: Prepare 2 separate sample areas of approximately 2 feet high by 2 feet wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints appearance to adjacent existing joints. The intent of the new pointing work is to match cleaned existing mortar. Newly pointed areas should be consistent with existing adjacent mortar joints for color and texture.

##### 1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each product indicated including recommendations for their applications and use. Includes test reports and certifications substantiating that products comply with requirements.
- B. Samples: Submit, for verification purposes, samples of the following:
1. Each new exposed masonry mortar to be used for replacing existing materials. Include in each set of samples the full range of colors and textures to be expected in completed work.

2. Each type of chemical cleaning material data.
3. Each type of chemical sealant material data.

#### **1.04 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to site in manufacturer's original and unopened containers and packaging bearing labels as to type and names of products and manufacturers.
- B. Protect masonry restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.
- C. Protect grout, mortar and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

#### **1.05 PROJECT CONDITIONS**

- A. Do not repoint mortar joints or repair masonry unless air temperatures are between 40 deg.F and 90 deg.F and will remain so for at least 48 hours after completion of work.
- B. Prevent mortar used in repointing and repair work from staining faces of surrounding masonry and other surfaces.
- C. Protect sills, ledges, projections and pedestals from mortar droppings.
- D. Do not proceed with application of materials in rainy conditions or if heavy rain is anticipated within 4 hours after application.

#### **1.06 SEQUENCING / SCHEDULING**

- A. Perform masonry restoration work in the following sequence:
  1. Rake or cut out existing mortar joints from indicated to be repointed.
  2. Repoint existing mortar joints of masonry indicated to be restored.

#### **1.07 SPECIAL WARRANTIES**

- A. Sealants - Manufacturer shall stand behind installed system for period of 10 years from Date of Substantial Completion against all the conditions indicated below. When notified in writing from Owner, Manufacturer shall, promptly and without inconvenience and cost to Owner correct said deficiencies.
  1. Loss of water repellency:
    - a. No more than 0.5 mil/20 minutes (80 mph wind driven rain equivalent).

### **PART 2 PRODUCTS**

#### **2.01 MASONRY MATERIALS**

- A. Portland Cement: ASTM C 150, Type I or Type II.



- B. Hydrated Lime: ASTM C 207, Type S, Type N or Type O.
- C. Mortar Sand: ASTM C 144, unless otherwise indicated.
  - 1. Color: Provide natural sand; of color necessary to produce required mortar color.
  - 2. For the repointing mortar, provide sand with rounded edges.
  - 3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.
- D. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- E. Water: Potable.

## **2.02 SEALANT**

- A. Product Qualifications:
  - 1. Comply with the provisions of the following standards:
    - a. Product composition:
      - Minimum 40% isobutyltrialkoxo silane and ethyl silicate
      - Alcohol carrier
      - Contains fungicide
    - b. Surface Appearance - No change in the surface appearance or texture.
    - c. ASTM C 97 "Water Absorption of Natural Stone"
      - > 80% reduction in absorption
    - d. ASTM C 88 "Lost of Soundness due to Weathering"
      - no loss
    - d. Breathability "Federal Specification SSW -110C"
      - 98.5% Moisture Vapor Transmission
    - e. Penetration - visual penetration - 0.20 inches average
- B. Regulatory Requirements: Products shall comply with State and local regulations concerning AIM (Architectural, Industrial and Maintenance) coatings regarding Volatile Organic Content (VOC).
  - 1. The use of 1,1,1 trichloroethane shall not be allowed.

## **PART 3 EXECUTION**

### **3.01 TUCKPOINT MORTAR MIXES**

- A. General:
  - 1. Measurement and Mixing: Measure cementitious and aggregate material in a dry condition by volume or equivalent weight. Do not measure by shovel, use known measure. Mix materials in a clean mechanical mortar mixer. If color is required, mix in with dry material.
  - 2. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate, color if required, materials together before adding any water. Maintain mortar in the dampened condition for 1 to 2 hours. Add water in small portions until mortar of desired consistency is reached. Use mortar within 30 minutes of final mixing.

### **3.02 REPOINTING MASONRY**

- A. Rake or grind out mortar joints as follows:
  - 1. Rake or grind out mortar joints not less than ½ inch in depth or less than that required to expose sound, unweathered mortar.
    - a. Contractor shall show a satisfactory Quality Control Program and demonstrated ability of operators to use tools without damage to masonry, or widening of joints. Quality Control Program shall include provisions for supervising performance and preventing damage due to worker fatigue.
- B. Rinse masonry joints as follows:
  - 1. Rinse masonry joint surfaces with water to remove dust and mortar particles. Time application of rinsing so that at time of pointing, joint surfaces are damp but free of standing water. For best practices, if rinse water has dried, dampen masonry joint surfaces before pointing.
- C. Tuckpoint mortar joints as follows:
  - 1. Tuckpoint mortar joints starting at one end and working away from starting area (this will ensure mortar joints are fully packed and no voids, air pockets are in mortar).
  - 2. Once area is complete, final tool (strike) mortar joints in opposite direction ensuring mortar joints are fully packed and tool (strike) to final appearance. Joints shall match existing joints as closely as possible. Unless otherwise directed by Architect or Owner.
  - 3. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar. Remove excess mortar from edge of joint by brushing.

### **3.03 FINAL CLEANING OF MASONRY**

- A. After mortar is fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or fiber brushes, and clean water, spray applied at low pressure.
  - 1. Do not use metal scrapers.
  - 2. Use appropriate products by PROSOCO, Inc. (WeatherSeal) or Diedrich Technologies.
- B. Wash adjacent woodwork and other non-masonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean masonry debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt and stains.

### **3.04 APPLICATION OF SEALANT TO MASONRY AND CONCRETE SURFACES - EXAMINATION**

- A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
  - 1. Do not proceed until unsatisfactory conditions have been corrected.

### **3.05 PREPARATION**

- A. Protection: Install coverings to protect adjacent surfaces.
- B. Surface Preparation:
  - 1. Verify masonry joints found to be unsound, hollow, or otherwise defective, have been raked out to a depth of 1/2 inch and pointed with mortar.
  - 2. Verify cracks that exceed 1/64 inch wide have been filled with pointing mortar.

### **3.06 APPLICATION**

- A. Product shall be applied as supplied by the manufacturer without dilution or alteration.
- B. Apply with a low-pressure (15 psi) airless spray equipment with a fan spray coarse nozzle, flooding the surface to obtain uniform coverage unless otherwise recommended by the manufacturer.
- C. Apply at a rate of not less than 100 square foot/gallon (or use guidelines for substrate or test patch data) unless the field tests determine that a heavier rate of application is necessary to meet the performance requirements.
- D. Apply at temperature and weather conditions recommended by the manufacturer or written in this specification.
- E. Follow manufacturer's recommendations concerning protection of glass, metal and other non-porous substrates. Contractor will be responsible to clean all surfaces that are contaminated by the water repellent.
- F. Follow manufacturer's recommendation concerning protection of plants, grass and other vegetation. Contractor will be responsible for replacing all plants, grass or vegetation damaged by the water repellent.
- G. Brush apply water repellent only at locations where overspray would affect adjacent materials and where not practicable for spray application.
- H. Start application at top of wall and work down surface with fog coat to break surface tension. Immediately apply treatment at full strength keeping a wet edge at all times. Avoid letting water repellent dry between passes.

### **3.07 FIELD QUALITY CONTROL**

- A. Spray Test: After water repellent has dried, spray coated surfaces with water.
  - 1. After surfaces have adequately dried, recoat surfaces that show water absorption.
- B. Manufacturer's Field Services:
  - 1. Furnish written certification that surface preparation method and final condition has manufacturer's approval and comply with the warranty.
  - 2. Test area: Furnish results of test area absorption on each type of substrate. Test results shall determine application rate.

- C. Test Area:
1. Before a sealer application the following field evaluation will be done. The cost of the field testing will be the responsibility of the Water Repellent Manufacturer.
  2. Prepare a three feet by three feet area to be sprayed with the water repellent. The area will be determined by the Owner. Apply the water repellent at a rate of 100 square foot/gallon. To produce a 6 to 8 inch rundown below the spray pattern.
  3. After allowing five days for the sample to cure run a RILEM uptake test on the treated area. Place one tube on the substrate and one tube on a mortar joint. Owner & Architect can be present for the application of the water repellent and the test.
  4. Acceptable minimum results are as stated in the warranty provisions. Coverage rate used to pass this test section must be used on entire project.

### **3.08 CLEANING**

- A. As Work Progresses: Clean spillage and overspray from adjacent surfaces using materials and methods as recommended by water repellent manufacturer.
- B. Remove protective coverings from adjacent surfaces when no longer needed.
- A. Upon completion of all work covered in a specification, the Contractor shall remove all equipment, material and debris, leaving the area in an undamaged and acceptable condition. Dispose of water repellent containers according to state and local environmental regulations.
- B. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to water repellents.

### **3.09 COMPLETION**

- A. Work that does not conform to specified requirements shall be corrected and/or replaced as directed by the Owners Representative at contractor's expense without extension of time.

**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**

## Section 06210

### INTERIOR FINISH CARPENTRY

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Work included: Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.
- B. Installing all finish hardware.
- C. Install all wood framing as shown or required.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wood wainscot
  - 2. Wood base, casing, & trims
  - 3. Interior window frames
  - 4. Shelving and clothes rods

##### B. Related Sections described elsewhere:

- |                               |               |
|-------------------------------|---------------|
| (1) Carpentry Work            | Section 06001 |
| (2) Cabinet Work              | Section 06410 |
| (3) Solid Surface Countertops | Section 06415 |
| (4) Wood Doors                | Section 08210 |
| (5) Aluminum Clad Windows     | Section 08521 |

##### 1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

#### PART 2 – PRODUCTS

##### 2.1 MATERIALS, GENERAL

- 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 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**

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## SECTION 06415

### SOLID SURFACE COUNTERTOPS

#### PART ONE - GENERAL

##### 1.1 SECTION INCLUDES

- A. Solid surface countertops.
- B. Setting materials and accessories.

##### 1.2 RELATED SECTIONS

- A. Section 05200 - Miscellaneous Metals
- B. Section 06001 - Carpentry
- C. Section 06210 – Interior Finish Carpentry.
- D. Section 06410 - Cabinetwork
- E. Section 07951 - Joint Sealants & Caulking

##### 1.3 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
  - 2. A118.4 - Latex-Portland Cement Mortar.

##### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Detailed specification of construction and fabrication.
  - 2. Manufacturer's installation instructions.
  - 3. Manufacturers detailed recommendations for handling, storage, installation, protection, and maintenance.
- C. Shop Drawings: Include countertop layout, dimensions, materials, finishes, cutouts, and attachments. Include installation details of location and layout of each type of fabrication and accessory.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Contract Closeout Submittals: Comply with Section 01700.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Manufacturer certified solid surface fabricator/installer.
  - 1. Minimum 2 years documented experience in work of this Section.
- B. Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.
  - 1. Minimum 2 years documented experience in work of this Section.
  - 2. Acceptable to or licensed by manufacturer.
- C. Source Limitations: Obtain materials and products from single source.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in fabricator's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction (AHJ).

## 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 degree F (18 and 24 degree C) for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

## PART 2 PRODUCTS

### 2.1 SOLID SURFACING

- A. Product: Refer to Architectural Drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive countertops. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

### 3.2 PREPARATION

- A. Precondition Solid Surfacing in accordance with manufacturer's printed installation instructions.

### 3.3 QUARTZ SURFACING INSTALLATION

- A. Install countertops in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Adhere countertops to supports with continuous beads of adhesive.
- C. Set in thin set mortar bed in accordance with ANSI A 108.5.
- D. Set plumb and level. Align adjacent pieces in same plane.
- E. Install with hairline joints.
- F. Fill joints between countertops and adjacent construction with joint sealer; finish smooth and flush.
- G. Installation Tolerances
  1. Maximum variation from level and plumb: 1/8 inch in 10 feet (3 mm in 3 m), noncumulative.
  2. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch (1.5 mm).

### 3.4 CLEANING

- A. Clean countertops in accordance with manufacturer's instructions.

### 3.5 PROTECTION

- A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged components that cannot be repaired to architect's satisfaction.
- B. Fabricator/Installer to provide a Care and Maintenance kit, review maintenance procedures and the warranty with the Owner's representative upon completion of project.

**END OF SECTION**



**SECTION 06810  
FIBERGLASS COMPOSITE  
BALUSTRADE SYSTEMS**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

- A. Balustrade Systems shall be Royal Corinthian, Inc. RoyalCast™ Balustrades OR Approved Equal.
  - 1. Baluster shall be Royal Corinthian Baluster according to their Design No. 0238.
  - 2. Top Rail shall be Royal Corinthian Top Rail according to their Design No. 0461-T.
  - 3. Bottom Rail shall be Royal Corinthian Bottom Rail according to their Design No. 0461-T.
  - 4. Newel Post shall be Royal Corinthian Newel Post according to their Design No. NP9-38.
  - 5. Newel Post Cap shall be Royal Corinthian Newel Post Cap according to their Design No. PC-2-9.
  - 6. All railing connections shall be made with Royal Corinthian Rail Connectors with spring loaded attachment pins (RB411 and RB431).
  - 7. All Rails will be elevated to allow for drainage, if required, using Royal Corinthian Drainage Spacers (RS-1 through RS-5).
  - 8. Filler material: General purpose.

**1.2 SUBMITTALS**

- A. Submit Royal Corinthian, Inc. literature and shop drawings.
- B. Submit baluster and/or top/bottom rail sample as requested by Architect.
- C. Field samples shall be capable of being incorporated into the actual construction.

**1.3 WARRANTY**

- A. The balustrade system shall be guaranteed in writing against defects of materials or workmanship for a period of 5 years to the original owner.
- B. Balustrade must be installed following Royal Corinthian, Inc. guidelines.

**1.4 VERIFICATION OF DESIGN**

- A. The components incorporated into the drawings show dimensions and styles chosen to accomplish the Architect's intended aesthetic result and to conform to the building's configuration in both form and function. The contractor shall verify that all components to be provided by Royal Corinthian for the work of this section will fit the building's structural elements and meet the visual design criteria on the drawings without materially altering profiles and alignments.
- B. Any additional support or backing components shall be provided by the installing contractor as part of the work of this section.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

- A. Royal Corinthian, Inc.  
603 Fenton Lane  
West Chicago, IL 60185  
T. 888-265-8661 F. 888-344-2937  
royalcor@royalcorinthian.com  
www.royalcorinthian.com
- B. Substitutions: Permitted.

### 2.2 RESIN AND FILLER MATERIALS

- A. Polyester resins shall be general purpose. The resin will be flame retardant polyester resin designed for use in the roto-cast method.
- B. Filler material shall be General Purpose, lightweight filler, or ASTM E 84-01 Class A rated.
- C. Final ratio of materials shall consist of polyester resin, filler, and fiberglass chop.
- D. Material thickness shall be 1/4" to 2" depending on product.
- E. Allowable Tolerances
  - 1. Wind Load Resistance:
    - a. Fiberglass components when installed shall resist wind loading.
    - b. Minimum wind loading requirements as per standard building code.
  - 2. Dimensional Tolerances of Finished Units
    - a. Dimensions 10' or under: +/- 1/4". Out of Square: 1/8" per 6'

## PART 3 - EXECUTION

### 3.1 DELIVERY

- A. Deliver materials in original packages, containers, or bundles bearing brand name & identification of manufacturer or supplier. Customer to unload and store materials onsite under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion, and damage from construction traffic and other causes.
- B. Handle materials and products to prevent damages to edges, ends, or surfaces
- C. Balustrade components shall be protected from dirt, rain (other elements,) and damage prior to and during installation.
- D. Water and/or dirt should not be allowed to get trapped between the protective shrink wrap and column components.

### 3.2 INSTALLATION

- A. Follow manufacturers detailed installation guidelines. They are available online or by request.
- B. Recommend Caulk for all joints is a high end construction adhesive that is flexible and matches the product in color and texture if available.
- C. Protect balustrade finish during storage and installation.

**END OF SECTION**

## 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 07540**  
**THERMOPLASTIC POLYOLEFIN (TPO)**  
**MEMBRANE ROOFING**

**PART 1 GENERAL**

1.01 SUMMARY

- A. Furnish and install elastomeric sheet roofing system, including:
  - 1. Roofing manufacturer's requirements for the specified warranty.
  - 2. Removal of entire existing roof membrane and flashings.
  - 3. Removal of all existing insulation down to the deck.
  - 4. Preparation of roofing substrates.
  - 5. Wood nailers for roofing attachment.
  - 6. Insulation.
  - 7. Cover boards.
  - 8. Vapor retarder / air barrier.
  - 9. Elastomeric membrane roofing.
  - 10. Metal roof edging and copings.
  - 11. Flashings.
  - 12. Walkway pads.
  - 13. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
  
- B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
  
- C. Comply with the published recommendations and instructions of the roofing membrane manufacturer.
  
- D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 RELATED SECTIONS

- A. Section 01070 – Cutting and Patching
  
- B. Section 05200 – Miscellaneous Metals
  
- C. Section 06001 – Carpentry Work
  
- D. Section 07620 – Sheet Metal Flashing and Trim
  
- E. Section 07951 – Sealants and Caulking

1.03 REFERENCES

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
- B. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.
- C. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.
- D. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2004.
- E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.
- F. ASTM D 1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting; 2003.
- G. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000.
- H. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2003.
- I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.
- J. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.
- K. FM 1-28 - Design Wind Loads; Factory Mutual System; 2002.
- L. FM 1-29 - Roof Deck Securement and Above Deck Roof Components; Factory Mutual System; 2005.
- M. PS 1 - Construction and Industrial Plywood; 1995.
- N. PS 20 - American Softwood Lumber Standard; 2005.
- O. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2003. (ANSI/SPRI ES-1).

#### 1.04 SUBMITTALS

- A. Product Data:
  1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
  2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include

data itemizing the components of the classified or approved system.

- B. Samples: Submit samples of each product to be used.
- C. Shop Drawings:
  - 1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
- D. Pre-Installation Notice: Copy to show that the manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the manufacturer.
- E. Executed Warranty

#### 1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Roofing installer shall have the following:
  - 1. Currently Approved Contractor by the Roofing Manufacturer.
  - 2. At least 5 years' experience installing specified system.
- B. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
  - 1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of the roofing work.
  - 2. Notify Architect well in advance of the meeting.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

#### 1.07 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty 20-Year Limited Warranty covering membrane, roof insulation, and membrane accessories.
  - 1. Limit of Liability: No dollar limitation.
  - 2. Scope of Coverage: Repair leaks in the roofing system caused by:
    - a. Ordinary wear and tear of the elements.
    - b. Manufacturing defect in Firestone brand materials.
    - c. Defective workmanship used to install these materials.
    - d. Damage due to winds up to 55 mph (88 km/h).
  - 3. Not Covered:
    - a. Damage due to winds in excess of 55 mph (88 km/h).
    - b. Damage due hurricanes or tornadoes.

- c. Hail.
- d. Intentional damage.
- e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products Co., Nashville, TN.  
[www.firestonebpc.com](http://www.firestonebpc.com).
- B. Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
  - 1. Specializing in manufacturing the roofing system to be provided.
  - 2. Minimum ten years of experience manufacturing the roofing system to be provided.
  - 3. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
  - 4. ISO 9001 certified.
  - 5. Able to provide polyisocyanurate insulation that is produced in own facilities.
- C. Manufacturer of Insulation and Cover Board: Same manufacturer as roof membrane.
- D. Manufacturer of Metal Roof Edging:
  - 1. Same manufacturer as roof membrane
  - 2. Metal roof edging products by other manufacturers
  - 3. Field- or shop-fabricated metal roof edgings

### **2.02 ROOFING SYSTEM DESCRIPTION**

- A. Roofing System:
  - 1. Membrane: Thermoplastic Polyolefin (TPO).
  - 2. Thickness: As specified elsewhere.
  - 3. Membrane Attachment: Fully adhered.
  - 4. Comply with applicable local building code requirements.
  - 5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
  - 6. Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM DS 1-28 and 1-29, and meeting minimum requirements of FM 1-60 wind uplift rating.
- B. Vapor Retarder Under Base Layer of Insulation:
  - 1. One Layer: woven tri-laminate high-density polyethylene top surface factory-laminated to SBS modified bitumen tape adhesive.
  - 2. Attachment: Liner released adhesive attachment.
- C. Insulation:
  - 1. Total Roof Assembly R Value: 45, minimum.
  - 2. Maximum Profile Thickness: 7.5 inches (191 mm).
  - 3. Maximum Individual Board Thickness: 95 mm (3.75 inches); use as many layers as necessary; stagger joints in adjacent layers.



4. Base Layer: Polyisocyanurate foam board, non-composite.
    - a. Attachment: Cold adhesive attachment.
  5. Intermediate/Top Layer(s): Polyisocyanurate foam board, non-composite.
    - a. Attachment: Cold adhesive attachment.
- D. Insulation Cover Board:
1. Type: High density Polyisocyanurate foam board, non-composite 1/2 inch (12 mm) thick.
  2. Attachment: Cold adhesive attachment.

## 2.03 TPO MEMBRANE MATERIALS

- A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
  2. Sheet Width: Provide the widest available sheets to minimize field seaming.
  3. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
  4. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C 1549.
  5. Color: White.
  6. Acceptable Product: ULTRAPLY TPO
- B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 457 mm (18 inches) wide.
- D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent.
  2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D 638 after heat aging.
  3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
  4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D 1004 after heat aging.
  5. Color: White.
  6. Acceptable Product: ULTRAPLY TPO Flashing by Firestone.
- E. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal; TPO QuickSeam Flashing by Firestone.
- F. Bonding Adhesive: Neoprene and SBR rubber blend, formulated for compatibility with the membrane other substrate materials, including masonry, wood, and insulation facings; ULTRAPLY Bonding Adhesive by Firestone.

- G. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing Pourable Sealer by Firestone.
- H. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.
- I. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.
- J. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.
- K. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.
- L. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.
- M. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch (3 mm) by 30 inches (760 mm) by 40 feet (12.19 m) long with patterned traffic bearing surface; UltraPly TPO Walkway Pads by Firestone.

#### 2.04 VAPOR RETARDER MATERIALS

- A. Retarder Sheet: woven tri-laminate high-density polyethylene top surface factory-laminated to SBS modified bitumen tape adhesive.
  1. Thickness: 0.030 inch (.76 mm) plus/minus 10 percent.
  2. Tensile Strength: 64/88 lbf/in (11.3/15.4 kN/m), minimum, when tested in accordance with ASTM D 5147.
  3. Ultimate Elongation MD/XD: 52/24 percent when tested in accordance with ASTM D 5147.
  4. Tearing Strength MD/XD: 84/90 lbf (375/400 N) when tested in accordance with ASTM D 5601.
  5. Water Vapor Permeance: 0.017 Perms (0.92 ng/Pa s m<sup>2</sup>) when tested in accordance with ASTM E 96 (Proc. B).
  6. Air Permeability: 0.00114 ft<sup>3</sup>/min ft<sup>2</sup> (0.007 ng/L/sec m<sup>2</sup>) when tested in accordance with ASTM D 1970 (75 Pa).
  7. Acceptable Product: V-Force Vapor Barrier Material by Firestone.

#### 2.05 ROOF INSULATION AND COVER BOARDS

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
  1. Thickness: As indicated elsewhere.
  2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
    - a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
  3. R-Value (LTTR):

- a. 1/2 inch (25 mm) Thickness: 6.0, minimum.
    - b. 3/4 inch (76 mm) Thickness: 18.5, minimum.
  - 4. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
  - 5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
  - 6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
  - 7. Acceptable Product: ISO95+ GLpolyiso board insulation by Firestone
- B. High Density Polyisocyanurate Cover Board: Non-combustible, water resistant high density, closed cell polyisocyanurate core with coated glass mat facers, complying with ASTM D 1623, and with the following additional characteristics:
- 1. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
    - a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
  - 2. Thickness: 0.5 inch (12.7mm).
  - 3. R-Value: 2.5 based on ASTM tests C158 and C177.
  - 4. Surface Water Absorption: <3%, maximum, when tested in accordance with ASTM C 209.
  - 5. Compressive Strength: 120psi, when tested in accordance with ASTM 1621.
  - 6. Density: 5pcf, when tested in accordance with ASTM 1622.
  - 7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
  - 8. Mold Growth Resistance: Passed, when tested in accordance with ASTM D 3273.
  - 9. Acceptable Product: ISOGARD HD Cover Board by Firestone.
- C. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
- 1. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
    - a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
  - 2. Thickness: 0.25 inch (6.4mm).
  - 3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C 473.
  - 4. Spanning Capability: As recommended by manufacturer for maximum flute spans.
  - 5. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
  - 6. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
  - 7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
  - 8. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.
- D. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- E. Insulation Adhesive: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesive furnished by roof membrane manufacturer.

## 2.06 METAL ACCESSORIES

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted

to roof edge nailer.

1. Wind Performance:
    - a. Membrane Pull-Off Resistance: 100 lbs/ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
    - b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
    - c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
  2. Fascia Face Height: 5 inches (127 mm).
  3. Edge Member Height Above Nailer: 1-1/4 inches (31 mm).
  4. Fascia Material and Finish: 24 gage, 0.024 inch (0.06 mm) galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
  5. Length: 144 inches (3650 mm).
  6. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
  7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
  8. Anchor Bar Cleat: 20-gauge, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
  9. Curved Applications: Factory modified.
  10. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
  11. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.
  12. Scuppers: Welded watertight.
  13. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the Drawings.
- B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
1. Wind Performance:
    - a. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
    - b. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-90 rating.
  2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
  3. Material and Finish: 24 gage, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
  4. Dimensions:
    - a. Wall Width: As indicated on the drawings.
    - b. Piece Length: Minimum 144 inches (3650 mm).
    - c. Curved Application: Factory fabricated in true radius.
  5. Anchor/Support Cleats: 20 gage, 0.036 inch (0.9 mm) thick pre-punched galvanized cleat with 12 inch (305 mm) wide stainless steel spring mechanically locked to cleat at 72

- inches (1820 mm) on center.
6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch (355 mm) long legs on corner, intersection, and end pieces.
  7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds (109 kg) for actual substrate used; no exposed fasteners.

## 2.07 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20 dimensional lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
  1. Width: 3-1/2 inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
  2. Thickness: Same as thickness of roof insulation.

## PART 3 INSTALLATION

### 3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
  1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
  2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
  3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Safety Data Sheets (SDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

### 3.02 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

### 3.03 PREPARATION

- A. Remove all of the existing roof system down to the roof deck including all existing composition base flashings on portion shown on the drawings. Dispose of all materials properly. Perform asbestos removal in accordance with federal, state and local regulations and dispose of waste in legal manner.
  - 1. At penetrations, remove all existing flashings, including lead, asphalt, mastic, etc.
  - 2. At walls, curbs, and other vertical and sloped surfaces, remove loose and unsecured flashings; remove mineral surfaced and coated flashings; remove excessive asphalt to provide a smooth, sound surface for new flashings.
- B. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- C. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- D. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.
- E. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

### 3.04 VAPOR RETARDER

- A. Before installing insulation install vapor retarder directly over the deck.
- B. Install retarder membrane by releasing the liner sheet from the integral SBS adhesive in

accordance with the manufacturer's prescribed conditions.

- C. Overlap adjacent sheet runs 3 in. (75mm) and 6 in. (150mm) at end lap. Stagger end laps no less than 12 in. (300mm) between sheet runs.
- D. Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.

### 3.05 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install insulation in a manner that will not compromise the vapor retarder integrity.
- C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- D. Lay roof insulation in courses parallel to roof edges.
- E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).
- F. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.
- G. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

### 3.06 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane adhered to the substrate, with edge securement as specified.
- E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
- F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 1:6 (2 in 12 inches) using mechanically fastened

reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.
2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

### 3.07 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
  1. Follow roofing manufacturer's instructions.
  2. Remove protective plastic surface film immediately before installation.
  3. Install water block sealant under the membrane anchorage leg.
  4. Flash with manufacturers recommended flashing sheet unless otherwise indicated.
  5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
  6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
  7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Existing Scuppers: Remove scupper and install new scupper.
- D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.
- E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
  1. Use the longest practical flashing pieces.
  2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
  3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
  4. Provide termination directly to the vertical substrate as shown on roof drawings.
- F. Roof Drains:
  1. Existing Drains: Remove all existing flashings, drain leads, roofing materials and cement from the drain; remove clamping ring.
  2. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.



3. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
  4. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
  5. Apply sealant on top of drain bowl where clamping ring seats below the membrane
  6. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
  2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
  3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
  4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

### 3.08 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the Drawings.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1 inch (25 mm) and maximum of 3 inches (75 mm) from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches (150 mm) on either side.
  2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

### 3.09 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

### 3.10 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the

work of this section; comply with recommendations of manufacturers of components and surfaces.

- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

### 3.11 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

**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 was 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 07885

**EXTERIOR INSULATION AND WALL SYSTEM**

PART ONE – GENERAL

1.01 DESCRIPTION

- A. Work included: Provide all exterior wall finish system products required for this Work as shown on the Drawings and necessary for the complete installation.

1.02 RELATED WORK DESCRIBED ELSEWHERE

- A. Sealants and Caulking – Section 07951

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 manufacturers regularly engaged in the 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 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. Manufacturer's recommended installation procedures.
- C. Inspection: 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.



## 1.05 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 material of all other trades.
- B. Replacement: In the event of damage, immediately make all repairs and replacement necessary to the approval of the Architect at no additional cost.

## PART TWO – PRODUCTS

### 2.01 GENERAL

- A. Provide all labor, materials, and equipment necessary to install the field-applied DRYVIT system or approved equal.
- B. All materials shall be equal to that manufactured by DRYVIT Systems, Inc., P.O. BOX 1014 One Energy Way West Warwick, RI 02893, (800) 556-7752.
- C. Materials: (M-System attachment with System II finish), Panzer system to 6' height, with expanded Class PB polystyrene.
  - 1. DRYVIT adhesives
  - 2. Styrofoam brand insulation
  - 3. DRYVIT, Fastener disk, Mesh
  - 4. DRYVIT Coat and Finish
  - 5. Miscellaneous caulks, expansion joints, etc.
- D. Other materials as required for a complete installation.

### 2.02 QUALITY STANDARDS

- A. In addition to complying with all pertinent codes, the Work is to be performed by DRYVIT approved or certified applicators.

## PART THREE – EXECUTION

### 3.01 INSPECTION

- A. Examine the areas and conditions of the substrate and details of the area before this Work is installed. Correct any condition detrimental to the Work.

### 3.02 INSTALLATION

- A. Install over clean dry smooth substrate.

- B. If required, use track system for unsecured surfaces. No surface is to be more than ¼” irregularity in one foot.
- C. Mixing: Dispersion adhesive is ready mixed and shall not be mixed with cement or any other additives.
- D. Apply insulation board per manufacturer’s requirements, as approved by the Architect.
- E. Apply finish per manufacturer’s requirements, as approved by the Architect.
- F. The color and finish is to be as shown on the Drawings.

**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	Acrylic or polysulfide
Joints in sills and thresholds	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 or 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 doorstep 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 rabbits 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**

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## SECTION 08120

### ALUMINUM AND GLASS DOORS

#### PART ONE - GENERAL

##### 1.01 DESCRIPTION

- A. Work included: Provide all aluminum and glass entrance doors and frames, complete in place not specifically described in other Sections of the Specifications, but as shown on Drawings or otherwise required for a complete operable facility.
- B. Related Work Described Elsewhere:
- |     |                         |               |
|-----|-------------------------|---------------|
| (1) | Wood Doors              | Section 08210 |
| (2) | Stock Hollow Metal Work | Section 08111 |

##### 1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified herein and with the General Requirements of these Specifications.
- 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. Qualifications of installers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary 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 Architect.

##### 1.03 SUBMITTALS

- A. General: Comply with provisions of the general requirements.
- B. Manufacturers' data: Within 30 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 details of each frame type, elevations of each door design type, details of all openings, and all details of construction, installation and anchorage.
- (4) Manufacturer's recommended installation procedures.

The manufacturer's recommended installation procedures, when approved by the Owner, 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 Owner and at no additional cost to the Owner.

### **PART TWO - PRODUCTS**

#### 2.01 ALUMINUM AND GLASS DOORS

- A. General: Aluminum and glass doors shall be of the sizes, types and design as shown on the Drawings and shall be equal to those manufactured by Kawneer Co., Inc., Indianapolis, Indiana.
- B. Doors shall be equal to Kawneer 350 med. with 10" bottom rail entrance with Class II clear anodic coating finish. Hardware shall be as shown on the Drawings. Locks are to be cylinders only. Glazing shall be 1/4" tempered glass. Exterior doors shall have all weatherstripping and thresholds. All hardware must be ADA compliant.

### **PART THREE - EXECUTION**

#### 3.01 DELIVERY:

- A. Deliver the aluminum glass doors and frames to the job site in a timely manner to permit orderly progress of the total work.

#### 3.02 CARE IN HANDLING:

- A. Care shall be exercised to protect doors, glass and frames from breakage, scratches, or damage of any kind.

(1) Damaged units shall be replaced by the Contractor and at no additional cost to the Owner.

#### 3.03 INSTALLATION:

- A. Install all aluminum glass doors, frames and store front system as shown on the Drawings, these Specifications, and in accordance with the manufacturer's specifications as approved by the Architect. Furnish all ADA compliant and necessary hardware as required for complete installation.

**END OF SECTION**

## 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 8710

##### 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. Steel insulated panels of flush design.
- 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 3/4 horsepower door openers.

##### 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. Wayne-Dalton
- B. Overhead
- C. Raynor
- D. Barcol
- E. Substitutions: Under provisions of Section 01300.

#### 2.02 MATERIALS

- A. Raynor Tri-Core insulated Tc-II with 24" x 8" insulated glass windows: 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 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 Aluminum Clad Window. Glazing is to be insulated.

## 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

### FINISH HARDWARE

#### PART ONE - GENERAL

##### 1.01 DESCRIPTION

- A. Work included: Furnish, install and/or deliver to the job site all finish hardware to match existing hardware required to complete the work as indicated on the Drawings and specified herein. Provide all trim attachments, and fastenings specified or required for proper and complete installation.
- B. Related work described elsewhere:
- (1) Carpentry Work – Section 06001
  - (2) Metal Doors – Section 08110
  - (3) Aluminum & Glass Doors – Section 08120
  - (4) Wood Doors – Section 08210

##### 1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified in this Section and with the General Requirements.
- 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 Owner.

##### 1.03 SUBMITTALS

- A. General: Comply with the general conditions.
- B. Product data:
- (1) Within 7 calendar days after award of the Contract, submit:
    - (a) Complete materials list of all items proposed to be furnished and delivered under this Section.
      - (aa) Identify each hardware item by manufacturer, the manufacturer's catalog number, and the location of the item in the work.

- (bb) Make the list in form suitable for ready checking by the Architect.
    - (b) Manufacturer's specifications, catalog cuts, and other data required to demonstrate compliance with specified requirements.
  - (2) Approval of the hardware list by the Architect shall not relieve the Contractor from the responsibility for furnishing all required finish hardware.
- C. Templates: In a timely manner to ensure orderly progress of the work deliver templates or physical samples of the approved finish hardware items to pertinent manufacturers of interfacing items, such as door and frames.

#### 1.04 PRODUCT HANDLING

- A. Packing and Marking: Individually package each unit of finish hardware, complete with proper fastenings and appurtenances, clearly marked on the outside to indicate the contents and specific location in the work.
- B. Protection: Use all means necessary to protect materials of this Section before, during and after delivery to the job site 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 Owner and at no additional cost to the Owner.

### **PART TWO - PRODUCTS**

#### 2.01 GENERAL

- A. Proprietary Products: References to specific proprietary products are used to establish minimum standards of utility and quality. Unless otherwise approved by the Owner, provide only the specific products. Design is based on the materials specified. Other materials may be considered by the Owner in accordance with the provisions of the general requirements.
- B. Manufacturers: The manufacturer shall be as shown on Hardware Schedule on the drawings or equal as approved by the architect.
- C. Fasteners: Furnish all finish hardware with all necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use.
  - (1) Furnish fastenings where necessary with expansion shields, toggle bolts, sex bolts, and other anchors approved by the Architect, according to the material to which the hardware is to be applied and the recommendation of the hardware manufacturer.
  - (2) All fastenings shall harmonize with the hardware as to material and finish.

- D. Finishes of all hardware shall match the finish of the locksets. Take special care to coordinate all of the various manufactured items furnished under this Section, to ensure acceptably uniform finish.

## 2.02 MATERIALS

### A. Butts:

- (1) Where doors are required to swing 180 degrees, furnish hinges of sufficient throw to clear the trim.

### B. Locksets and latchsets shall be as shown on the Drawings, or equal as approved by the Architect.

### C. Hinges: As shown on the Drawings, or equal as approved by the Architect.

### D. Threshold: As shown on the Drawings, or equal as approved by the Architect.

### E. Door Sweeps: As shown on the Drawings, or equal as approved by the Architect.

### F. Door Stops: Furnish door stops of height to engage the doors.

### G. Closers: Semi-automatic, provide for push button entry/exit.

### H. Panic Hardware: Push/pull, non-locking.

### I. Miscellaneous: All other items, not specifically described but required by the Contractor subject to the approval of the Architect.

## 2.03 KEYING

- A. Provide one master key and individual keys as necessary for all doors.

## 2.04 TOOLS AND MANUALS

- A. With the delivery of permanent keys, deliver to the Owner one complete set of adjustment tools and one set of maintenance manuals for locksets, latchsets, closers, and panic devices.

## **PART THREE - EXECUTION**

### 3.01 DELIVERIES

- A. Stockpile all items sufficiently in advance to ensure their availability and make all necessary deliveries in a timely manner to ensure orderly progress of the total work.

### 3.02 INSPECTION AND INSTALLATION

- A. Upon completion of the installation, and as a condition of its acceptance, visually inspect all finish hardware furnished under this Section and place in optimum working condition.

### 3.03 KEY CHANGING

- A. At the time of final acceptance of the work, void the construction key system and in the presence of the Architect, demonstrate that the specified keying system is operating properly.

**END OF SECTION**



## 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 55E to 65E, 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 AW@ or AS@ 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.

### 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 09400

### THIN-SET EPOXY TERRAZZO

#### 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 thin-set epoxy terrazzo in areas indicated on Drawings and as specified herein for a good and complete job.
1. Thin-set epoxy terrazzo flooring including preparation of substrates.
  2. Thin-set precast epoxy terrazzo tread or tread and riser units.
  3. Thin-set precast epoxy terrazzo wall base units.
  4. Related accessories.
- B. Related Work Described Elsewhere:
1. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.
- C. Related Sections:
1. Section 07900 Joint Sealants
  2. Section 09900 Painting

##### 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. Manufacturer's Product Data: For each type of terrazzo and accessory. System will be evaluated on the basis of standards. For tests not listed in published data, manufacturer shall supply missing data according to standard referenced.
1. Physical properties.
  2. Performance properties.
  3. Specified tests.
  4. Material Safety Data Sheet.
  5. Manufacturer's standard warranty.
- B. Shop Drawings: Including terrazzo installation requirements. Include plans, elevations, sections, component details and attachments to other work. Show layout of the following sections, component details and attachments to other work. Show layout of the following:
1. Divider strips.

2. Control and expansion joint strips.
  3. Base and border strips.
  4. Abrasive strips.
  5. Stair treads, risers and landings.
  6. Pre-cast terrazzo jointing and edge configurations including anchorage details.
  7. Terrazzo patterns.
- C. Samples: Initial selections from selected manufacturer color plates showing the full range of colors and patterns available for each terrazzo type indicated.
- D. Samples for Verification: Match architect's samples for each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes and proportions. Prepare samples of same thickness and from same material to be used for the work in size indicated below:
1. Epoxy terrazzo: minimum 6" x 6" (152.4mm x 152.4mm) sample of each color and type of terrazzo.
  2. Precast epoxy terrazzo: minimum 6" x 6" (152.4mm x 152.4mm) sample of each color and type of terrazzo.
  3. Accessories: 6" length (152.4mm) of each kind of divider strip, stop strip, and control joint strip required.
  4. Stair Treads: 12" length (304.8mm) wide sample combination tread/riser with cast-in nosing.
- E. Manufacturer Experience:
1. Submit proof of associate membership in NTMA.
  2. Furnish list of at least five (5) epoxy terrazzo projects using material being submitted for this project installed during the last five (5) years of the same scope, complexity and at least 50 percent of the square footage.
- F. Qualification Data: For qualified installer.
1. Submit proof of contractor membership in NTMA.
  2. Furnish list of at least five (5) epoxy terrazzo projects using material being submitted for this project installed during the last five (5) years of the same scope, complexity and at least 50 percent of the square footage.
- G. Material Test Reports: For moisture and/or relative humidity of substrate.
- H. Maintenance Data: Submit 2 copies of NTMA maintenance recommendations and 2 copies of manufacturer's instructions.

#### 1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is acceptable to architect and epoxy terrazzo manufacturer to install manufacturer's products.
1. Engage a terrazzo contractor with at least five (5) years of satisfactory experience in installation of epoxy terrazzo. Terrazzo contractor shall demonstrate experience during last five (5) years of at least five (5) projects of comparable scope and complexity of at least 50 percent of the total square footage of this project.
  2. Engage an installer who is a contractor member of NTMA.

- B. Source Limitations:
1. Obtain primary Epoxy Terrazzo Flooring System materials including moisture treatment, membranes, primers, resins and hardening agents for a single manufacturer with proof of NTMA membership.
  2. Obtain aggregates, divider strips, sealers and cleaners from source recommended by primary materials manufacturer.
  3. Engage an epoxy manufacturer with at least ten (10) years experience.
- C. Pre-Installation Conference: Conduct conference at project site to comply with requirements in Section 01200 – Project Meetings. Review methods and procedures related to terrazzo including, but not limited to, the following:
1. Inspect and discuss installation procedures, joint details, job site conditions, substrate specification, vapor barrier details and coordination with other trades.
  2. Review and finalize construction schedule and verify availability of materials, installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
  3. Review special terrazzo designs and patterns.
  4. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions.
- D. NTMA Standards: Comply with NTMA’s “Terrazzo Specifications and Design Guide” and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- E. Mock-ups: Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mock-ups for terrazzo including accessories.
    - a. Size: Minimum 100 sq. ft (9.3 sq. m) of typical poured-in-place flooring and base condition for each color and pattern in locations directed by architect.
  2. Approved mock-ups may become part of the completed work if undisturbed at time of substantial completion.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in supplier’s original wrappings and containers labeled with source’s or manufacturer’s name, material or product brand name and lot number if any.
- B. Store materials in their original, undamaged packages and containers inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures and humidity.
1. Storage temperatures should be between 50°F to 80°F (10.0°C to 26.6°C).

#### 1.06 PROJECT CONDITIONS

- A. Prior to surface preparation, terrazzo contractor shall:
1. Evaluate slab condition, including slab moisture content and extent of repairs required, if any.
  2. Maintain the ambient room and floor temperature at 60°F (15.5°C) or above for a period extending 72 hours before, during and after floor installation. Concrete to receive epoxy terrazzo shall have cured for at least 28 days and be free of all curing compounds. Test concrete substrate to determine acceptable moisture levels prior to installation. Testing should be conducted according to ASTM F2170 (determining relative humidity in concrete slabs using situ probes). Proceed with installation only after substrates have a maximum relative humidity measurement reading less than 80%. If relative humidity measurement reading is greater than or equal to 80%,



moisture vapor treatment is required. Apply to terrazzo substrates according to vapor treatment product data sheet.

B. Prior to and during each day of installation, the terrazzo contractor shall:

- a. Verify that the dew point is at least 5°F (-15°C) less than the slab and air temperature.

C. Acceptable Substrates:

1. Level tolerance: Concrete sub-floor shall be level with a maximum variation from level of ¼” in 10 feet (6.4mm in 3.1mm). Any irregularity of the surface requiring patching and/or leveling shall be done using appropriate fill and selected aggregates as recommended by the manufacturer.
2. Concrete floor shall be prepared mechanically by shot blasting in accordance with ICRI Guideline No. 03732. Specifically, surface preparation results should achieve a CSP3-CSP5 profile.
3. Concrete floor shall receive a steel trowel finish.
4. Concrete shall be cured a minimum of 28 days. No curing agents are to be used in areas to receive terrazzo.
5. Concrete slab shall have an efficient moisture vapor barrier (suggested minimum: 15 mils (.4mm thickness) directly under the concrete slab. Moisture barrier shall NOT be punctured.
6. Saw cutting of control joints must be done between 12 and 24 hours after placement of the structural concrete and at a frequency compatible to ACI recommendations.

D. Provide permanent lighting or, if permanent lighting is not in place, simulated permanent lighting conditions during terrazzo installation.

E. Provide protection from other trades prior to final acceptance by owner.

## PART TWO – PRODUCTS

### 2.01 EPOXY TERRAZZO

A. Products:

1. Terroxy Resin Systems by Terrazzo & Marble Supplies Companies, Wheeling, IL ([www.tmsupply.com](http://www.tmsupply.com))
2. Or Equal Manufacturer

B. Materials:

1. Primer for slabs on-grade, light weight concrete and green concrete.
  - a. Physical properties of moisture mitigating primer shall have a maximum of 0.3 perms with 100% RH.
2. Flexible Reinforcing Membrane for substrate crack preparation and reflective crack reduction.
  - a. Optional: fiberglass scrim.
3. Epoxy Matrix and colors required for mix indicated.
  - a. Physical properties without aggregates. All specimens cured for 7 days at 73-77°F (22.8-25°C) and 50 percent plus or minus 2 percent RH. This product shall meet the following requirements:

PROPERTY	TEST METHOD	NTMA REQUIREMENTS
Hardness	ASTM D-2240 using Shore-D Durometer	60-85
Tensile Strength	ASTM D-638	3,000 psi min. 20.7 MPa
Compressive Strength	ASTM D-695 Specimen B cylinder	10,000 psi min. 68.9 MPa
Flexural Strength	ASTM D-790	Not specified
Chemical Resistance	ASTM D-1308 seven days at room temperature by immersion method	No deleterious effects: Distilled Water Mineral Oil Isopropanol Ethanol 0.025 Detergent Solution 1% Soap Solution 10% Sodium Hydroxide 10% Hydrochloric Acid 30% Sulfuric Acid 5% Acetic Acid

- b. Physical properties with aggregates. For Epoxy Matrix blended with three volumes of Valdres marble blended 60% #1 chip and 40% #0 chip, ground and grouted with epoxy resin according to Installation Specifications, finishing to a nominal 3/8" (9.5mm) thickness. All specimens cured for 7 days at 73-77°F (22.8-25°C) and 50 percent RH plus or minus 2 percent RH. This finished Epoxy Matrix shall meet the following requirements:

PROPERTY	TEST METHOD	NTMA REQUIREMENTS
Flammability	ASTM D-635	Self extinguishing, extent of burning 0.25 inches (6.4mm) max.
Thermal Coefficient of Linear Expansion	ASTM D-696	25x10 <sup>-6</sup> inches per inch per degrees to 140°F 11.4x10 <sup>-7</sup> cm per cm per degrees to 60°C max
Bond Strength	ACI COMM 403, Bulletin 59-43 (pages 1139-1141)	300 psi (100% concrete failure) 2.1 MPa (100% concrete failure)

4. Aggregates (Options: marble, glass, mother of pearl, porcelain, concrete) complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
- Abrasion and Impact Resistance: Less than 40% loss per ASTM C 131.
  - 24-Hour Absorption Rate: Less than 0.74%.
  - Dust Content: Less than 1.0% by weight.
  - Pre-Consumer or Post- Consumer Recycled Content: \_\_\_%
5. Finishing Grout: As recommended by manufacturer.
- C. Mix: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
- Color and pattern schedule: Where the following designations are indicated, provide specified terrazzo matrices matching architect's samples:
    - TZ1: \_\_\_\_\_
    - TZ2: \_\_\_\_\_

## 2.02 STRIP MATERIALS

- A. Thin-set Divider Strips: L-Type.

1. Material \_\_\_\_\_ selected from Domus Terrazzo full range.
2. Guide of commonly used L-type divider strips for Thin-set Epoxy Terrazzo Systems:

SYSTEM HEIGHT	STRIP HEIGHT	STRIP WIDTH
3/8" System	3/8"	16 Gauge 1/8" 1/4"
SYSTEM HEIGHT	STRIP HEIGHT	STRIP WIDTH
9.5mm System	9.5 mm	16 Gauge 3.2 mm 6.4 mm

B. Control/Construction Joints (saw cut, cold joint):

Option 1. Preferred: Separate double L-type angles back to back with minimum 1/8" (3.2mm) width between. Fill joint and area between strips with semi-flexible joint filler.

Option 2. Fill saw cut with 100% solids epoxy. Place single L-type angle strip shouldered on concrete, adjacent to the joint.

Option 3. For artwork considerations only. Buried Joint: Fill saw cut with 100% solids epoxy, followed by application of manufacturer membrane system (40mils/1.0mm) with fiberglass mesh reinforcement embedded into the membrane. Note: Movement from the substrate may reflect through the finished flooring.

C. Expansion Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8" (3.2mm) width between. Fill area between strips with semi-flexible joint filler.

D. Random Crack Detail: For cracks over 1/16" width before surface preparation.

Fill saw cut with 100% solids epoxy, followed by application of manufacturer membrane system (40mils/1.0mm) with fiberglass mesh reinforcement embedded into the membrane. Note: Movement from the substrate may reflect through the finished flooring.

E. Special Considerations: For epoxy terrazzo exposed to direct sunlight use strip method B Option 1 (referenced above) every 8'-12' in each direction to compensate for thermal expansion/contraction.

### 2.03 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: 100% solids epoxy resin adhesive recommended by manufacturer.

1. Use adhesive that has a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by terrazzo contractor for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Fill and selected aggregates as recommended by manufacturer.

- D. Joint Compound: Manufacturer joint filler, color to be selected by architect to match/compliment terrazzo.
- E. Cleaner: Manufacturer cleaner, a neutral cleaner with pH factor between 7 and 10 specifically designed for terrazzo.
- F. Surface Finish System: Level of polish to be specified by architect in accordance with desired appearance and level of reflectivity.
- G. Sealer: Slip and stain-resistant sealer that is chemically neutral with a pH factor between 7 and 10, that meets a standard coefficient of friction of 0.5 or higher, as measure by the James Machine (ASTM D-2047 Test Method), does not affect physical properties of terrazzo and complies with NTMA's "Terrazzo Specifications and Design Guide."
  - 1. Option 1: \_\_\_\_\_
  - 2. Option 2: \_\_\_\_\_

#### 2.04 PRECAST TERRAZZO

- A. Precast Terrazzo Units: Precast epoxy terrazzo base, stair treads, thresholds, benches, and planter units.
  - 1. Manufacturers: Subject to compliance with requirements, provided products acceptable to architect.
- B. Precast Terrazzo Base Units: 1/4" (6.4 mm) thick, cast in maximum lengths possible, but not less than 36" (900mm).
  - 1. Type: As indicated on the drawings.
  - 2. Height: As indicated on the drawings.
  - 3. Outside Corner units: With finished returned edges at outside corner.
  - 4. Color and Pattern: Match architect's sample.
- C. Terrazzo Cove Base:
  - 1. Option 1: Poured-in-place cove based with 3/4" (19mm) radius, 4" (101mm) high.
  - 2. Option 2: Precast Epoxy Terrazzo Cove Base: Type \_\_\_\_\_, 4" (101mm) high.
- D. Precast Terrazzo Stair Treads: Thickness indicated with cast-in nosing.
  - 1. Tread/Riser: 1/2" (12.7mm) thick epoxy, Type \_\_\_\_ with abrasive pattern \_\_\_\_\_.
  - 2. Color and Pattern: Match architect's sample.

### PART THREE - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates and areas, with Terrazzo Contractor present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions, including level tolerances, have been corrected.

### 3.02 PREPARATION

- A. Clean substrates of substances, including oil, grease and curing compounds, that might impair terrazzo bond. Provide clean, dry and neutral substrate for terrazzo application.
- B. Concrete Slabs:
  - 1. Provide sound concrete surface free of laitance, glaze, efflorescence, curing compounds, form release agents, dust, dirt, grease, oil and other contaminants incompatible with terrazzo.
    - a. Prepare concrete mechanically by shot blasting. Surface preparation results should achieve a CSP3-CSP5 profile according to International Concrete Repair Institute Guideline No. 03732.
    - b. Repair or level damaged and deteriorated concrete according to manufacturer requirements.
    - c. Repair cracks and non-expansion joints greater than 1/16" (1.6mm) wide according to manufacturer instructions.
  - 2. Verify that concrete substrates are visibly dry and free of moisture.
  - 3. Moisture Testing:
    - a. Test for moisture according to ASTM F2170 (determining relative humidity in concrete slabs using in situ probes).
    - b. Proceed with installation only after substrates have a maximum relative humidity measurement reading less than 80%. If relative humidity measurement reading is greater than or equal to 80%, moisture vapor treatment is required. Apply to terrazzo substrates according to moisture vapor treatment product data sheet.
- C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
  - 1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperature and ventilation conditions during installation.

### 3.03 EPOXY TERRAZZO INSTALLATION

- A. General:
  - 1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
  - 2. Place, rough grind, grout, cure grout, fine grind and finish terrazzo according to manufacturer's product data sheet and NTMA's "Terrazzo Specifications and Design Guide."
  - 3. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
  - 4. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- B. Thickness: 3/8" (9.5mm)
- C. Flexible Reinforcing Membrane:
  - 1. Option 1: Membrane application for isolated cracking. Route out all cracks and fill with 100% solids epoxy. Apply manufacturer membrane system (spread at 40 mils/1.0 mm thickness) across the crack allowing 12 inches (304.8 mm) on either side. Imbed fiberglass scrim at a minimum of 9" into wet membrane and saturate with additional membrane.
  - 2. Option 2: Membrane application for extensive cracking or crack prevention. Route out all cracks and fill with 100% solids epoxy (fiberglass scrim optional). Apply manufacturer membrane

system (spread at 40 mils/1.0 mm thickness) over prepared substrate to produce full substrate coverage in areas to receive terrazzo.

- D. Primer: Apply to terrazzo substrates according to manufacturer primer product data sheet.
- E. Strip Materials:
1. Divider and Accessory Strips:
    - a. Install strips in adhesive setting bed without voids below strips or mechanically anchor strips as required to attach strips to substrate.
    - b. Control/Construction Joins (saw cut, cold joint):
      - Option 1. Preferred: Separate double L-type angles back to back with minimum 1/8" (3.2mm) width between. Fill joint and area between strips with semi-flexible joint filler.
      - Option 2. Fill saw cut with 100% solids epoxy. Place single L-type angle strip shouldered on concrete, adjacent to the joint.
      - Option 3. For artwork considerations only. Buried Joint: Fill saw cut with 100% solids epoxy, followed by application of manufacturer membrane system (40mils/1.0mm) with fiberglass mesh reinforcement embedded into the membrane. Note: Movement from the substrate may reflect through the finished flooring.
    - c. Expansion Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8" (3.2mm) width between. Fill area between strips with semi-flexible joint filler.
    - d. Random Crack Detail: For cracks over 1/16" width before surface preparation. Fill saw cut with 100% solids epoxy, followed by application of manufacturer membrane system (40mils/1.0mm) with fiberglass mesh reinforcement embedded into the membrane. Note: Movement from the substrate may reflect through the finished flooring.
    - e. Special Considerations: For epoxy terrazzo exposed to direct sunlight use strip method B Option 1 (referenced above) every 8'-12' in each direction to compensate for thermal expansion/contraction.
- F. Placing Terrazzo:
1. Mix epoxy matrix with chips and fillers in ratios directed by manufacturer.
  2. Trowel apply terrazzo mixture over epoxy primer to provide a dense flat surface to top of divider strips. Allow to cure per manufacturer recommendations before rough grinding.
- G. Rough Grinding: Grind with 24 grit silicon carbide or 24 grit turbo diamonds until all terrazzo strips and marble chips are uniformly exposed.
- H. Grouting:
1. Cleanse floor with clean water and rinse.
  2. Remove excess rinse water by wet vacuum, dry and fill voids with manufacturer filler.
  3. Allow grout to cure. Grout may be left on terrazzo until other trades work is completed.
- I. Polishing: Polish with 120 grit resin pads or equivalent stones until all grout is removed from surface. Produce surface with a minimum of 70 percent aggregate exposure.
1. Optional: High finish polish

### 3.04 PRECAST TERRAZZO INSTALLATION

- A. Install precast units using method recommended by NTMA and manufacturer unless otherwise indicated.

- B. Seal joints between units with joint sealants.

### 3.05 CLEANING AND PROTECTION

- A. Cleaning: Remove grinding dust from installation and wash all surfaces with manufacturer recommended cleaner.
- B. Sealing: Apply slip and stain-resistant sealer that is chemically neutral with a pH factor between 7 and 10, that meets a standard coefficient of friction of 0.5 or higher, as measure by the James Machine (ASTM D-2047 Test Method), does not affect physical properties of terrazzo and complies with NTMA's "Terrazzo Specifications and Design Guide."
- C. Protection: Upon completion, the work shall be ready for final inspection and acceptance by the owner or agent. Provide final protection and maintain conditions, in a manner acceptable to terrazzo contractor, that ensure terrazzo is without damage or deterioration.

**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 ceiling tile as specified on the Finish Schedule. Panels are to be as shown on Drawings, including accents and color.

### 2.02 METAL GRID SYSTEM

- A. Where suspended ceilings are indicated on the drawings provide 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 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 09775

### SANITARY WALL FINISH

#### PART ONE: GENERAL

##### 1.01 DESCRIPTION:

- A. This section describes the requirements for furnishing and installing fiberglass reinforced plastic panels according to manufacturer's recommendations.

##### 1.02 SUBMITTALS:

- A. Submit in accordance with Section (Insert Section Number)
  1. Two samples of each type of panel, each type of trim and fastener.
  2. Shop Drawings: Indicate the location and dimension of joints and fastener attachments.
  3. Installation Guide #6211.

##### 1.03 QUALITY ASSURANCE:

- A. Provide panels and molding only from the manufacturer specified to ensure warranty and color harmonization of accessories.

##### 1.04 Delivery, Storage, and Handling:

- A. Deliver of Materials: Package sheets on skids or pallets for shipment to project site.
- B. Storage of Materials: Store panels in a dry place at the project site.
- C. Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

##### 1.05 PROJECT CONDITIONS:

- A. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
- C. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

## PART TWO: PRODUCTS

### 2.01 MATERIALS:

- A. Wall and/or ceiling panels shall be KEMLITE Kemply with Surfaseal fiberglass reinforced plastic panels as manufactured by KEMLITE COMPANY, Joliet, Illinois, USA Phone: 1-800-435-0080 or 1-815-467-8600, Fax: 1-815-467-8666

1. Wall Panels:

Wall Panels shall be: (choose one substrate from "Kemply Wall Panels" table) substrate with a factory laminated white (choose one skin from "Kemply Wall Panels" table) skin, size to be (choose size and skin one or two sides from "Kemply Wall Panels" table).

2. Wall panels are specified on Architectural Drawings.

B. ALL PANELS MEET USDA/FSIS REQUIREMENTS.

The Kemply panels above, except for the 3/32" OSB with 0.05" Glasbord-PWI skin one side, have not been tested for physical properties or for fire resistance. The Glasbord finish has been tested (see Kemlite Technical Bulletins 65024, 6229 and 6283). Substrate physical properties and fire resistance are the responsibility of the substrate manufacturer. Kemlite makes no claims as to the products worthiness of the composite for any specific application, overall physical properties, or fire resistance.

Numerical flame spread and smoke development ratings are not intended to reflect hazards presented by Kemlite Company products or any other material under actual fire conditions. These ratings are determined by small scale tests conducted by independent testing facilities using the American Society for Testing and Materials E-84 test standard (commonly referred to as the "Tunnel Test"). KEMLITE PROVIDES THESE RATINGS FOR MATERIAL COMPARISON PURPOSES ONLY. Like other organic building materials (e.g. wood), panels made of fiberglass reinforced plastic resins will burn. When ignited, frp may produce dense smoke very rapidly. All smoke is toxic. Fire safety requires proper design of facilities and fire suppression systems, as well as precautions during construction and occupancy. Local codes, insurance requirements and any special needs of the user of the product will determine the correct fire-rated interior finish and fire suppression system necessary for a specific installation.

1. Division Bars, Corner Trim: Panel manufacturer's standard length extruded vinyl pieces; longest length possible to eliminate end joints.
2. Fasteners: Non-corrosive drive rivets.

## PART THREE-PREPARATION

### 3.01 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean, and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

- B. Do not begin installation until backup surfaces are put into satisfactory condition.

### 3.02 APPLICATION

- A. Do all cutting with carbide tipped saw blades or drill bits, or cut with snips.
- B. Install panels with manufacturer's recommended gap for panel field and corner joints.
- C. Fastener holes in the panels must be predrilled 1/8" (3.2mm) oversize.
- D. For trowel type and application of adhesive, follow adhesive manufacturer's recommendation.
- E. Using products acceptable to manufacturer, install the frp panel system in accordance with panel manufacturer's printed instructions, Installation Guide #6211.

### 3.03 CLEANING

- A. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.
- B. For current distribution and technical information, please call or write: Kemplite Company, Inc., P.O. Box 2429, Joliet, IL 60434, (800) 435-0080, (815) 467-8600, FAX (815) 467-8666. Kemplite, Glasbord, Surfaseal, Thread on the backside and Fluorescent Thread on the Frontside are registered trademarks of Kemplite Company, Inc.

**END OF SECTION**



**SECTION 09840**  
**ACOUSTICAL WALL TREATMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the Acoustic Finishes as shown and specified in the described system(s): Adjust list below to suit Project
  - 1. Wall Acoustic Finish
- B. Related Sections include the following:
  - 1. Section 06210 Interior Finish Carpentry

**1.3 SUBMITTALS**

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 "Submittal Procedures".
- B. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.
- C. Submit product test reports from a qualified independent 3<sup>rd</sup> party testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.
- D. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.
- E. Samples for Initial Selection:
  - 1. Submit minimum 2-inch by 8-inch samples. Indicate full color and edge detail.
- F. Samples for Verification:
  - 1. Submit minimum 2-inch by 8-inch sample for each color
- G. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

**1.4 QUALITY ASSURANCE**

A. Manufacturers Qualifications

1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least two (2) consecutive years and which can show evidence of those materials being satisfactorily used on at least three (3) projects of similar size, scope and location. At least three (2) of the projects shall have been successful for use two (2) years or longer.
2. Manufactured panels must be produced from a minimum of 50% post-consumer recycled content.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Acoustic Finishes and specified items in manufacturer's standard protective packaging.
- B. Do not deliver Acoustic Finishes, components and accessories to Project site until areas are ready for installation.
- C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.
- D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of project.
- E. Before installing Acoustic Finishes, permit them to reach room temperature.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install Acoustic Finishes until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

- A. Warranty Period: 1 year after the date of substantial completion.
- B. The warranty shall not deprive the owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Manufacturer: Felt Right, LLC., Salt Lake City, Utah, USA / Telephone (801) 742-1458

## 2.2 MATERIALS

- A. Felt tiles produced by Felt Right
  - 1. Recycled Rigid PET Felt
  - 2. Size: Various
  - 3. Thickness: Felt Right 3/8"
  - 4. Basis of Design Product: The design of Acoustic Tile systems is provided by Felt Right, LLC. Products from other manufacturers must be approved by the Architect or Designer prior to bidding in accordance with the Instructions to Bidders and Section 10 60 00 "Product Requirements".
- B. Sheet minimum performance attributes:
  - 1. Noise Reduction Coefficient (ASTM C423) – 0.35
  - 2. Panels must be produced from a minimum of 50% post-industrial recycle content.

## 2.3 MISCELLANEOUS MATERIALS

- A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaner: Type recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of Acoustic Finishes will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for the installation of Acoustic Finishes.
- B. Utilize fasteners provided by manufacturer.
- C. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

### 3.3 CLEANING AND PROTECTION

- A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

**END OF SECTION**

## Section 09900

### PAINTING

#### 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, 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.

#### B. Exterior Painting:

##### *1) Previously Painted Masonry and Concrete Walls*

- a. Pretreatment: Repair all damaged concrete areas, cracks and damaged surface areas according to industry standards.
- b. Spot Prime Coat (any exposed rusting steel/rebar areas): **B58T101 Macropoxy 920 Penetrating Epoxy – Clear**
- c. Spot Prime Coat (bare masonry areas only): **LX02W0050 Loxon Concrete & Masonry Primer/Sealer - Interior/Exterior Latex**
- d. Spot Prime Coat (any chalked existing painted areas or bare concrete/masonry where laitance and chalk is present after pressure washing): **LX03W0100 Loxon Acrylic Conditioner - Guide Coat White** or **LX03V0100 Loxon Acrylic Conditioner – Clear**
- e. Optional Patching Compound – First Stripe Coat Over Hairline Cracks: **WL700GLSB Concrete and Masonry Elastomeric Patch – Brush Grade Smooth** or **WL700GLSK Concrete and Masonry Elastomeric Patch – Knife Grade Smooth** or **WL700GLTB Concrete and Masonry Elastomeric Patch – Brush Grade Textured** or **WL700GLTK Concrete and Masonry Elastomeric Patch – Knife Grade Textured** (apply at 10 mils DFT.)

A one part urethane sealant such as **SU21S0010 Loxon S1 One Component Smooth Polyurethane Sealant** or **SU31T0010 Loxon TX One Component Textured Polyurethane Sealant** can also be used.

- f. Optional Patching Compound – Second Stripe Coat Over Hairline Cracks: **WL700GLSB Concrete and Masonry Elastomeric Patch – Brush Grade Smooth** or **WL700GLSK Concrete and Masonry Elastomeric Patch – Knife Grade Smooth** or **WL700GLTB Concrete and Masonry Elastomeric Patch – Brush Grade Textured** or **WL700GLTK Concrete and Masonry Elastomeric Patch – Knife Grade Textured** (apply at 10 mils DFT.)

A one part urethane sealant such as **SU21S0010 Loxon S1 One Component Smooth Polyurethane Sealant** or **SU31T0010 Loxon TX One Component Textured Polyurethane Sealant** can also be used.

- g. Full Prime Coat: **LX02W0050 Loxon Concrete & Masonry Primer/Sealer - Interior/Exterior Latex**
  - h. Finish Coat (Hybrid Elastomeric Acrylic Finish Coat): **LX11W0051 - Loxon XP Waterproofing Masonry Coating – Flat**
  - i. Optional Second Finish Coat (Hybrid Elastomeric Acrylic Finish Coat): **LX11W0051 - Loxon XP Waterproofing Masonry Coating – Flat**
- 2) *Previously Painted Exterior Wood Trim (100% Acrylic Exterior Finish Coat)*
- a. Prime/Spot Prime Coat (bare non-bleeding woods areas only): **B42W8041 Exterior Latex Wood Primer – White**
  - b. Prime/Spot Prime Coat (bare bleeding woods areas only; redwood and cedar): **Y24W8020 Exterior Oil-Based Wood Primer**
  - c. Two Finish Coats: **A80W1151 SuperPaint Exterior Latex Flat** or **A89W1151 SuperPaint Exterior Latex Satin** or **A84W1151 SuperPaint Latex Gloss**
- 3) *Previously Painted Metal Trim and Moldings*
- a. Pretreatment (bare galvanized metal only): Great Lakes Laboratories “Clean ‘N Etch Cleaner”.
  - b. Prime Coat (bare galvanized metal only): **B66W1310 Pro Industrial Pro-Cryl Universal Primer**
  - c. Prime Coat (bare ferrous metal only): **B50WZ4 Kem Bond HS High Solids Alkyd Universal Metal Primer**
  - d. Two Finish Coats: **A80W1151 SuperPaint Exterior Latex Flat** or **A89W1151 SuperPaint Exterior Latex Satin** or **A84W1151 SuperPaint Latex Gloss**

C. Interior Painting:

1) *Interior Previously Painted Drywall*

- a. Spot Prime Coat (bare plaster areas only): **LX02W0050 Loxon Concrete & Masonry Primer/Sealer - Interior/Exterior Latex**
- b. Two Finish Coats: **B30W12651 ProMar 200 Zero VOC Interior Latex Flat** or

**B20W12651 ProMar 200 Zero VOC Interior Latex Eg-Shel or B31W2651 ProMar 200 Zero VOC Interior Latex Semi-Gloss**

2) *Interior Previously Painted Wood Doors*

- a. Prime Coat: **B51W1150 EXTREME BOND Interior/Exterior Bonding Primer or B49W8820 Multi-Purpose Interior Oil-Based Primer**
- b. Two Finish Coats: **B53W2251 Pro Industrial Waterbased Alkyd Urethane Enamel Low Sheen or B53W2151 Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss or B53W2051 Pro Industrial Waterbased Alkyd Urethane Enamel Gloss**

D. Preparation

- 1) Pressure wash/clean all surfaces to be painted to remove all dirt, grease, chalk, loose paint and surface contaminates.
- 2) Where a sheen is present on the existing coating, sand the existing paint finish to create a surface profile so the new coating can obtain proper mechanical adhesion.
- 3) If the surfaces to be painted are heavily contaminated with grease or oil, clean the highly contaminated areas with Great Lakes Laboratories Extra Muscle Prepaint Cleaner.
- 4) On ferrous metal surfaces remove all loose existing paint and corrosion by using SSPC-SP2 Hand Tool Cleaning and SSPC-SP3 Power Tool Cleaning.
- 5) Follow all instructions on the Product Data Sheet and Product Label.

E. Mockups

- 1) Mockup samples should be applied before the start of the project to insure the acceptable and successful installation technique. Successful mockup samples will also help insure the compatibility of the new coatings with the previously painted surfaces. Acceptable mockup samples can then be approved by the owner/design professional before the start of the project.

**END OF SECTION**

**SECTION 10426**  
**SPECIALTY SIGNS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Signage

**1.02 SUBMITTAL**

- A. Manufacturers must submit 3 references showing products for projects completed within the last 5 years.
- B. Submit manufacturer's technical data and installation for each type of sign required.
- C. Submit shop drawings listing sign size, letterform and letter heights.
- D. Submit one full size sample sign of type, style and color specified, including method of attachment. If approved, the sample will become part of the job.

**1.03 SIGN TYPE DESCRIPTION**

- A. Signage shall consist of room number and room function to meet the requirements of the Americans with Disabilities Act - 1990 (ADA) and CABO ANSI A1 17.1 - 1992.

**PART 2 PRODUCTS**

**2.01 MANUFACTURER**

- A. Provide products from Mohawk Sign Systems, Inc.® P.O. Box 966, Schenectady, NY 12301-0966. 518/ 370-3433 or approved equal. Other manufacturers must submit their signage products to the Architect 10 days prior to the bid date for approval to be considered as an equal.

**2.02 GRAPHIC PROCESS**

- A. All signs shall be manufactured using Graphic Process Series 200A - Sand Carved® using Format D.
  - 1. Tactile characters shall be raised the required 1/32" inches from sign face. Glue-on letters or etched backgrounds are not acceptable.
  - 2. All text shall be accompanied by Grade 2 Braille. Braille shall be separated ½" from the corresponding raised characters or symbols. Grade 2 Braille translation to be provided by the signage manufacturer.

3. All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.
- B. Plaque material shall be Special Purpose SP125 decorative thermosetting high pressure laminate. Material to be 1/8" thick laminate with a melamine resin surface and a phenolic resin core which provides resistance to abrasion, stains, alcohol, solvents, boiling water, and heat. The material shall be NEMA rated and have flammability and smoke values that meet the standards for flammability of interior materials.
  - C. Background color as selected by architect from manufacturer's actual color samples.
  - D. Letterform shall be Gill Sans upper case letters and numbers
  - E. Size of letters and numbers shall be as follows:
    1. Room numbers shall be 1".
    2. Lettering for room ID signs shall be 5/8" or as noted.
    3. Symbol size shall be 4".
    4. Standard Grade 2 Braille shall be 1/2" below copy.
    5. Corners: 1/2" radius
  - F. Copy position: CC (centered/centered) or as indicated on drawings.

## 2.03 SIGN DESIGN

- A. *See sign layouts on architectural drawings along with sign schedule.*

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Signs shall be mounted using vinyl tape and silastic adhesive. Mechanical for sign Type E. All signs shall be mounted 60" from the floor to the center of the sign on the latch side. The distance between the door frame and sign should be 2". Installer user assumes responsibility for suitable installation of the signs.

### 3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled signs surface according to manufacturer's instructions. Protect from damage until acceptance.

**END OF SECTION**

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**SECTION 10800**  
**TOILET ROOM ACCESSORIES**

**PART ONE - GENERAL**

**1.01 DESCRIPTION**

- A. **Work Included:** Provide all toilet room accessories, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.
- B. **Related Work Described Elsewhere:**
- (1) Installing, or furnishing and installing, concealed support devices for the work of this Section, is specified in pertinent other Sections.

**1.02 QUALITY ASSURANCE**

- A. **Standards:** Comply with standards specified herein 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 Architect.

**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) Complete material list showing all items proposed to be furnished and installed under the section.
  - (c) Manufacturer's recommended methods of installation.
  - (d) Complete descriptive data on fasteners proposed for each type of wall construction, recommended mounting locations, and mounting instructions.
- (2) The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the 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. 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

- A. Anchors and Fasteners: Provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the accessory to be mounted and well suited for use with the supporting construction. Where exposed fasteners are permitted, provide oval head fasteners with finish matching the accessory.
- B. Finish: All accessory items shall be stainless with chrome finish.
- C. Design is based on use of products manufactured by the Bobrick & Restoration Hardware Co., and catalog numbers of that manufacturer are given as an indication of the quality and style required. Equal products by other manufacturers approved by the Owner will be accepted such as, but not limited to, A&J, ASi, Bradley, GAMCO, McKinney/Parker, in accordance with the General Conditions.

### 2.02 ACCESSORY ITEMS

- A. Provide the following in the numbers and locations shown on the drawings.

## PART THREE - EXECUTION

### 3.01 INSPECTION

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

### 3.02 COORDINATION

- A. Throughout construction of substrate surfaces, use all means necessary to ensure proper and adequate provision for concealed support devices, and for finished openings, to receive the work of this Section.

### 3.03 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all components plumb, level, square, and firmly into position for long life under hard use. Mount all items at the manufacturer's recommended mounting height unless otherwise shown on drawings.

**END OF SECTION**

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe, fittings, valves, and connections for sprinkler systems.
- B. Related Sections:
  - 1. Division 03 - Concrete Forming and Accessories: Execution requirements for inserts and sleeves specified by this section.
  - 2. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
  - 3. Division 09 - Painting and Coating: Execution requirements for piping painting specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
  - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - 2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
  - 3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
  - 4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - 5. ASME B16.25 - Buttwelding Ends.
  - 6. ASME B16.3 - Malleable Iron Threaded Fittings.
  - 7. ASME B16.4 - Gray Iron Threaded Fittings.
  - 8. ASME B16.5 - Pipe Flanges and Flanged Fittings.
  - 9. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
  - 10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
- B. ASTM International:
  - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 2. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
  - 3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - 4. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
  - 5. ASTM B32 - Standard Specification for Solder Metal.
  - 6. ASTM B75 - Standard Specification for Seamless Copper Tube.
  - 7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
  - 8. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- 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 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.

E. National Fire Protection Association:

1. NFPA 13 - Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
3. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

F. Underwriter Laboratories, Inc.:

1. UL 1887 - Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

1.3 SYSTEM DESCRIPTION

A. Firestopping Materials: Comply with requirements of Division 07.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping Materials: Comply with requirements of Division 07.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Product Data:

1. Submit manufacturer's catalogue information. Indicate valve data and ratings.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and tag numbering.

C. Operation and Maintenance Data: Submit spare parts lists.

## 1.7 QUALITY ASSURANCE

- A. Provide fire sprinkler piping located in plenums with peak optical density not greater than 0.5; average optical density not greater than 0.15; flame spread not greater than 5 feet (1.5 m) when tested in accordance with UL 1887.
- B. 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.
- C. All Fire Protection components (including couplings, fittings, valves and accessories) to be supplied by one manufacturer and shall be UL listed and/or FM approved.
- D. Grooving tools shall be of the manufacturer as the grooved components.

## 1.8 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum three years' experience or certified by manufacturer of equipment to be installed.

## 1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Deliver and store valves in shipping containers, with labeling in place.
- C. Furnish cast iron and steel valves with temporary protective coating.
- D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

## 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

## 1.12 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for basic fire suppression materials and methods.

## 1.13 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two sets of valve stem packing for each size and type of valve installed.

## PART 2 PRODUCTS

### 2.1 VALVES

- A. Manufacturers:
  - 1. Design Base; Victaulic.
  - 2. ASC.
  - 3. Grinnell Corp.
  - 4. Reliable Sprinkler Corp.
  - 5. Substitutions: Division 01 - Product Requirements.
- B. Gate Valves:
  - 1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
  - 2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.
  - 3. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged or grooved ends, iron body indicator post assembly.
- C. Globe or Angle Valves:
  - 1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded or grooved ends, with back seating capacity.
  - 2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged or grooved ends, renewable seat and disc.
- D. Ball Valves:
  - 1. Up to and including 2 inches: Bronze or Stainless steel two piece body, brass, chrome plated bronze, or stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union or grooved.
  - 2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle or gear drive hand wheel for sizes 10 inches and over, flanged or grooved.
- E. Butterfly Valves:

1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.
2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device, and internal external tamper switch rated 10 amp at 115 volt AC.

F. Check Valves:

1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded or grooved ends.
2. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged or grooved ends with automatic ball check.
3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded or grooved, wafer, or flanged ends.

G. Drain Valves:

1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

## 2.2 BURIED PIPING WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, ASTM A135/135M/135M, ASTM A795/A795M, or ASME B36.10, Schedule 40 black or galvanized, with ASME C105 polyethylene jacket, or double layer, half-lapped 10 mil polyethylene tape.

1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped 10 mil polyethylene tape.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
3. Joints: AWS D1.1, welded.
4. Casing: Closed glass cell insulation or Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves.

B. Copper Tubing: ASTM B75, ASTM B251, or ASTM B88 Type K annealed.

1. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper and bronze, solder joint, pressure type.
2. Joints: AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze or ASTM B32, Alloy Grade Sb5 tin-antimony solder.
3. Casing: Closed glass cell insulation or Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves.

C. Cast Iron Pipe: AWWA C151.

1. Fittings: AWWA C110, standard thickness.
2. Joints: AWWA C111, rubber gasket.
3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

## 2.3 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A53/A53M, Grade B; ASTM A135/135M; ASTM A135/135M UL listed, threadable, light wall, rolled or grooved ends as appropriate to pipe material and use, wall thickness, pressures, size and method of joining; ASTM A795/A795M; or ASME B36.10; black or galvanized.
  - 1. Smaller than 4" diameter: Minimum Schedule 40.
  - 2. 4" diameter and larger: Schedule 10 or greater.
  - 3. Fittings: Design Base Victaulic; FireLock series.
    - a. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
    - b. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.
    - c. Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM B47.
    - d. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe. Carbon-steel housing with integral pipe stop and O-ring pocked and O-ring uniformly compressed into permanent mechanical engagement onto pipe.
    - e. Mechanical Formed Installation-Ready Fittings:
      - 1) Cast ductile iron conforming to ASTM A-526, with continuous gasket through fitting of synthetic rubber of grade to suit intended service, confirming to ASTM D-2000.
    - f. Coupling bolts shall be anti-corrosion plated carbon steel.
- B. Cast Iron Pipe: AWWA C151.
  - 1. Fittings: AWWA C110, standard thickness.
  - 2. Joints: AWWA C111, rubber gasket.
  - 3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

## 2.4 PIPE HANGERS AND SUPPORTS

- A. Conform to NFPA 13; NFPA 14 where applicable.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp or Angle ring.

- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

## 2.5 FLEXIBLE ARM-OVER ASSEMBLY

- A. Design Base: Victaulic; Vic-Flex series.
- B. Flexible arm-over assembly with corrugated flexible stainless steel hose and braided stainless steel cover. UL-2443 compliant for pressure cycling, corrosion resistance, flow characteristics, vibration resistance, leakage, mechanical and hydrostatic strength. Working Pressure rated for 175psi.
- C. 1" Coupling for threaded connection to branch line (inlet).
- D. Adjustable-position fitting for connection to ½" or ¾" sprinkler head.
- E. Matching support brace shall provide for secure attachment to accessible ceiling grid or support members for installation above solid ceilings.

## 2.6 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 07.

## 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.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Obtain permission from Architect before using powder-actuated anchors.
- E. Do not drill or cut structural members.
- F. Install firestopping to seal all openings in rated partitions. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material. Remove



incompatible materials affecting bond. Install support materials as needed to arrest liquid material leakage.

### 3.3 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains.
- B. Install Work in accordance with Codes and Standards adopted at the project location, compliant with requirements of local Authority Having Jurisdiction (AHJ).
- C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- D. Install piping to conserve building space, to not interfere with use of space and other work.
- E. Group piping whenever practical at common elevations.
- F. Install pipe sleeve at piping penetrations through footings, rated partitions and walls, and through floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- G. Install piping, with fittings or couplings with flexible components, to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Pipe Hangers and Supports:
  - 1. Install in accordance with NFPA 13 and NFPA 14 as applicable.
  - 2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
  - 3. Place hangers within 12 inches of each horizontal elbow.
  - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
  - 7. Install copper plated hangers and supports for copper piping or listed packing between hanger or support and piping.
- I. Slope piping and arrange systems to drain at low points.
- J. Painting:
  - a. Prime coat all steel hangers and supports including concealed piping.
  - b. In occupied spaces; finish coat all exposed steel hangers, supports, and piping to match color of adjacent structure or trim as selected by Architect.
  - c. Prepare exposed pipe, fittings, supports, and accessories for finish painting.
    - 1) Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - d. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
  - e. Refer to Division 09.

- K. Do not create penetrations through building structural members unless indicated or directed by Structural Engineer in writing.
- L. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.
- M. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- N. Form or cut grooves for mechanical coupling systems compliant with geometry required by coupling manufacturer and to maintain industry standard residual thickness of piping at groove.
- O. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation and any finish or paint are applied to surrounding surfaces.
- P. Install gate, ball or butterfly valves for shut-off or isolating service.
  - 1. Install only valves with Outside Indication of position for main service entry isolation and at backflow prevention devices.
  - 2. Install with tamper detection where required by applicable code.
- Q. Install drain valves at main shut-off valves, low points of piping and apparatus.
- R. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut.

### 3.4 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Division 07.

### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. 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. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- B. Coordinate with fire alarm system installer to ensure all tamper detection circuits are compatible with system and fully operational at completion.

### 3.6 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.

3.7 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Clean entire system after other construction is complete.

END OF SECTION

## SECTION 21 05 16

### EXPANSION FITTINGS AND LOOPS FOR FIRE-SUPPRESSION 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 21 05 00 - Common Work Results for Fire Suppression: Product and installation requirements for piping used in fire protection systems.
  - 2. Section 21 05 48 - Vibration and Seismic Controls for Fire-Suppression Piping and Equipment: Product and installation requirements for vibration isolators used in piping 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.
  
- B. Expansion Compensation Design Criteria:
  - 1. Installation Temperature: 50 degrees F.
  - 2. Fire Protection System Temperature: 85 degrees F.
  - 3. Safety Factor: 30 percent.

##### 1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
  
- B. Shop Drawings:

1. Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.
2. Include shop drawing information for piping expansion compensation.
3. Submit shop drawings.

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. Design Data:

1. Indicate criteria and show calculations.
2. Submit calculations.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX. AWS D1.1.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

## 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 documented experience or approved by manufacturer.

## 1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

## 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.
- B. Furnish five year manufacturer warranty for leak free performance of packed expansion joints.

## PART 2 PRODUCTS

### 2.1 FLEXIBLE PIPE CONNECTORS

- A. Steel Piping:
  - 1. Inner Hose: Stainless Steel, or Bronze.
  - 2. Exterior Sleeve: Braided.
  - 3. Pressure Rating: 125 psig WSP and 450 degrees F.
  - 4. Joint: Flanged, Threaded, Threaded with Union, Welded, Grooved, or as specified for pipe joints.
  - 5. Size: Use pipe-sized units.
  - 6. Maximum offset: 3/4 inch on each side of installed center line.
- B. Copper Piping:
  - 1. Inner Hose: Bronze
  - 2. Exterior Sleeve: Braided bronze.
  - 3. Pressure Rating: 125 psig WSP and 450 degrees F.
  - 4. Joint: Flanged, Threaded, Threaded with Union, Soldered, Grooved, or as specified for pipe joints.
  - 5. Size: Use pipe sized units
  - 6. Maximum offset: 3/4 inch 1 inch on each side of installed center line

### 2.2 EXPANSION JOINTS

- A. Stainless Steel Bellows Type:
  - 1. Pressure Rating: 125 psig WSP and 400 degrees F 200 psig WOG and 250 degrees F.

2. Maximum Compression: 1-3/4 inch 3 inch.
  3. Maximum Extension: 1/4 inch.
  4. Joint: Flanged, Welded, Grooved for mechanical coupling, or as specified for pipe joints.
  5. Size: Use pipe sized units
  6. Application: Steel piping 3 inches and smaller.
- B. External Ring Controlled Stainless Steel Bellows Type:
1. Pressure Rating: 125 psig WSP and 400 degrees F 200 psig WOG and 250 degrees F 225 psig and 70 degrees F.
  2. Maximum Compression: 15/16 inch.
  3. Maximum Extension: 5/16 inch.
  4. Maximum Offset: 1/8 inch.
  5. Joint: Flanged or grooved for mechanical coupling.
  6. Size: Use pipe sized units
  7. Accessories: Internal flow liner.
  8. Application: Steel piping 3 inch and larger.
- C. Sphere, Elbow, and Flexible Compensators:
1. Body: Teflon; Neoprene and nylon.
  2. Working Pressure: psi
  3. Maximum Temperature: degrees F.
  4. Maximum Compression: 1/2 inch 3/4 inch 1 inch 1-1/8 inch.
  5. Maximum Elongation: 3/8 inch 1/2 inch 5/8 inch 7/8 inch.
  6. Maximum Offset: 3/8 inch 1/2 inch 3/4 inch 7/8 inch.
  7. Maximum Angular Movement: 15 30 45 degrees.
  8. Joint: Tapped steel flanges, unions, or grooved for mechanical coupling.
  9. Size: Use pipe sized units
  10. Accessories: Control rods Control cables.
  11. Application: Steel piping 2 inch and larger.
- D. Two-ply Bronze Bellows Type:
1. Construction: Bronze with anti-torque device, limit stops, internal guides.
  2. Pressure Rating: 125 psig WSP and 400 degrees F 200 psi WOG and 250 degrees F.
  3. Maximum Compression: 1-3/4 inch 3 inch.
  4. Maximum Extension: 1/4 inch.
  5. Joint: Soldered or as specified for pipe joints.
  6. Size: Use pipe sized units
  7. Application: Copper piping.
- E. Low Pressure Compensators with two-ply Bronze Bellows:
1. Working Pressure: 75 psig 80 psig.
  2. Maximum Temperatures: 250 degrees F 400 degrees F.
  3. Maximum Compression: 1/2 inch.
  4. Maximum Extension: 5/32 inch.
  5. Joint: Soldered.
  6. Size: Use pipe sized units
  7. Application: Copper or steel piping 2 inch and smaller.
- F. Copper with Packed Sliding Sleeve:

1. Maximum Temperature: 250 degrees F.
2. Joint: Flanged, Threaded, grooved for mechanical coupling, or as specified for pipe joints.
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.

### 2.3 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 Ductile Iron Cast steel body, double ball bearing race, field lubricated, with rubber (Buna-N) 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. 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 as indicated on Drawings. Refer to 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.
- G. Provide expansion loops as indicated on Drawings.

### 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.



REA Park Clubhouse  
Terra Haute, IN

END OF SECTION

SECTION 21 05 48

VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Inertia bases.
  - 2. Vibration isolators.
  
- B. Related Sections:
  - 1. Division 03 - 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 07 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
  - 3. Section 21 05 16 - Expansion Fittings and Loops for Fire-Suppression Piping: Product requirements for anchors and piping expansion compensation.
  - 4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports.
  - 5. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of 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 S1.4 - Sound Level Meters.
  - 2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
  - 3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
  - 4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.
  
- C. Air-Conditioning and Refrigeration Institute:
  - 1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.
  
- D. American Society of Heating, Refrigerating and:
  - 1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
  - 2. ASHRAE Handbook - HVAC Applications.
  
- E. 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.
- B. Provide minimum static deflection of isolators for equipment as follows:
  - 1. 20 HP or smaller;
    - a. Under 600 rpm: 1 inch
    - b. 600 - 900 rpm: 0.25 inch
    - c. Over 900 rpm: 0.125 inch
  - 2. Over 20 HP;
    - a. Under 600 rpm: 2 inch
    - b. 600 - 900 rpm: 0.5 inch
    - c. Over 900 rpm: 0.25 inch
- C. Use concrete inertia bases for base-mounted pumps over 10 hp.

### 1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate inertia bases and locate vibration isolators. Indicate vibration isolator type. Submit catalog information indicating materials, dimensional data.

### 1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of hangers including attachment points.

### 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 certified by manufacturer.

### 1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

## PART 2 PRODUCTS

### 2.1 INERTIA BASES

#### A. Structural Bases:

1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

#### B. Concrete Inertia Bases:

1. Mass: Minimum of 1.5 times weight of isolated equipment.
2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.
3. Connecting Point: Reinforced to connect isolators and snubbers to base.
4. Concrete: Reinforced 3,000 psi concrete.

### 2.2 VIBRATION ISOLATORS

#### A. Listed or 3<sup>rd</sup> party certified for the application.

#### 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.

### 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.

#### 3.2 INSTALLATION

- A. Install isolation for motor driven equipment.
- B. Bases:
  1. Set steel bases for 1 inch clearance between housekeeping pad and base.
  2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.
- C. Adjust equipment level.
- D. Install spring hangers without binding.
- E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- F. 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.
- G. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. 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.
- H. Support piping connections to isolated equipment resiliently as follows:
  1. Up to 4 inch Diameter: First three points of support.
  2. 5 to 8 inch Diameter: First four points of support.
  3. 10 inch Diameter and Over: First six points of support.
  4. 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 01 - Quality Requirements; Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

END OF SECTION

## SECTION 21 13 13

### WET-PIPE SPRINKLER SYSTEMS

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section includes wet-pipe sprinkler system, system design, installation, and certification.
- B. Related Sections:
  - 1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

##### 1.2 REFERENCES

- A. National Fire Protection Association:
  - 1. NFPA 13 - Installation of Sprinkler Systems.

##### 1.3 SYSTEM DESCRIPTION

- A. System to provide coverage for complete building unless otherwise noted.
- B. Provide hydraulically designed system to NFPA 13 hazard and Group occupancy requirements coordinated with and determined by Architect.
- C. Determine volume and pressure of incoming water supply from water flow test data.
  - 1. When not available, coordinate design assumptions with information obtained from local Fire Department or Water Utility.
  - 2. Revise design when test data becomes available prior to submittals.
- D. Interface system with building fire and smoke alarm system.
- E. Provide fire department connections as required by local Fire Department.

##### 1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
- C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- D. Design Data: Submit design calculations signed and sealed by Professional Engineer.

- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with applicable NFPA Code and requirements currently adopted at Project location.

#### 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 documented experience approved by manufacturer.
- C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

#### 1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Store products in shipping containers until installation.
- C. Furnish piping with temporary inlet and outlet caps until installation.

#### 1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

#### 1.11 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.



- B. Furnish extra sprinklers of quantity to meet NFPA requirements.
- C. Furnish suitable wrenches for each sprinkler type.
- D. Furnish metal storage cabinet.

## PART 2 PRODUCTS

### 2.1 SPRINKLERS

- A. Manufacturers:
  - 1. Design Base; Victaulic.
  - 2. Ansul Incorporated.
  - 3. Automatic Sprinkler Corp.
  - 4. Kike Protection Systems.
  - 5. Grinnell Corp.
  - 6. Reliable Sprinkler Corp.
  - 7. WSA Inc.
  - 8. Substitutions: Division 01 - Product Requirements.
- B. Suspended Ceiling Type:
  - 1. Design Base; Victaulic Firelock V3800 series (e.g. V3801).
  - 2. Type: Semi-recessed type with matching cover plate.
  - 3. Finish: Enamel color to match ceiling finish; as selected by Architect.
  - 4. Characteristics: UL listed, standard response, glass bulb type; temperature rated for specific area hazard, pressure rated to match system.
- C. Exposed Area Type:
  - 1. Design Base; Victaulic Firelock V24/27/34 series (e.g. V2703).
  - 2. Type: Standard upright type with guard.
  - 3. Finish: Brass or Chrome plated.
  - 4. Characteristics: UL listed, standard response, Fusible-solder link or Glass bulb type; temperature rated for specific area hazard, pressure rated to match system.
- D. Side wall Type:
  - 1. Design Base; Victaulic Firelock V2709.
  - 2. Type: Recessed horizontal side wall type with matching escutcheon plate and guard.
  - 3. Finish: Enamel color to match wall finish; as selected by Architect.
  - 4. Escutcheon Plate Finish to match.
  - 5. Characteristics: UL listed, standard response, Fusible-solder link or Glass bulb type; temperature rated for specific area hazard, pressure rated to match system.
- E. Freeze risk enclosures:
  - 1. Design Base; Victaulic Firelock V36 series.
  - 2. Type: Pendent, recessed pendent, sidewall, recessed sidewall with matching escutcheon plate and guard.
  - 3. Finish: Stainless steel.

## 2.2 PRESSURE MAINTENANCE PUMP

- A. Type: Close coupled motor and positive displacement pump unit.
- B. Construction: Bronze with stainless steel shafts, carbon bearings.
- C. Performance: differential pressure to meet calculated requirements.
- D. Motor: Open drip proof, permanently lubricated.
- E. Accessories: Include flexible hose connections, inlet strainer, isolation valves.
- F. Operation: Automatic with pressure switch actuation.

## 2.3 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate alarm, with pressure retard chamber and variable pressure trim; with test and drain valve where required.
- B. Electric Alarm: Electrically operated gong with pressure alarm switch.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- D. Fire Department Connections:
  - 1. Type: wall type with brass or chrome plated finish, or Free-standing type with ductile iron pedestal and brass or chrome plated finish, to match requirements of local Fire Department.
  - 2. Outlets: Two way with thread size to suit local Fire Department hardware; threaded dust cap and chain of matching material and finish.
  - 3. Drain: 3/4 inch automatic drip.
  - 4. Label: "Sprinkler - Fire Department Connection".

## 2.4 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: In accordance with Section 26 05 03 and Electrical service shown to building on Electrical Drawings.
- B. Controls: Supervisory switches, Water Level Supervisory Switches, Tank Temperature Supervisory Switches, Room Temperature Supervisory Switches, Disconnect Switch.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with NFPA requirements applicable to Project.
- B. Install buried shut-off valves in valve box. Install with post indicator.

- C. Install approved back-flow preventer assembly at sprinkler system water source connection.
- D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.
- E. Install outside alarm-gong on building wall.
- F. Install piping to minimize obstruction with other work.
- G. Install piping in concealed spaces above finished ceilings.
- H. Center sprinklers in at least one direction in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements.
- I. Connect to fire pump system where applicable.
- J. Install guards on sprinklers as indicated on Drawings.
- K. Hydrostatically test entire system.
- L. Require test be witnessed by local Authority Having Jurisdiction; provide copy to Owner and Architect.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Verify signal devices are installed and connected to fire alarm system.

### 3.3 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Flush entire piping system of foreign matter.

### 3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution and Closeout Requirements: Protecting installed construction.
- B. Apply masking tape or paper cover to sprinklers, cover plates, and sprinkler escutcheons not receiving field painted finish. Remove after painting.

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 bronze.
- C. Copper Tubing: ASTM B42, Temper O61 annealed.
  - 1. Fittings: ASME B16.26 cast bronze.
  - 2. Joints: Flared.



- D. Polyethylene Pipe: ASTM D2239 SIDR 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 SIDR 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 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

REA Park Clubhouse  
Terra Haute, IN

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, ¼-turn, w/vacuum breaker, ¾" 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 11 23

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Natural gas piping buried within 5 feet of building.
2. Natural gas piping above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Strainers.
7. Natural gas pressure regulators.
8. Natural gas pressure relief valves.
9. Underground pipe markers.
10. Bedding and cover materials.

B. Related Sections:

1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Access doors for concealed valves and accessories.
3. Division 09 - Painting and Coating: Product requirements for painting for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
4. ASME B31.9 - Building Services Piping.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. 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 B88 - Standard Specification for Seamless Copper Water Tube.

4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
5. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
6. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

E. American Water Works Association:

1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

H. Underwriters Laboratories Inc.:

1. UL 842 - Valves for Flammable Fluids.

### 1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.
- C. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89 and Section 220529.
- D. Use plug or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Coordination with other trades
  1. Ensure gas piping is properly sized and routed to all gas burning kitchen, plumbing, and mechanical equipment.
  2. Deliver volume and pressure required by manufacturer's installation instructions.
  3. Include dirt leg and isolation valve upstream of each device gas train.

#### 1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. 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. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
    - a. Strainers.
    - b. Natural gas pressure regulators.
    - c. Natural gas pressure relief valves.
- C. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves, piping system, and system components.
- C. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

#### 1.6 QUALITY ASSURANCE

- A. Perform natural gas Work in accordance with NFPA 54.
- B. Perform work in accordance with applicable code and local gas company requirements.
- C. 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 valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

## 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

## 1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

## 1.12 COORDINATION

- A. Division 01 - Administrative Requirements: Requirements for coordination.

## 1.13 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

## PART 2 PRODUCTS

### 2.1 NATURAL GAS PIPING, BELOW GRADE WITHIN 5 FT OF BUILDING

- A. PE Pipe: ASTM D 2513, SDR 11.
  - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. **Vent casing aboveground.**
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded or flanged or suitable for welded connection.

- e. Tracer wire connection.
- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
  - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
  - b. Outlet shall be threaded or flanged or suitable for welded connection.
  - c. Bridging sleeve over mechanical coupling.
  - d. Factory-connected anode.
  - e. Tracer wire connection.
  - f. Ultraviolet shield.
  - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Lyall, R. W. & Company, Inc.
    - 2) Mueller Co.; Gas Products Div.
    - 3) Perfection Corporation; a subsidiary of American Meter Company.
  - b. PE body with molded-in, stainless-steel support ring.
  - c. Buna-nitrile seals.
  - d. Acetal collets.
  - e. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Lyall, R. W. & Company, Inc.
    - 2) Mueller Co.; Gas Products Div.
    - 3) Perfection Corporation; a subsidiary of American Meter Company.
  - b. Fiber-reinforced plastic body.
  - c. PE body tube.
  - d. Buna-nitrile seals.
  - e. Acetal collets.
  - f. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Dresser Piping Specialties; Division of Dresser, Inc.
    - 2) Smith-Blair, Inc.
  - b. Stainless-steel flanges and tube with epoxy finish.
  - c. Buna-nitrile seals.
  - d. Stainless-steel bolts, washers, and nuts.



8. Factory-installed anode for steel-body couplings installed underground.

- B. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M forged steel welding type.
  2. Joints: ASME B31.9, welded.
  3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

## 2.2 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
  2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.
- B. Copper Tubing: ASTM B88, Type K or L ASTM B280, drawn.
1. Fittings: ASME B16.26 cast bronze, compression type.
  2. Joints: Flared.
- C. Corrugated Stainless Steel Tubing (final equipment connections):
1. Manufacturer:
    - a. Design Base: Omega Flex; TracPipe.
    - b. Parker Hannifin Corporation; Parflex Division.
    - c. Titeflex.
    - d. Tru-Flex Metal Hose Corp.
  2. 3<sup>rd</sup> party listed to ANSI LC 1.
  3. ASTM E84 compliant with respect to flame spread and smoke density.
  4. 3<sup>rd</sup> party listed for through-penetration firestop systems without removal of the jacket.

## 2.3 REGULATOR VENT PIPING, ABOVE GRADE

- A. Indoors: Same as natural gas piping, above grade.
- B. Outdoors: PVC pipe, tubing, and fittings, UL 651.

## 2.4 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
  2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
  2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

## 2.5 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. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.
- C. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

## 2.6 PLUG VALVES

- A. Manufacturers:
  1. DeZURIK, Unit of SPX Corp.
  2. Flow Control Equipment, Inc.
  3. Homestead Valve
  4. Substitutions: Division 01 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 78, Class 150 Class 300, semi-steel construction, round square rectangular port, full pipe area regular opening, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
- C. 2-1/2 inches and Larger: MSS SP 78, Class 150 Class 300, semi-steel construction, round square rectangular port, full pipe area regular opening, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated worm gear-operated.

## 2.7 PIPE HANGERS AND SUPPORTS

- A. See Section 220529.

## 2.8 STRAINERS

- A. Manufacturers:
  1. Mueller Steam Specialty
  2. O.C. Keckley Company
  3. Spirax Sarco, Inc.
  4. Substitutions: Division 01 - Product Requirements.
- B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

- D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

## 2.9 NATURAL GAS PRESSURE REGULATORS

- A. Furnish materials in accordance with utility recommendations
- B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.

## 2.10 NATURAL GAS PRESSURE RELIEF VALVES

- A. Product Description: Spring loaded type relief valve.
  - 1. Body: Aluminum.
  - 2. Diaphragm: Nitrile.
  - 3. Orifice: Aluminum Brass Stainless steel.
  - 4. Maximum operating temperature: 150 degrees F.
  - 5. Inlet Connections: Threaded.
  - 6. Outlet or Vent Connection: Same size as inlet connection.

## 2.11 PIPE MARKING

- A. Prime and Paint piping per Division 09.
  - 1. Concealed or rooftop: International Yellow standard for gas piping.
  - 2. Exposed within view of ground: Color to match existing or as selected by Architect to match building trim.
- B. See Section 220553.

## 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.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.3 INSTALLATION - INSERTS

- A. Provide inserts for placement in concrete forms.
- B. Provide 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 above flush with top of recessed into and grouted flush with slab.

### 3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with Section 220529 and ASME B31.9 ASTM F708 and MSS SP 89.

### 3.5 INSTALLATION - BURIED PIPING SYSTEMS

- A. Install natural gas piping in accordance with NFPA 54 and local Utility requirements.
- B. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.
- C. Establish elevations of buried piping with not less than 4 ft of cover.
- D. Establish minimum separation of 10 from other services piping in accordance with code.
- E. Remove scale and dirt on inside of piping before assembly.
- 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 plastic ribbon tape continuous over top of pipe. buried 6 inches below finish grade, above pipe line;

### 3.6 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Install natural gas piping in accordance with NFPA 54 and local Authority Having Jurisdiction.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient.
- D. Where required, bend pipe with pipe bending tools in accordance with procedures intended for that purpose.
- E. Install piping to conserve building space and not interfere with use of space.
- F. Size and install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.
- G. Group piping whenever practical at common elevations.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- I. Sleeve pipe passing through partitions, walls and floors.
- J. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.
- K. Provide clearance for installation of insulation and access to valves and fittings.
- L. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
- N. Provide support for utility meters in accordance with requirements of utility company.
- O. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood. Protect vent against entry of insects and foreign material.
  - 1. Minimum Vent Size: Connection size at regulator vent connection.
  - 2. Run individual vent line from each relief device, independent of breather vents.
- P. Breather vents may be combined to a manifold together with piping sized for combined appliance vent requirements.
- Q. Contractor shall prepare and prime-coat ALL ferrous pipe, fittings, supports, and accessories that are not pre-finished, so that they are corrosion protected at installation. All exposed piping (inside and exterior) shall be readied for finish painting. Refer to Division 09.
- R. Install identification on piping systems including underground piping.

- S. Install valves with stems upright or horizontal, not inverted.
- T. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- U. Install medium pressure gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.
- V. Install medium pressure gas pressure regulator with tee fitting not less than 10 pipe diameters down stream of regulator. Cap or plug one opening of tee fitting.
- W. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors as indicated on Drawings.
- X. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 7 inch wg 11 inch wg 2 psi 5 psi inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

### 3.7 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements.
- B. Where gas appliance will be damaged by test pressure, disconnect appliance and cap piping during pressure test. Reconnect appliance after pressure test and leak test connection.
- C. Where gas appliance is designed for operating pressures equal to or greater than piping test pressure, provide gas valve to isolate appliance or equipment from gas test pressure.
- D. Pressure test natural gas piping in accordance with NFPA 54.
- E. Where new branch piping is extended from existing system, pressure test new branch piping only. Leak test joint between new and existing piping with noncorrosive leak detection fluid or other approved method.
- F. When pressure tests do not meet specified requirements, remove defective work, replace and retest.
- G. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.
  - 1. Where leakage is detected, shut off gas supply until necessary repairs are complete.
- H. Do not place appliances in service until leak testing and repairs are complete.

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.
8. Interceptors.

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 AIR ADMITTANCE VALVES

- A. Certified by ASSE to 1050 and 1051, shall meet the requirements of:
  - 1. International Plumbing Code 2009 917.1 & 2012 918.1
  - 2. International Residential Code 2009/2012 P3114.1
  - 3. Uniform Plumbing Code (UPC) 2009 Section 301
  - 4. Listed by IAPMO; Conform to ASTM D2661/D2665/F409 for packages with drainage adapter.

- B. Self-cleaning design; upon each activation to allow air, seal shall mechanically move to ensure a clean reseal.

## 2.5 PIPE HANGERS AND SUPPORTS - See Section 22 05 29.

## 2.6 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.

## 2.7 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.

## 2.8 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.

## 2.9 GREASE INTERCEPTORS

- A. Manufacturer:
  - 1. Design Base: as Scheduled on Drawings.
  - 2. Watts
  - 3. Jay R. Smith
  - 4. Zurn.
  - 5. Substitutes: Submit for pre-approval prior to bid per Division 01 requirements.
- B. Characteristics:
  - 1. Construction: Steel or precast grease interceptor. Steel unit shall be anti-corrosion coated inside and outside.
  - 2. Sizing: 4" inlet/outlet, 3" vent, flowrate and physical capacity as Scheduled on Drawings.

## 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. Electric water heaters.
- 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 manufacturer warranty for water heater.

## PART 2 PRODUCTS

### 2.1 ELECTRIC WATER HEATERS

- A. Manufacturers:
  - 1. A.O.Smith; ENLB series.
  - 2. Broan Manufacturing Co. Inc.
  - 3. Patterson-Kelley Co.
  - 4. Substitutions: Division 01 - Product Requirements.
- B. Type: Factory-assembled and wired, electric, vertical storage, dual-element.
- C. Capacity: As Scheduled on Drawings.
- D. Tank: Glass lined welded steel; thermally insulated with minimum 1 inch insulation encased in corrosion-resistant steel jacket; baked-on enamel finish.

- E. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in ni-chrome elements, high temperature limit thermostat.
- F. Accessories: Brass water connections and dip tube, drain valve, anode rod, and ASME rated temperature and pressure relief valve.

## 2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: In accordance with Section 26 05 03 and the following:
  - 1. 230 volts, single phase, 60 Hz.
- B. Disconnect Switch: Factory mount disconnect switch at equipment.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heater on housekeeping pad, minimum 3-1/2 inches high and larger than water heater base. Refer to Division 03.
- C. Connect domestic hot water domestic cold water piping to supply and return water heater connections.
- D. Install the following piping accessories.
  - 1. On outlet:
    - a. Thermometer.
    - b. Shutoff valve.
  - 2. On inlet:
    - a. Strainer
    - b. Shutoff valve.
- E. Install discharge piping from relief valves and drain valves to nearest floor drain.
- F. Install water heater trim and accessories furnished loose for field mounting.
- 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 34 00

FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Gas-fired water heaters.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
  - 2. Section 22 07 00 - Plumbing Insulation: Field applied insulation for domestic water heaters.
  - 3. Section: 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.
  - 4. Section 23 11 23 - Facility Natural-Gas Piping: Execution requirements for gas piping connections specified by this section.
  - 5. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI Z21.10.1 - Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
  - 2. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. American Society of Mechanical Engineers:
  - 1. ASME PTC 25 - Pressure Relief Devices.
  - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- D. National Fire Protection Association:
  - 1. NFPA 54 - National Fuel Gas Code.
- E. United States Department of Energy:
  - 1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.3 SUBMITTALS

- A. Section 01 33 00 - 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:
  - 1. Water Heaters: Submit dimensioned drawing of water heater indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
  - 2. Pumps: Submit certified pump curves showing pump performance characteristics. Indicate pump type, capacity and power requirements.
- 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. Section 01 70 00 - 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 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 when tested per ANSI Z21.10.

#### 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.
- B. Convene minimum one week prior to commencing work of this section.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - 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.

## 1.9 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 five year manufacturer warranty for water heater systems.

## 1.11 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

## PART 2 PRODUCTS

### 2.1 GAS FIRED WATER HEATERS (CONDENSING)

- A. Manufacturers:
  - 1. A. O. Smith; GPHE, BTH or BTX series.
  - 2. Laars; HWG series.
  - 3. Lochinvar; Armor X2 series.
  - 4. Rheem; Equal.
  - 5. Ruud; GHE or HE series.
  - 6. State; Premier GP6 series.
  - 7. Substitutions: Division 01 - Product Requirements.
- B. Type: Automatic, natural gas fired, Condensing mode operation, vertical storage, sealed combustion and flue with power venting.
- C. Minimum thermal efficiency; 90%.  
  
Capacity: As Scheduled on Drawings.
- D. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.
- E. Controls: Automatic water thermostat with adjustable temperature range from 120 to 180 degrees F Automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

## 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 on each side.
- C. Connect natural gas piping in accordance with NFPA 54.
- D. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.
- E. Connect piping to supply and return water heater connections.
- F. Install the following piping accessories.
  - 1. On inlet:
    - a. Strainer.
    - b. Shutoff valve.
  - 2. On outlet:
    - a. Thermometer.
    - b. Pressure gage.
    - c. Shutoff valve.
- G. Install the following piping accessories on natural gas piping connections.
  - 1. Strainer. Sediment trap ('dirt leg').
  - 2. Pressure gage.
  - 3. Shutoff valve.
  - 4. Regulator and vent if needed.
- H. Install discharge piping from relief valves and drain valves to nearest floor drain.
- I. Install diaphragm expansion tank at water heater.
- J. Install water heater trim and accessories furnished loose for field mounting.
- K. Install electrical devices furnished loose for field mounting.
- L. Install control wiring between water heater control panel and field mounted control devices.
- M. Connect flue to water heater outlet, full size of outlet. Refer to Section 23 51 00.
- N. Domestic Hot Water Storage Tanks:
  - 1. Provide support, rated for seismic zone of project.
  - 2. Clean and flush after installation. Seal until pipe connections are made.

### 3.2 SCHEDULE

- A. As indicated on 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. Service sinks.
  
- B. Related Sections:
  - 1. Division 07 - 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. Division 01 - 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. Division 01 - 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. 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: 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. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish documentation of manufacturer warranty for plumbing fixtures.

#### 1.9 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two sets of faucet washers, flush valve service kits, lavatory supply fittings, shower heads, and toilet seats.

### PART 2 PRODUCTS

#### 2.1 KITCHEN EQUIPMENT/FIXTURES

- A. As indicated on Drawings to match Architectural kitchen layout by B&B foods.

#### 2.2 WATER CLOSETS (WC)

- A. As Scheduled on Drawings.



2.3 URINALS (UR)

- A. As Scheduled on Drawings.

2.4 LAVATORIES (LAV)

- A. As Scheduled on Drawings.

2.5 SINKS (LS, KS, PS, HS)

- A. As Scheduled on Drawings.

2.6 SERVICE SINKS (MS)

- A. As Scheduled on Drawings.

2.7 LAVATORY INSULATION KIT

- A. Manufacturers:
  - 1. Design Base: IPS Corp; TruBro series.
  - 2. Plumberex; Handy Shield or Pro-eXtreme series.
- B. Product Description: 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.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify electric power is available and of correct characteristics.
- D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

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. Division 01 - 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. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Clean plumbing fixtures and equipment.

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit use of fixtures before final acceptance.

### 3.8 SCHEDULES – Except where otherwise noted on Drawings, install typical fixture as follows:

- 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.
  - 3. Lavatory:
    - a. Standard: 31 inches to top of basin rim.
    - b. Accessible: 34 inches to top of basin rim.
  - 4. Water Cooler Fountain:
    - a. Standard Adult: 40 inches to top of basin rim.

REA Park Clubhouse  
Terra Haute, IN

- b. Accessible: 36 inches to top of spout.
- c. Child: 30 inches maximum to top of spout.

B. Fixture Rough-In:

Fixture	Hot inches	Cold inches	Waste inches	Vent inches
Water Closet (Flush Valve):		1	4	2
Urinal (Flush Valve):		3/4	2	1-1/2
Lavatory:	1/2	1/2	1-1/2	1-1/4
Sink:	1/2	1/2	1-1/2	1-1/4
Service Sink:	1/2	1/2	3	1-1/2

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 – Equipment Sections: For equipment, devices, and system components to implement sequences of operation.

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.

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. 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.
- B. Temperature Setpoints (adjustable, programmable schedule):
  - 1. Cooling:
    - a. Occupied: 72 deg F
    - b. Un-Occupied: 77 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.
- C. Humidity Setpoint: 55% RH maximum.
  - 1. Upon exceeding setpoint, activate Dehumidification mode.
- D. CO2 Setpoint: 1,100 ppm maximum, 700 ppm acceptable.
  - 1. CO2 sensor in return air path or in space as indicated on Drawings.
  - 2. Upon exceeding setpoint, activate Demand Controlled Ventilation mode.

### 3.2 SPLIT SYSTEM

- A. Occupied Period
  - 1. Activate Occupied period upon programmed schedule times, and/or upon momentary pushbutton or equivalent signal manually selected at thermostat interface.
  - 2. Open OA damper from fully closed (unoccupied) to Minimum position (approx. 10%) and monitor CO2 sensor in Return air path.
  - 3. Activate Supply fan continuously.
  - 4. Monitor space temperature and automatically activate heating or cooling mode as required to meet Occupied setpoints.
- B. Unoccupied Period
  - 1. Close OA damper to fully closed.
  - 2. Activate Supply fan only upon a call for heating or cooling.
  - 3. Monitor space temperature and automatically activate heating or cooling mode as required to meet Unoccupied setpoints.
- C. Heating Mode (heatpump + natural gas)
  - 1. Refrigerant system shall be activated in heating mode to meet setpoint.
  - 2. Backup natural gas heating shall be initiated upon failure of heatpump operation to meet setpoint, or when disabled by outdoor conditions, and staged or modulated as scheduled to meet set point.
- D. Cooling Mode

1. Refrigerant system shall be activated, and staged or modulated where so scheduled, to meet setpoint.

E. Dehumidification Mode

1. Refrigerant system shall be activated and space allowed to be cooled 3 deg F below temperature setpoint to meet Relative Humidity setpoint.

F. Demand Controlled Ventilation Mode

1. For unit indicated on Drawings as DCV-controlled: During Occupied periods, upon CO2 in return air path rising above maximum/setpoint, modulate the Outside Air inlet damper open from Minimum/Occupied (approx. 10%), to full design volume position (determined during TAB), to meet acceptable CO2 levels.

### 3.3 RADIANT PANEL

A. Heating Mode: activate to maintain space temperature.

1. Electric: Line voltage thermostat, or equivalent low voltage thermostat with power supply and relay/contactors, shall activate power to RCP resistance heating circuit in panel.

### 3.4 UNIT HEATER

A. Heating Mode: activate to maintain space temperature.

1. Electric: Line voltage thermostat, or equivalent low voltage thermostat with power supply and relay/contactors, shall activate power to UH to activate supply fan and heating circuit.

### 3.5 EXHAUST FANS

A. Kitchen Hood Exhaust Fan & Makeup Air Unit:

1. Lights shall be manually selected On/Off.
2. KH-1: Fan manually activated at control panel On/Off
3. MUA-1: Automatically activated when KH exhaust fan is in operation
  - a. Heating; automatically activated and modulated/staged to meet Discharge Air Temperature to provide neutral makeup air.
4. Fire Suppression: Automatically activated in case of fire
  - a. Monitoring circuit shall be capable of providing dry-contact signal to disable any shunt-trip breakers to automatically disable electrical power to any/all cooking equipment upon triggering of fire suppression and trigger any gas solenoid valve(s) closed to shut off and isolate gas serving cooking equipment upon triggering of fire suppression.

B. Ventilation Control:

1. (CF-1) Ceiling air circulation fan shall be activated manually by dedicated control station where shown.
2. (EF-1) Fan shall be activated automatically by occupancy-based switched lighting circuit serving any space served by this fan.
  - a. Provide and install diodes, relay/contactors, or other components as necessary to ensure fan operates whenever lighting is activated in any space served by this fan, and remain active until space is no longer occupied.

### 3.6 GOLF CART GARAGE VENTILATION/SAFETY SYSTEM

- A. Provide and install relay/contactors for control of each EF-2 exhaust fan and associated motorized actuator for open/close of each intake and exhaust louver.
  - 1. Ensure that motorized dampers for louvers are powered to “open” position when EF-2 circuit(s) are activated.
  
- B. Primary On/Off signal:
  - 1. Tie activation coil/circuit for EF-2 fans to switched lighting circuit for golf cart garage to ensure fans are activated and operational during all times that space is occupied.
  
- C. Override On/Off signal:
  - 1. Provide and install Carbon Monoxide (CO) detector in the space at location compliant with manufacturer’s recommendations.
  - 2. Upon CO-stat signal indicating CO levels have exceeded setpoint maximum CO level of 50 ppm, activate EF-2 relay/contactors circuit to enable exhaust fans.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct Materials.
2. Flexible ducts.
3. Single wall spiral round ducts.
4. Ductwork fabrication.
5. Duct cleaning.
6. Insulated flexible ducts.
7. Single wall spiral flat oval ducts.
8. Double wall spiral insulated flat oval ducts.
9. Casings.

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 C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.



11. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
  12. 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. Construct ductwork to NFPA 90B for one or two family dwellings, spaces not exceeding 25,000 cu ft, and buildings of combustible construction up to three stories in height.
  - 2. Construct ductwork to NFPA 96 standard for commercial kitchens.

#### 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: **22 gauge thickness**, unless otherwise noted.
  - 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 AND 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: 4 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.

### 2.4 SINGLE WALL SPIRAL ROUND DUCTS

- 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 8 inches	26
>8 inches to 20 inches	24
> 20 inches to 36 inches	22
> 36 inches to 50 inches	20
> 50 inches to 84 inches	18

- D. Construct fittings of one gauge thicker than the sheet stock.

### 2.5 PRE-INSULATED RIGID PHENOLIC DUCT

- A. Manufacturers:
  1. Kingspan; KoolDuct series.

2. Substitutions: Division 1 - Product Requirements.

- B. Product Description: UL-181 Rigid fiber-free phenolic duct-board with reinforced foil airside and external jacketing meeting Class 1 Air Duct, listed UL-181 compliant and UL 723 tested to less than 25/50 flame/smoke spread.
1. Design Base: Kingspan KoolDuct 1-3/16" series Air Duct Board
  2. Framing: Each exposed edge section shall be reinforced structurally with metal framing, extruded aluminum, with gasketed or sealed connection to adjacent section.
  3. Thermal Conductivity: R-8 (0.15 at 75 degrees F per ASTM C518).
  4. Maximum Air Velocity: 4,000 feet per minute.
  5. Temperature: -15 degF - 180 degF.
  6. Duct Pressure: up to +4"/-3"W.C.

## 2.6 SINGLE WALL SPIRAL FLAT OVAL DUCTS

- 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 22 gauge; where greater than 24 inches in major axis, minimum 20 gauge.
- E. Construct fittings with minimum 20 gauge; where greater than 24 inches in major axis, minimum 18 gauge.

## 2.7 DOUBLE WALL SPIRAL INSULATED ROUND DUCTS

- 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 with light reinforcing corrugations, galvanized steel outer wall, 1 inch thick glass fiber insulation, perforated inner wall.
- C. Finish:
1. In underground or corrosive applications; include corrosion-protection Duct Coating:
    - a. Polyvinyl chloride plastic, 4 mil thick on outside and 1 mil thick on inside.
    - b. Temperature range: minus 30 degrees F to 200 degrees F.

2. In exposed dry, interior applications; include ferrous rated Primer ready for finish Painting per Division 09, final finish color selected for Division 09 Contractor by Architect.
- D. Construct duct minimum 24 gauge; where greater than 24 inches in diameter, minimum 22 gauge.
- E. Construct fittings with 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.
- C. RIGID PRE-INSULATED 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.

### 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. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.
- I. Casings: Install floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles.
- J. 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 or operable windows: 10 feet.
- K. For outdoor ductwork exterior to the building, protect ductwork, ductwork supports, linings and coverings from weather;

1. Prime all ferrous materials and components, including fasteners, ready for weatherproof coating or finish.

### 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 diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- C. 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.
  1. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
  2. Maximum Allowable Leakage: In accordance with ICC IECC.

### 3.6 SCHEDULES

- A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply	Steel, Aluminum
Return and Relief	Steel, Aluminum, Preinsulated Phenolic Duct
General Exhaust	Steel, Aluminum, Preinsulated Phenolic Duct
Outside Air Intake	Steel, Preinsulated Phenolic Duct

- B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply	1 inch wg regardless of velocity.
Return, Exhaust, and Relief	1/2 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 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
  - 2. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
  - 3. 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 EXTERIOR OUTLET BACKDRAFT DAMPERS

- A. Product Description: Stainless-Steel or extruded aluminum. Multi-Blade, barometric back-draft dampers; parallel-action, gravity-balanced. Blades top-pivoted, not linked together.
- B. Body of matching Stainless-Steel or aluminum, round slip-fit connection to match size of exhaust duct piping (typically 4" or 6"), with back surface flat to accept weatherproof sealant. Include insect screen behind louvered damper blades.

### 2.4 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.

### 2.5 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. Duct Transition Connection, Damper Style, rectangular connection.

G. Finish: Mill galvanized.

## 2.6 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.

## 2.7 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

## 2.8 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 wall locations.
  - 1. Verify which ductwork penetrations of rated partitions are not exempt from Code requirements for including a Fire Damper.
  - 2. Confirm with Architect where any field discovered conditions make partition rating unclear to determine whether or not partition penetration requires Fire Damper.
  - 3. Verify openings are sleeved and 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 or where required at non-exempt locations of ductwork penetrating a fire rated partition. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
  - 1. Install dampers square and free from racking with blades running horizontally.
  - 2. Do not compress or stretch damper frame into duct or opening.
  - 3. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
  - 4. 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 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Diffusers.
  - 2. Registers
  - 3. Grilles.
  - 4. Roof Hoods
  
- B. Related Sections:
  - 1. Division 09 - 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. Division 01 - 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. Test Reports: Rating of air outlet and inlet performance.
  
- D. Manufacturer's Installation Instructions: Submit relevant instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - 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.
- B. Test and rate louver performance in accordance with AMCA 500.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section.

## 1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.

## 1.8 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Manufacturers:
  - 1. Carnes
  - 2. Hart and Cooley
  - 3. Metal\*Aire
  - 4. KRUEGER
  - 5. Nailor
  - 6. TUTTLE & BAILEY
  - 7. Price
  - 8. Titus
  - 9. Substitutions: Per Division 1, shall be approved by engineer prior to bid.

### 2.2 ROUND CEILING DIFFUSERS

- A. Characteristics: As Scheduled on Drawings.
- B. Product Description: Type: Round, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sector baffles and/or adjustable pattern only where specifically indicated on Drawings or Schedule.
  - 1. Diffuser collar not more than 1 inch above ceiling.
  - 2. In hard ceilings, furnish plaster ring and ceiling plaque.
- C. Fabrication: Steel or aluminum with baked enamel or powdercoat finish; white.

- D. Accessories: Butterfly manual volume damper or automatic volume control device at branch takeoff. Where branch takeoff is not accessible, similar device in neck adjustable from diffuser face with removable key operator.

## 2.3 CEILING RECTANGULAR DIFFUSERS

- A. Characteristics: As Scheduled on Drawings.
- B. Type: Panel Size, neck/connection size, configuration, and shape to match Schedule; diffuser to discharge air in 360 degree pattern unless otherwise indicated.
  - 1. Frame shall be selected for each outlet to match the ceiling construction shown on Architectural plans. In plaster ceilings, furnish plaster frame and ceiling frame.
  - 2. Powder coat or baked enamel factory finish after fabrication.
  - 3. Aluminum construction where scheduled.
- C. Accessories: Manual volume damper or automatic volume control device at branch takeoff. Where branch takeoff is not accessible, similar device in neck adjustable from diffuser face with removable key operator.
- D. 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.

## 2.4 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Characteristics: As Scheduled on Drawings.
- B. Type: Specification grade, Panel Size, neck/connection size, configuration, and shape to match design base scheduled on Drawings.
- C. Manual volume damper at branch takeoff where practical, in neck where necessary due to construction/ceiling type (Adjustable from below).
- D. Powdercoat or baked enamel factory finish after fabrication.
- E. Fabrication: Aluminum construction where scheduled.
- F. Accessories: Where not individually connected to exhaust fans;
  - 1. Manual volume balancing damper at branch takeoff where possible.
  - 2. Integral, gang-operated, opposed blade type with removable key operator operable from face where necessary due to inaccessible ceiling type.

## 2.5 CEILING SLOT INLETS AND OUTLETS

- A. Design Base: Carnes; DARC series.

- B. Characteristics: As Scheduled on Drawings.
- C. Type: Continuous 1-inch-wide slot, two slots wide, designed for nominal 100cfm/ft.
  - 1. Supply diffusers shall include adjustable vanes for left, right or vertical discharge.
  - 2. Return slots shall be open and include black acoustic insulation.
  - 3. All devices installed in fire rated ceilings (per Architectural Drawings) shall include integral ceiling fire damper or be fire-rated as an assembly.
- D. Fabrication:
  - 1. Face shall be Aluminum extrusions with factory anodized or clear lacquer finish.
  - 2. Frame: Min. 1 inch margin with concealed fasteners and supports.
  - 3. Mounting accessories and gasket, flanges, end caps, etc. to match ceiling type, size, and layout shown on Drawings.
  - 4. Plenum: Integral. Aluminum where used in Pool areas. Galvanized steel where used in other spaces.
- E. Accessories: Where used for Supply air, include volume damper or automatic volume control device at branch takeoff. Where branch takeoff is not accessible, similar device in neck adjustable from diffuser face with removable key operator.

## 2.6 WALL SUPPLY REGISTERS/GRILLES

- A. Characteristics: As Scheduled on Drawings.
- B. Type: Streamlined adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, horizontal face, single deflection unless otherwise noted.
- C. Frame: Min. 1 inch margin with countersunk screw mounting and gasket.
- D. Fabrication: Aluminum extrusion frames and blades, steel or aluminum housing, with factory baked enamel paint-after-fabrication or powdercoat finish; white.
- E. Accessories:
  - 1. Manual volume damper or automatic volume control device at branch takeoff.
  - 2. Where branch takeoff is not accessible, integral, gang-operated, opposed blade type with removable key operator operable from face.

## 2.7 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with stationary blades or grid-core as Scheduled.
- B. Frame: Min. 1 inch margin with countersunk screw mounting.
- C. Fabrication: Aluminum margin frame and blades/core, with factory baked enamel or powdercoat finish; white. Where used in natatorium areas exposed to pool air, entire assembly shall be aluminum and only stainless steel or aluminum fasteners shall be used. Other spaces may have galvanized steel support assemblies, dampers, or frames.

D. Damper:

1. None where connected to exhaust fan or serving equipment with no return connections to other spaces.
2. Where serving a combined duct with returns from multiple spaces, include manual volume balancing damper at branch takeoff where possible, or integral, gang-operated, opposed-blade type operable from face of register where necessary due to inaccessible ceiling type.

2.8 DOOR GRILLES

- A. Door grilles: As specified by Architect.

2.9 LOUVERS (EXTERIOR)

A. Manufacturers:

1. Carnes
2. Greenheck
3. Loren-Cook
4. Mestek
5. Penn Barry
6. Ruskin
7. Nailor
8. Substitutions: Per Division 1, shall be approved by engineer prior to bid.

B. Louver construction:

1. Specification grade, all-Aluminum construction as scheduled, rain-proof drainable design.
2. Adjustable blade damper assembly on inside.
3. Anodized or powdercoat factory finish in color selected by Architect to match building trim.
4. Minimum depth: 4"
5. Insect/pest screen: stainless steel mesh.

2.10 ROOF HOODS

A. Manufacturers:

1. Greenheck
2. Loren-Cook
3. Penn Barry
4. Ruskin
5. Nailor
6. Substitutions: Per Division 1, shall be approved by engineer prior to bid.

- B. Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

- C. Fabricate of reinforced galvanized steel, minimum 16 gage base and 20 gage hood, or aluminum, minimum 16 gage base and 18 gage hood.

1. Furnish removable hood; bird screen with 1/2 inch square mesh and factory baked enamel or powdercoat finish.

- D. Fabricate hood outlet area minimum of twice throat area.
- E. Roof Curb: Min. 16 inch high, galvanized steel or aluminum construction with continuously welded seams, cant strips, 1 inch insulation and curb bottom, and nailer strip.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify inlet and outlet locations.
- C. Verify ceiling and wall systems are ready for installation.
- D. During construction install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

#### 3.2 INSTALLATION

- A. Install diffusers to ductwork with airtight connection.
- B. 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.
- C. Install back-draft dampers on discharge of exhaust fans and as indicated on Drawings.
- D. Prevent passage of unfiltered air around filters by installing felt, rubber, or neoprene gaskets.
- E. Paint visible portion of ductwork behind air outlets and inlets matte black.

#### 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.
- B. Install balancing dampers on duct take-off to diffusers and grilles and registers, regardless of whether dampers are specified as part of diffuser, or grille and register assembly.
- C. Paint ductwork visible behind air outlets and inlets matte black in accordance with Division 09.

#### 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 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 3<sup>rd</sup> 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), etc shall have supply fan motors selected for appropriate Static Pressure handling to ensure Scheduled airflows for equipment and ductwork system and 50% loading of:
    - a. Final filters, which shall be MERV-12 or as Scheduled for each equipment.
    - b. Where system or equipment is not capable of full MERV-12 filtration due to physical constraints of factory/manufacturer, notify Architect/Engineer.
- 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 00

FURNACES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Gas Fired Furnaces.
  - 2. Heatpump Units.
  - 3. Thermostats.
  
- 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 design guide requirements.
  
- C. Related Sections:
  - 1. Section 23 11 23 - Facility Natural-Gas Piping: Execution requirements for natural gas piping specified in this section.
  - 2. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ductwork and duct liner specified by this section.
  - 3. Section 23 33 00 - Air Duct Accessories: Execution requirements for flexible duct connections specified by this section.
  - 4. Section 23 40 00 - HVAC Air Cleaning Devices: Product requirements for air filters for placement by this section.
  - 5. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI Z21.47 - Gas-Fired Central Furnaces.
  
- B. 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.
  
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
  - 2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - 3. ASHRAE 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers.
  
- D. International Code Council:
  - 1. ICC IFGC - International Fuel Gas Code.

- E. National Electrical Manufacturers Association:
  - 1. NEMA MG 1 - Motors and Generators.
- F. National Fire Protection Association:
  - 1. NFPA 54 - National Fuel Gas Code.
  - 2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
  - 3. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- G. Underwriters Laboratories Inc.:
  - 1. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical.
- H. 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 DOE 10 CFR; ANSI Z21.47; UL 727 as applicable.

### 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, electronic air cleaners, condensing units and thermostats 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 heat exchangers.
- C. Furnish five year manufacturer's warranty for condensing units.

#### 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.

### PART 2 PRODUCTS

#### 2.1 GAS FIRED FURNACES

- A. Manufacturers:
  - 1. Design Base: Daikin DZ6VSA series as Scheduled on Drawings.
  - 2. Aeon

3. Carrier Corp.; MURA series
  4. Lennox
  5. Trane.
  6. York
  7. Substitutions: Division 01 - Product Requirements.
- B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, gas heating section, dX coil section, controls, air filter and accessories; wired for single power connection with control transformer.
1. Air Flow Configuration: As indicated on Drawings.
  2. Fuel: Natural gas fired
  3. Electric dX Refrigeration: Integrated refrigerant cooling/heating coil section or modular design with cased A-coil with matching outdoor package containing low-ambient variable capacity heatpump (compressor, condenser coil and condenser fan).
  4. Accessories:
    - a. Concentric Exhaust/Air Intake Vent termination kit.
- C. Provide equipment that is UL listed as suitable for clearance space available in installed location.
- D. Cabinet: Steel with baked enamel finish, easily removed and secured access panels, insulated case with anti-microbial coating or elastomeric insulation. Safety interlock for furnaces installed indoors.
- E. Supply Fan:
1. Centrifugal type, mounted with vibration isolation.
  2. Motor:
    - a. Direct drive
    - b. Electrically Commutated Motor (ECM)
    - c. Variable speed to meet Design Base unit features.
- F. Heat Exchanger: Aluminized/Stainless steel crimped, welded, or tubular type, with corrosion proof coated or stainless steel secondary condensing coil.
- G. Gas Burner:
1. Condensing Mode operation for minimum Annual Fuel Utilization Efficiency (AFUE) 90%.
  2. Sealed type with combustion air supply piped to unit.
  3. Gas valve; electronic, 100% safety gas shut-off; pressure regulation, safety ignition system, manual On-Off, filtration.
  4. Electronic ignition.
  5. Combustion air control and automatic powered venting.
  6. Corrosion resistant combustion air blower with permanently lubricated motor.
  7. Safety Controls:
    - a. Ignition and flame-sensing safety controls to prove adequate combustion air supply and stop gas flow on ignition failure.
    - b. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive outlet air temperature, automatic reset.
- H. Operating Controls:

1. Programmable Thermostat/Unit controller: Controls furnace system to meet functions required by Sequence of Operations.
  2. Adjustable setpoint for Occupied and Unoccupied periods.
  3. Low voltage, 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.
  4. Electric solid state microcomputer based thermostat or unit controller shall include:
    - a. Remote sensor(s) where noted or required by Sequence of Operations.
    - b. Automatic switching from heating to cooling.
    - c. Setpoints by time of day.
    - d. Programming based on every day of week.
    - e. Selection features including degree F or degree C display, 12 or 24-hour clock, remote sensor, fan on-auto.
    - f. Battery replacement without program loss.
    - g. Thermostat display:
      - 1) Time of day and Day of week.
      - 2) Actual room temperature.
      - 3) Programmed temperature setpoint.
      - 4) System mode indication: Heating, Cooling, Fan Auto/On, Occupied/Unoccupied.
  5. Provide dry-contact output to control Outside Air damper position or auxiliary equipment.
  6. For units where DCV is noted:
    - a. CO2-stat: CO2 sensor in return air for Demand Controlled Ventilation.
    - b. Override control to move OA damper position from initial-open (upon Occupied signal noted above) position, to the 'full design' volume position determined during Test and Balance to meet Scheduled full design ventilation air.
- I. Air Filters:
1. 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.
  2. Construction: Install 1-inch thick disposable type filter during.
  3. Completion: per Section 234000.
- J. Performance:
1. Ratings: Seasonal Efficiency Rating not less than requirements of ASHRAE 103.
  2. Refer to Furnace Schedule. Gas heating capacities are sea level ratings.
  3. Air Handling: Performance as scheduled.
  4. Heating Capacity: As Scheduled.
- K. Electrical Characteristics: In accordance with Section 26 05 03 and the following:
1. 120/208 volts as scheduled, single phase, 60 Hz.
  2. Disconnect Switch: Mount switch on or near equipment.
- L. Evaporator A-coil Assembly
1. Standard series supplied with furnace noted above, compliant with Scheduled requirements and the following.
  2. Construction and Ratings: In accordance with ARI 210/240, UL listed for the application.
  3. Evaporator Coil: Integral assembly inside of air handler main body or a matching separate modular installation placed in a draw-through position. Copper tube aluminum fin assembly,

stainless steel or composite/polymeric drain pan, drain connection with P-Trap, refrigerant piping connections, restricted distributor or thermostatic expansion valve, steel cabinet with baked enamel finish and insulation.

- a. Cooling Capacity: As scheduled.

## 2.2 HEATPUMP UNITS

- A. Standard low-ambient variable capacity heatpump 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.
- 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:
  1. Tied to control of indoor air handler to ensure proper mode of operation to fulfill Sequence of Operations requirements.
  2. Variable capacity to match load.
  3. Heatpump mode to low ambient outside conditions as Scheduled.
- E. Electrical Characteristics: In accordance with Section 26 05 03 and the following:
  1. 208 volts, single or three phase as scheduled, 60 Hz.
  2. Disconnect Switch: Mount switch adjacent equipment, final connection shall be liquid tight flexible conduit.

## 2.3 AUXILIARY DRAINAGE

- A. Where blocked drain or condensate pan overflow can cause building damage, provide auxiliary drain pan with separate drain line under unit producing condensate.

1. Minimum Length and Width: 3 inches larger than unit length and width.
2. Minimum Depth: 1.5 inches.
3. Materials:
  - a. Metal Pan: Galvanized steel, minimum 0.0276 inch thick.
  - b. Nonmetallic Pan: Minimum 0.0625 inch thick.

## 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 gas fired furnaces in accordance with NFPA 54.
- B. Install oil-fired furnaces in accordance with NFPA 31.
- C. Install vent connections in accordance with NFPA 211 and NFPA 54. Seal all penetrations.
- D. Install refrigeration systems in accordance with ASHRAE 15. Insulate all refrigerant piping.
- E. Install humidifiers in accordance with ARI 630.
- F. Mount downflow furnaces installed on combustible floors on combustible-floor base.
- G. Mount air cooled condenser-compressor package on concrete or composite housekeeping pad.
- H. Installation - Natural Gas Piping:
  1. Connect natural gas piping in accordance with NFPA 54, full size of unit gas train inlet. Arrange piping with clearances for burner service.
  2. Install the following piping accessories on natural gas piping connections.
    - a. Strainer.
    - b. Pressure gage.
    - c. Shutoff valve.
    - d. Pressure reducing valve.

\*\*\*\*\* OR \*\*\*\*\*

- I. Installation - Propane Gas Piping:
  1. Connect propane piping in accordance with NFPA 58.
  2. Connect propane piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
  3. Install the following piping accessories on propane piping connections. Refer to Section 23 11 26.
    - a. Strainer.



- b. Pressure gage.
- c. Shutoff valve.
- d. Pressure reducing valve.

\*\*\*\*\* OR \*\*\*\*\*

- J. Installation - Fuel Oil Piping:
  - 1. Connect fuel oil piping in accordance with NFPA 31.
  - 2. Connect fuel oil piping to unit, full size of unit connection. Arrange piping with clearances for burner service.
  - 3. Install the following piping accessories on fuel oil piping connections. Refer to Section 23 11 13.
    - a. Strainer.
    - b. Shutoff valve.
- K. Connect humidifier to domestic water piping.
- L. Pipe drain for each item as noted on manufacturer's installation instructions, from cooling coils; gas-fired heat exchanger and vent condensate disposal; humidifiers; auxiliary condensate pan etc. to nearest floor drain or sanitary hub-drain connection for the purpose, coordinated with Plumbing trade.
- M. Connect units to electric supply and connect controls remote from units.
- N. Install control components supplied with equipment and provide control wiring between all sensors and equipment.
- O. Install control wiring between thermostat, indoor unit, and outdoor unit for a complete operational system.
- P. Install cased coil evaporator unit fastened to furnace.
- Q. Connect system return ductwork to return air section or filter-box assembly with flexible duct connection.
- R. Connect system supply ductwork to equipment outlet with flexible duct connection.

END OF SECTION

SECTION 23 83 00  
RADIANT HEATING UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
  - 1. Unit Heaters
  - 2. Radiant Ceiling Panels
- B. Related Sections:
  - 1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout, locations of terminations, thermostats, and branch circuit connections.
- C. Product Data: Submit data for RCP and control components.
- D. Manufacturer's Installation Instructions: Submit support details, and connection requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit description of controls and repair methods and parts list of components.

1.4 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept RCPs and baseboard heaters on site in factory wrapping. Inspect for damage.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.

## 1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

## 1.8 SEQUENCING

- A. Section 01 10 00 - Summary: Work sequence.

## 1.9 COORDINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.

## 1.10 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

## PART 2 PRODUCTS

### 2.1 Unit Heaters (UH)

- A. Manufacturers:
  - 1. BASE OF DESIGN: Raywall.
  - 2. Berko equal
  - 3. Markel equal
  - 4. Substitutions: Division 01 - Product Requirements.
- B. Description: Heavy Duty Commercial Convection Heater for use in potentially heavy abuse areas
- C. Construction
  - 1. Powder coated 22 Gauge steel front and 20 Gauge junction boxes
  - 2. Stainless Steel heating element and aluminum fins
- D. Thermostats
  - 1. In-Built thermostats field installed in junction boxes in non public areas.
  - 2. Thermostat to be wall mounted with metal lockable boxes keyed alike in public areas
- E. Electrical Characteristics: In accordance with Section 26 05 03 and Drawings

### 2.2 Radiant Ceiling Panels (RCP)

- A. Manufacturers:
  - 1. BASE OF DESIGN: Solid State Heating Corp; Enerjoy series.
  - 2. Berko equal
  - 3. Markel equal
  - 4. Raywall equal
  - 5. Substitutions: Division 01 - Product Requirements.

- B. Shall be constructed of a solid state heating element backed with 1” thick, high density fiberglass board. Panel to have aluminum face and frame with textured face to match acoustic ceiling tile appearance.
- C. Thermostat for line voltage snap-action operation for temperature control.
  - 1. Where thermostat is installed on wall in the space due to inaccessible/hard ceiling, provide and install lockable hinged cover over thermostat.
  - 2. Where thermostat is installed above accessible ceiling, provide type with remote bulb/sensor with capillary routed concealed in wall to backbox for bulb below, with ventilated stainless steel cover.
- D. Rating Wattage and operational Voltage as Scheduled on Drawings.
- E. Coordinate installation, line-voltage control thermostat rough-in, and circuit requirements with electrical trade.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify ceiling framing is ready to receive Work.
- C. Verify field measurements are as shown on Drawings.
- D. Verify required utilities are available, in proper location, and ready for use.

#### 3.2 INSTALLATION

- A. Prevent damage by sharp rocks, metal, or other objects during installation.
- B. Properly suspend Radiant Ceiling Panels as necessary based upon ceiling finish in location, surface mounting may be allowed upon engineer’s approval with kit.
- C. Coordinate installation of devices with other trades and make allowances to prevent interference with other trades.

#### 3.3 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform testing to ensure heating elements are performing properly.
- C. Submit written test report showing functional test of each unit.

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### 3.4 DEMONSTRATION AND TRAINING

- A. Demonstrate operation of each equipment and associated controls.

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 EXISTING WORK

- A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.
- B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.
- C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

### 3.3 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.
- J. Coolers and Freezers: Cut and seal any required conduit openings in freezer and cooler walls, floor, or ceilings.

### 3.4 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.

### 3.5 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.



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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; 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 or direct burial insulation, in raceway, service-entrance cable, liquid-tight metal clad cable for equipment connections.
6. Underground Locations: Building wire, Type THHN/THWN/XHHW or direct burial insulation, in raceway, service-entrance cable.

#### 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.

### 2.2 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.

### 2.3 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.

### 2.4 METAL CLAD CABLE

- A. Conductor: Copper.
- B. Insulation Voltage Rating: 600 volts.

- C. Insulation Temperature Rating: 75 degrees C.
- D. Armor Material: Steel.
- E. Armor Design: Interlocked metal tape or Corrugated tube.
- F. Jacket: Where required by application.
- G. MC-PCS: Metal Clad cable – Power Control Signal. 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).

## 2.5 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. Furnish manufacturer's standard accessories; match finish on raceway.

## 2.6 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.

## 2.7 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.
    - b. 120/208V/3PH - black, red, blue.
    - c. 120/240V/3PH - black, orange, blue.
  - 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. 120/208V/3PH - White.
    - c. 120/240V/3PH - White.
    - d. When two or more neutrals are located in one conduit, individually identify each with proper circuit number or equivalent NEC-compliant method.
    - e. No branch circuits shall share a common grounded (neutral) conductor.
- B. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- C. Feeder Circuit Conductors: Uniquely color code each phase.
- D. 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.

## PART 3 EXECUTION

### 3.1 EXISTING WORK

- A. Remove exposed abandoned cable and accessories, including abandoned components above accessible ceiling finishes.
- B. Disconnect and remove abandoned cable. Remove abandoned cable when boxes being serviced are abandoned and removed.
- C. Maintain access to existing distribution boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- D. Extend existing cable installations using materials and methods compatible with existing electrical installations, or as specified.
- E. Clean and repair existing cable and accessories to remain or to be reinstalled.

### 3.2 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 EXISTING WORK

- A. Modify existing grounding system to maintain continuity to accommodate renovations.
- B. Extend existing grounding system using materials and methods compatible with existing electrical installations, or as specified. Bond existing grounding system to new installation using same size Grounding Electrode Conductor as that used for bonding newly installed grounding field.

#### 3.4 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 existing grounding field.
  - 5. Bond together new metal structural elements 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.

### 3.5 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. 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.
  - 3. Perform ground resistance testing in accordance with IEEE 142.
  - 4. Perform continuity testing in accordance with IEEE 142.

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.
- 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 for branch circuits 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.
- J. Natatorium Locations: Provide stainless steel or aluminum conduit, or non-metallic conduit. Provide stainless steel, cast aluminum, or non-metal outlet, junction, and pull boxes to match conduit. Provide flush mounting outlet box in finished areas.

### 1.4 DESIGN REQUIREMENTS

- A. Minimum raceway size: 3/4 inch unless otherwise specified.



- B. Minimum single pole switch-leg raceway size: ½ 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. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- B. Size: selected based on NEC fill capacity requirements for the application.
- C. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

## 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 gray 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 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

### 3.3 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.

### 3.4 INSTALLATION - RACEWAY

- A. 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.
- B. Any raceway routing shown is approximate location only unless dimensioned. Route to complete wiring system.
- C. Arrange raceway supports to prevent misalignment during wiring installation.
- D. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Group related raceway; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional/future raceways.
- F. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- G. Do not attach raceway to ceiling support wires or other piping systems.

- H. Construct wireway supports from steel channel.
- I. Route exposed raceway parallel and perpendicular to walls.
- J. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- K. 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.
- L. Maintain clearance between raceway and piping for maintenance purposes.
- M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. 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.
- Q. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams.
- S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- T. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control, and expansion joints.
- U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- W. 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.
- X. Close ends and unused openings in wireway.

### 3.5 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings or as specified in section for outlet device.
- B. Adjust box location up to 8 feet prior to rough-in to accommodate intended purpose.

- C. Orient boxes to accommodate wiring devices oriented as specified in other Sections.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. 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.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box where between-stud location is required.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

### 3.6 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.

### 3.7 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.
- C. Install knockout closures in unused openings in boxes.

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3.8 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 34

FLOOR BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes floor boxes; floor box service fittings; poke-through fittings; and access floor boxes.
- B. Related Sections:
  - 1. Division 7 - Firestopping: Firestopping for electrical work.
  - 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 27 26 - Wiring Devices: Receptacles for installation in floor boxes.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
  - 1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog data for floor boxes service fittings.

1.4 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution and Closeout Requirements: Closeout procedures.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 EXTRA MATERIALS

- A. Division 1 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
  - 1. FSR, Inc.
  - 2. Hubbell Wiring Devices; SystemOne series.
  - 3. Wiremold; Evolution series.
  - 4. Substitutions: Division 01 - Product Requirements.

## 2.2 FLOOR BOXES

- A. Floor Boxes: NEMA OS 1, minimum 1-1/2 inches deep.
- B. Adjustability: Adjustable to floor finish elevation.
- C. Material: Cast metal or formed steel.
- D. Shape: Round or Rectangular, unless otherwise noted on drawings.

## 2.3 FLUSH-COVER-TYPE CONVENIENCE RECEPTACLE SERVICE FITTING

- A. Material: Stainless Steel.
- B. Configuration: Duplex flap opening unless otherwise noted on Drawings.
- C. Protective Ring, Split Nozzle, and/or Ring as appropriate: Metal finish to match.

## 2.4 FLUSH-COVER-TYPE COMMUNICATION OUTLET

- A. Material: Stainless Steel to match power outlets.
- B. Configuration: Standard combination threaded opening.
- C. Protective Ring, Split Nozzle, and/or Ring as appropriate: Metal finish to match.

## 2.5 FLUSH-COVER-TYPE COMBINATION FITTING

- A. Material: Stainless Steel.
- B. Configuration: Duplex flap opening with com. opening unless otherwise noted on Drawings.
- C. Protective Ring, Split Nozzle, and/or Ring as appropriate: Metal finish to match.

## 2.6 POKE-THROUGH FITTINGS

- A. Product Description: Fire-rated assembly comprising service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.
- B. Fire Rating: Meet or exceed rating of floor assembly, coordinate with Architectural construction details.
- C. Service Fitting Type: Flush.
- D. Housing: Stainless Steel.
- E. Device Plate: Stainless steel.
- F. Configuration: As noted on Drawings

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify locations of floor boxes and outlets prior to rough-in.

### 3.2 INSTALLATION

- A. Boxes and fittings are indicated on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet to accommodate intended purpose.
- B. Floor Box Requirements: Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- C. Set floor boxes level.
- D. Install raceway system from each box to recessed large/deep backboxes (one for each system/channel), in adjacent wall or as shown, and extend conduit to above accessible ceiling or ceiling structure height.
- E. Where poke-through box and fittings are used for locations where feed is accessible from below, install junction box for each service (power, data, etc.) with access into each channel, and extend raceway as per method used for that service as required.
- F. Preserve fire resistance rating of all penetrations, using materials and methods specified in Division 7.
- G. Install protective rings split nozzle on active flush cover service fittings.

### 3.3 ADJUSTING

- A. Division 1 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust floor box flush with finish flooring material.

### 3.4 CLEANING

- A. Division 1 - Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.

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 EXISTING WORK

- A. Install identification on all unmarked existing equipment scheduled to remain and affected by the scope of work of this project, in accordance with this section.
- B. Replace lost nameplates, labels, and/or markers.

### 3.3 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:
  - 1. 10,000 amperes RMS symmetrical for 240 volt, two ungrounded buss panelboards.
  - 2. 22,000 amperes RMS symmetrical for 208 volt, three ungrounded buss panelboards.

- 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: Existing to remain. 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; meet or exceed utility RMS symmetrical amps available at panel location.
  - 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 EXISTING WORK

- A. Coordinate with owner to schedule work to ensure no panelboard work interrupts operational hours for the portion of the facility affected by work.
- B. Disconnect abandoned panelboards. Remove or install blank cover for abandoned panelboards as noted on Drawings.
- C. Maintain access to existing panelboards remaining active and requiring access. Modify installation or provide access panel where required for Code-compliance.
- D. Clean and repair existing panelboards to remain or to be reinstalled.

#### 3.2 INSTALLATION – NEW PANELBOARDS

- A. Install new breakers in available slots.
  - 1. Where installing in existing panelboards that are to be reused or retained; As necessary, remove spare, unused, or abandoned breakers and install new breakers in place, as required to provide circuits meeting manufacturer's nameplate data for each equipment within the scope of this project. Return any unused breakers to owner.
- 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.

### 3.3 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.

### 3.4 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 WALL SWITCHES (LINE VOLTAGE)

- A. Product Description: NEMA WD 1, [General-Duty].
- B. AC only general-use snap switch.
  - 1. Body and Handle: Plastic with toggle/rocker handle.
  - 2. 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.

## 2.3 WALL DIMMERS

- A. Product Description: 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. Leviton; IP710-series (LF, DLZ, LFZ)
    - b. Lutron; DVSTV-WH Diva
    - c. Electronic solid-state dimmer or lighting controller for LED light engine and electronic dimming controller equipped fixtures compatible with 0-10VDC control signal.
- B. Type: Compatible with fixture(s) to be controlled, or as indicated on Drawings.
  - 1. Level Control: Body and Handle: plastic with linear slide to retain level setting.
    - a. 0-10V Dimmer where required to match fixture.
  - 2. On/Off: Plastic pushbutton or hinged toggle.
  - 3. Color: White unless otherwise selected by Architect to match other coverplates.
  - 4. 3-way or Single-Pole as indicated for circuit on Drawing.

## 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.

## 2.5 RECEPTACLES

- A. Product Description: NEMA WD 1, Specification-grade, general-duty, general use receptacle. Each device shall be 3<sup>rd</sup>-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 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. 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.

## 2.6 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 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).

## 2.7 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 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.



- B. Modify installation to maintain access to existing wiring devices to remain active.
- C. Clean and repair existing wiring devices to remain or to be reinstalled.

### 3.4 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole on bottom.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- G. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. 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.
- J. Use jumbo size plates for outlets installed in masonry walls and where needed to conceal gaps in other areas.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

### 3.5 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 installation of wiring devices with underfloor raceway service fittings.
- D. Coordinate installation of wiring devices with floor box service fittings.

### 3.6 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.

### 3.7 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

### 3.8 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

\*\*\*\*\*

This section includes enclosed switches for use as disconnects in service and distribution systems rated 600 volts and less.

\*\*\*\*\*

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 MAIN SERVICE FUSED DISCONNECT SWITCH

- A. Design Base reference: GE; TH-series.
- B. Product Description: NEMA-3R, Service Rated, Heavy-Duty switch, surface mounted.
  - 1. Where Fusible service or OCPD type required; fuse holders and lugs for all ungrounded conductors of size/capacity ratings as indicated on Drawings.
  - 2. Where three-phase service is served; four wire, three-phase, with switch for all ungrounded conductors of size/capacity ratings as indicated on Drawings and lug/bus for grounded conductor.
  - 3. Where single-phase service is served; three-wire, single-phase, with switch for all ungrounded conductors of size/capacity ratings as indicated on Drawings and lug/bus for grounded conductor.
  - 4. Furnish copper ground bus for service GEC.
  - 5. Cabinet Front: Access door shall be sealed and allow opening only with service de-energized.

### 2.3 EQUIPMENT OCPD FUSIBLE SWITCH ASSEMBLIES

- A. Product Description: NEMA KS 1, Type GD, enclosed load interrupter knife switch. 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: Switches identified for use as service equipment are to be labeled for this application. Furnish solid copper neutral assembly and equipment ground bar.
- E. Furnish switches with copper current carrying parts.

#### 2.4 NONFUSIBLE SWITCH ASSEMBLIES

\*\*\*\*\*

Type HD switches are heavy duty, and GD are general duty.

UL standards do not require Type GD switches to have cover interlocks; include to meet Project conditions.

\*\*\*\*\*

- A. Product Description: NEMA KS 1, Type [HD] [GD] [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.
- 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. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid copper neutral assembly and equipment ground bar.
- D. Furnish switches with copper current carrying parts.

#### 2.5 SWITCH RATINGS

- A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
- B. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere).

### PART 3 EXECUTION

#### 3.1 EXISTING WORK

- A. Disconnect and remove abandoned enclosed switches.
- B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing enclosed switches to remain or to be reinstalled.

#### 3.2 INSTALLATION

- A. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

- B. Height: 5 feet to operating handle.
- C. Install fuses for fusible disconnect switches.
- D. Install engraved plastic nameplates.
- E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

### 3.3 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, light engines, 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 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.

1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.5 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 EXISTING WORK

- A. Disconnect and remove abandoned luminaires, lamps, and accessories.
- B. Extend existing interior installations using materials and methods compatible with existing installations, or as specified.
- C. Clean and repair existing interior luminaires to remain or to be reinstalled.

### 3.2 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.

### 3.3 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.

### 3.4 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.

### 3.5 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.

### 3.6 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Protecting finished work.
- B. Re-lamp or replace light engine or, when necessary, entire luminaire, having failed light sources at Substantial Completion.
- C. Return all operable salvaged fixtures shown or scheduled for removal to owner.
  - 1. Coordinate with owner's representative for intended storage location for salvaged fixtures.
  - 2. Remove all lamps from fixtures scheduled for removal, and return operable lamps to owner for service replacement. Dispose of all inoperative lamps legally offsite.

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3.7 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: Nickel-Cadmium or Nickel-Metal-Hydride type, with minimum 90 minute capacity.
- 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. Install suspended exit signs using pendants supported from swivel hangers. Install pendant length required to suspend sign at indicated height.
- B. 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.
- C. Install wall-mounted emergency lighting units and exit signs at height as indicated on Drawings.
- D. Install accessories furnished with each emergency lighting unit and exit sign.
- E. Connect emergency lighting units and exit signs to branch circuit outlets provided in Section 26 05 33 as indicated on Drawings.

- F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.
- G. Install specified lamps in each emergency lighting unit and exit sign.
- H. 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.

### 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 26 56 00  
EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes exterior luminaries, poles, and accessories.

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).
  3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.
- C. Product Data: Submit dimensions, ratings, and performance data.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.6 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.7 MAINTENANCE MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

## PART 2 PRODUCTS

### 2.1 LUMINAIRES

- A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Refer to Section 01 60 00 - 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. Delivered lumens and color temperature shall be as scheduled, and selected to match throughout any occupied space or sight-lines.
  - 3. Dimmable using 0-10V signal or through direct communication with fixture as scheduled. Dimming devices and systems shall be selected for compatibility with fixtures installed.

### 2.3 METAL POLES

- A. Material and Finish: As Scheduled on Drawings.
- B. Section Shape and Dimensions: Round unless otherwise indicated.
- C. Height: per drawing schedule and details.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and Project conditions.
- B. Verify foundations or bases, as applicable, are ready to receive fixtures.

### 3.2 EXISTING WORK

- A. Disconnect and remove abandoned exterior luminaries.
- B. Extend existing exterior luminaire installations using materials and methods compatible with existing installations, or as specified.
- C. Clean and repair existing exterior luminaries to remain or to be reinstalled.

### 3.3 INSTALLATION

- A. Install concrete bases for lighting poles at locations as indicated on Drawings, in accordance with Section 03 30 00.
- B. Install poles plumb. Install shims or double nuts to adjust plumb.



1. Grout around each concrete base as applicable.
  - C. Install lamps/light-engines in each luminaire where not factory mounted.
  - D. Bond and ground luminaries, metal accessories, and metal poles in accordance with Section 26 05 26. Install supplementary grounding electrode at each pole remote from building for lightning protection.
- 3.4 FIELD QUALITY CONTROL
- A. Section 01 40 00 - Quality Requirements. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
  - B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
  - C. Lighting systems shall be tested to ensure proper calibration, adjustment, programming of controls, and operation.
- 3.5 ADJUSTING
- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
  - B. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings.
- 3.6 CLEANING
- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
  - B. Clean photometric control surfaces as recommended by manufacturer.
  - C. Clean finishes and touch up damage.
- 3.7 PROTECTION OF FINISHED WORK
- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
  - B. Relamp or replace light engine at luminaries having failed light sources at Substantial Completion.
- 3.8 SCHEDULES - As noted on Drawings.

END OF SECTION

SECTION 27 00 00

COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes general work results for Communications systems infrastructure.
  - 1. NO premises cabling, termination jacks or active gear are included in the scope of construction of this project.
  - 2. Pathways and infrastructure are the extent of installation, including any required firestopping where rated partitions are penetrated as documented in the architectural, structural, mechanical, and electrical Drawings.
  - 3. Wallboxes at jack locations shown on Drawings, with pull cords in conduit/raceway where concealed, shall be provided, stubbed to nearest accessible ceiling location approximately as shown on Drawings.
- B. Contractor shall coordinate and install pathway only, with fire barrier rated sealant/stopping and pull cord, for owner's use to route homeruns from new addition back to existing building collection closet for tele/data and media.
- C. Not In Contract:
  - 1. Active Gear/Equipment:  
Audio, television, media delivery, computers, active equipment, 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.
  - 2. Cabling or termination jacks:  
None in scope of work.
- D. Related Sections:
  - 1. Section 26 05 33 - Conduits and Backboxes.
  - 2. Section 26 05 26 - Grounding and Bonding.

1.2 REFERENCES

- A. American National Standard Institute (ANSI)
- B. American Society of Testing Materials (ASTM)
- C. Institute of Electrical and Electronic Engineers (IEEE)
- D. National Electrical Manufacturers Association (NEMA)
- E. International Electrical Testing Association (IETA):
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

- F. National Fire Protection Association (NFPA):
  - 1. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- G. Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA):
  - 1. TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard.
  - 2. TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
- H. Underwriters Laboratories, Inc. (UL):
  - 1. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.

### 1.3 SYSTEM DESCRIPTION

- A. Horizontal Pathway:
  - 1. Conform to TIA/EIA 569, using backboxes rated for the construction type and conduit for each location, stubbed up to nearest accessible ceiling space, with a minimum of 6" extended into accessible cavity.

### 1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog data for each device.
- C. Test Reports: Indicate procedures and results for specified field testing and inspection.
- D. Submit any requests for approval of substitute materials in writing to the Architect at least ten days prior to bid opening, compliant with Division 01 requirements.
  - 1. Basis of Design: Where equipment is identified by manufacturer and catalog number, the characteristics and performance of that product shall be considered the base of requirements for quality and performance. Where manufacturers are identified, Contractor may submit appropriate equivalent item by that manufacturer matching the Basis of Design. The Engineer's decision of whether submitted equipment is acceptable shall be final and binding.
  - 2. All changes necessary to accommodate substituted equipment shall be made at the Contractor's expense, as approved by the Engineer, coordinated with all other trades, at no further cost to owner. Detailed product cut sheets, Drawings where appropriate, and required information indicating the required changes shall be submitted for approval at the time the substitution is requested.

### 1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

## 1.6 QUALITY ASSURANCE

- A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one year from the date of manufacture), unused and without blemish or defect.
- B. Equipment shall bear labels attesting to 3<sup>rd</sup>-Party testing (UL, FM, etc.), where subject to label service.
- C. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer.
  - 1. Components of an assembled unit need not be products of the same manufacturer, but must offer a partner manufacturer with a certified end-to-end solution.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company shall have been engaged in the manufacture of equipment or materials of this Section a minimum of three years, and have available for review testing, certification, and descriptive data for all products to meet requirements specified.
- B. Installer:
  - 1. Company specializing in systems and products specified in this Section with minimum three years' experience.

## 1.8 COORDINATION

- A. Coordinate with owner or owner's staff for final rough in locations.
- B. Coordinate communications work with that of other sections as required to ensure that the entire communications work will be carried out in an orderly, complete and coordinated fashion.
  - 1. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
  - 2. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration firestop systems.
  - 3. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

## PART 2 PRODUCTS

### 2.1 TELECOMMUNICATIONS TERMINATION BACKBOARD

- A. Material: Plywood, prefinished, certified/stamped Fire Retardant to meet Fire safety code requirements for painted, fire retardant mounting backboards.

- B. Size: 4 x 8 feet typical sheet stock, total as required for application or as indicated on Drawings, 3/4 inch thick.

## 2.2 BONDING TERMINATION

- A. Manufacturers
  - 1. ERICO TGB-A12L06PT
  - 2. Burndy
  - 3. Panduit
  - 4. Substitutions: Division 01 - Product Requirements.
- B. Inter-System Bonding Tie (ISBT) busbar shall meet or exceed ANSI/TIA-607-B requirements, compliant with TIA/EIA 607; Copper, tin plating, 1/4" thick plate, length min 12", width min 2", holes 5/16" and 7/16" with min spacing 1" between pairs, 1" stand-off brackets, 1-1/2" insulators and accessories as required.
- C. Grounding Lugs and Hardware: Grounding lugs shall be 2-hole and installed with a crimper, impressing the die # on the lug base. Lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also acceptable.
- D. Conductor: Bonding shall be performed compliant with NEC requirements and per Section 26 05 26, with green insulated THHN copper conductor.

## 2.3 FIRESTOPPED DATA PATHWAYS

- A. Manufacturers
  - 1. Design Base: Specified Technologies Inc; EZ-Path series.
  - 2. Substitutions: Division 01 - Product Requirements.
- B. General: Use only through-penetration firestop system products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- C. Firestopped Penetration Device:
  - 1. Factory fabricated and listed product may be used in lieu of field-fabricated firestopped pathways.
  - 2. Fire rated cable pathway devices may be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways. Devices shall:
    - a. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
    - b. Be tested for the surrounding construction and cable types involved.
    - c. Have UL listing at intended cable load.
- D. Coordination:
  - 1. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.
- E. Related Products for field installations:

1. Latex Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.
2. Devices: Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
3. Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
4. Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame-retardant poly bag.
5. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
6. Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag).
7. Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil.
8. Plugs: Re-enterable, foam rubber plug impregnated with intumescent material for use in blank openings and cable sleeves.
9. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing individual cable penetrations. Grommets shall be tested in single membrane or through-penetration conditions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Prior to submitting bids of the Project, contractor shall inspect the site of the work to become familiar with all existing conditions that may affect the work and cost of the project.
- B. Contractor shall confirm with owner all exact locations of intended backboxes and rough-ins shown on Drawings.
- C. Obtain all permits and inspections for the installation of this work at no further cost to owner. Deliver to the Owner all permits and certification of inspections issued by authorities having jurisdiction.
- D. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence.
  1. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.
  2. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.
  3. Start of work indicates acceptance of conditions.

### 3.2 PROTECTION

- A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

- B. Damage from rain, dirt, sun and ground water when exposed in exterior locations shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.
- C. Damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents.
- D. Damaged finish or paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer.

### 3.3 INSTALLATION

- A. Backboard:
  - 1. Backboard(s) shall be installed on finished wall of space identified on Drawings, with minimum ¼" spacer.
  - 2. Backboard(s) shall be prefinished, or field painted with two (2) coats of gray fire-retardant paint after inspection by Fire Marshall or AHJ but prior to installation of any hardware.
- B. Grounding:
  - 1. Contractor shall install one ISBT, connected at a single point to the building Electrical Service GEC, in accordance NEC requirements. Ground and bond pathways, cable shields, and equipment, and main grounding bus bar for communications, bonded to building entry service Grounding Electrode Conductor, in accordance with Division 26, NEC 250.94, and ANSI/TIA/EIA-60 requirements.
  - 2. Locate on the wall of Collection Point and bond the busbar at one point with minimum #6 AWG copper conductor extended to the ISBT.
  - 3. All wires used for communications grounding purposes shall be identified with green insulation. Non-insulated bonding conductors or straps shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-A.

### 3.4 FIRESTOPPING

- A. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. General Requirements: Install through-penetration firestop systems in accordance with "Performance Criteria" Article and in accordance with the conditions of testing and classification as specified in the published design.
- D. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration firestop systems products.

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1. Seal all openings or voids made by penetrations to ensure an air and water-resistant seal.
2. Protect materials from damage on surfaces subjected to traffic.

### 3.5 FIELD QUALITY CONTROL

- A. Dispose of all material and debris left by work offsite; remove waste and debris from each space during the course of work at the end of each daily work period, and from interiors and exteriors of electrical equipment at the completion of task. Clean accessible current carrying elements prior to being energized.
- B. Substantial Completion:
  1. Division 01 - Execution and Closeout Requirements.
  2. Submit all closeout submittals.

END OF SECTION



SECTION 28 31 00

DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes alarm devices.
- B. Related Sections:
  - 1. Section 26 05 19 - Electrical Power Conductors and Cables.
  - 2. Section 26 05 29 - Hangers & Supports.
  - 3. Section 26 05 33 - Raceway and Boxes.
  - 4. Section 26 05 26 - Grounding and Bonding.

1.2 SYSTEM DESCRIPTION

- A. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
  - 1. Local fire alarm signaling devices sound and visual alert.
  - 2. Signal transmits to other devices through either conductor (direct connection) or wireless means, so that all other devices in building also trigger sound and visual alert.
- B. Test Operation: Each unit shall have push-button test switch.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog data showing features, electrical characteristics, and connection requirements.

1.4 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.

1.5 MAINTENANCE MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Provide owner with parts list and complete manufacturer's cutsheet showing model numbers for reference in future replacements.

## PART 2 PRODUCTS

### 2.1 GENERAL

#### A. Manufacturers

1. BRK
2. First Alert
3. Gentex
4. Kidde
5. Substitutions: per Division 1 requirements, must be approved by Engineer prior to bid.

### 2.2 SMOKE/HEAT DETECTION AND ALARM DEVICE

#### A. Design Base:

1. GENTEX: 7139CS-C
2. BRK: 7010BSL

#### B. Product Description:

1. Detection: Photo-electric or ionization smoke detector sensing chamber, fully screened to resist entry of pests.
2. Heat-only or combination detectors include fixed temperature sensing to activate.
3. Visual Alert: 177 candela Xenon strobe light.
4. Audible Alert: Solid state piezo horn rated at 85dB at 10 ft.
5. Status: A visual green LED power-on indicator to confirm unit is receiving power or is in alarm.
6. Test: A button shall be available to check alarm functions by simulating a smoke condition, causing the unit to alarm.
7. Alarm Latch: to identify which detector initiated an alarm condition.
8. Low battery: to visually identify which unit is in low battery condition.
9. Alarm Silence: button to temporarily silence nuisance alarm.
10. Ambient Temperature: unit shall be capable of operating between 40°F - 100°F.
11. Relative Humidity: unit shall be capable of operating between 10% - 90%RH.
12. Interconnection: unit shall be capable of connecting via either an extra conductor ("3-wire" daisy-chain configuration), or separate low-voltage cabling, or wireless communications, such that all units in the building will be activated upon any unit detecting a fire condition.
13. The unit shall meet or exceed requirements of: UL-217, UL-1971, ADA, ANSI-117.1, NFPA-72, NFPA-101 and the IFC.

#### C. Electrical Characteristics:

1. Line voltage power: 120VAC, 60Hz.
2. Backup power: Typical; 9VDC battery.
3. Auxiliary Relays: auxiliary relay contact or wireless equivalent to provide accessory functions or as required for potential use by other systems or equipment.

#### D. Mounting:

1. Semi-recessed where located in ceiling or stud construction, with concealed backbox and cabling in cavity.
2. Surface mounted where located on solid ceiling or other construction with no cavity, in 'finish' style box served by matching metal surface-mount raceway.

## 2.3 CARBON MONOXIDE DETECTOR

- A. Product Description:
  - 1. Carbon Monoxide detection and alarm unit.
  - 2. Comply with UL 268.
- B. Electrical Characteristics:
  - 1. Line voltage power: 120VAC, 60Hz.
  - 2. Backup power: Typical; 9VDC battery.
  - 3. Auxiliary Relays: auxiliary relay contact or wireless equivalent to provide accessory functions or as required for potential use by other systems or equipment.
- C. Mounting:
  - 1. Semi-recessed where located in ceiling or wall with cavity stud construction, with concealed backbox and cabling in cavity.
  - 2. Surface mounted where located on solid ceiling or wall, or other construction with no cavity, in 'finish' style box served by matching metal surface-mount raceway.

## 2.4 WIRE AND CABLE

- A. Product Description:
  - 1. Line voltage cable; per Section 260519.
  - 2. Non power-limited fire protective signaling cable, copper conductor, 150 volt insulation rated 60 degrees C.
  - 3. Power-limited fire protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.

## 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 with other devices installed by other trades, adjust final locations as needed to avoid conflicts at no further cost to owner.
  - 2. Ensure that all systems are fully functional and provided with compatible power and signals.

### 3.2 INSTALLATION

- A. Furnish Lithium backup battery for each unit with a battery backup feature.
- B. Furnish cabling to connect entire system including both line voltage and any signal cabling required by manufacturer's wiring diagrams.
- C. Follow manufacturer's recommended procedures for installation, setup and testing, including recommended location, height, and orientation, coordinated with construction and other items in the space to ensure proper function and accessibility.

- D. Install 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors in flexible raceway such as AC/MC or stranded conductors in conduit.
  - 1. Connect conduit and wire to all components.
  - 2. Ground and bond fire alarm equipment and circuits in accordance with NEC and Section 26 05 26.
- E. Automatic Detector Installation: Conform to NFPA 72.

### 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; ensure that all units are properly linked such that detection of a fire condition at any unit will trigger annunciation alerts by all units in the building.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Division 01 - Quality Requirements: Manufacturer's field services.

### 3.5 DEMONSTRATION AND TRAINING

- A. Demonstrate operation, testing, and maintenance instructions at project site with owner's representative.

END OF SECTION