

# SPECIFICATION FOR

# PROJECT:

# City of Huber Heights Ohio New Public Works Facility

# OWNER:

City of Huber Heights 6131 Taylorsville Rd. Huber Heights, Ohio 45424

# SPECIFICATION DATE:

February 6, 2024

# **BID DATE:**

March 5, 2024

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# City of Huber Heights Ohio

# **New Public Works Facility**

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#### INVITATION FOR BIDS

Contractors are invited to bid on City of Huber Heights Ohio - New Public Works Facility, located at 5001 Taylorsville Road, Huber Heights, OH 45424 as described in the Drawings and Specifications dated February 6, 2024 as prepared by:

> Kueny Architects, LLC 10505 Corporate Drive, Suite 100, Pleasant Prairie, Wisconsin 53158. Phone number (414) 690-3197 jonw@kuenyarch.com anita@kuenyarch.com

A Pre-Bid meeting will be held on March 14, 2024 at 10 AM starting at City Hall located at 6131 Taylorsville Rd. Huber Heights, Ohio 45424. Then going to the site location 5001 Taylorsville Road, Huber Heights, OH 45424.

Sealed Bids will be received by The City of Huber Heights locate at 6131 Taylorsville Rd, Huber Heights, Ohio 45424, on March 26, 2024 at the receptionist's desk in the main office up until 1:00 PM Local Standard Time. At that time Bids will be opened publicly read aloud for consideration by the Owner.

The Project consists of Construction of a New 54,000 square foot Public Works Facility. The facility will house, the complete Public Works Department. Outbuildings include a 7,200 square foot Salt Storage Facility and Fuel Island.

Bids will be based on a single lump sum for the following separate Contracts:

1. General

The Contract Documents, including Plans and Specifications are on file with:

3. Bid Tool 1. Dodge 5. Bid Ocean Inc. 3. Bid Tool4. Daily Reporter

2. ConstructConnect 6. Builders Exchange

Bidding Documents, including Drawings and Specifications, may be obtained via email by contacting Anita Stanley at anita@kuenyarch.com or by calling (262) 587-8101.

Plans and Specification may be access online from BPI Inc.'s project portal, send an email to dfs@bpicolor.com with the project name in the subject line. Include the Company Name, Contact Person, and a valid email address that can receive correspondence regarding the project. Contact BPI (414) 327-5010 with any questions.

Bidders may be required to submit a brief statement of their qualifications to the Architect before submitting a Bid.

All Bidders will be required to submit a complete list of subcontractors with their proposals, or within 24 hours after bid due date.

All Bids will remain firm for a period of 90 days after the opening date.

A certified check or a satisfactory Bid Bond executed by the Bidder and satisfactory Surety Company in the amount of 10% of the Bid made payable to The City of Huber Heights, shall accompany each bid.

00 11 16-1 February 6, 2024 **INVITATION FOR BIDS**  Successful Bidders will be required to furnish and pay for a satisfactory Performance Bond, and Labor and Materials Bond in the amount of 100% of the Contract.

The Owner reserves the right to accept or reject any and all Bids in their best interest.

NOTE: This Project has a Liquidated Damages-Bonus clause.

\* \* \* \* \* \* \* \* \* \*

## **SECTION 00 21 13 INSTRUCTIONS TO BIDDERS**

# A. Description of Project

- 1. Work of Construction of a New 54,000 square foot Public Works Facility. The facility will house, the complete Public Works Department. Outbuildings include a 7,200 square foot Salt Storage Facility and Fuel Island.
- 2. Work by Owner: The following work will be accomplished by the owner or will be let under separate Contracts not included in this Specification:
  - a. Furniture and Furnishings. (not including fixed seating)
- 3. Unusual Conditions: It is assumed that no unusual conditions will be encountered during the actual performance of the Work. However, the Contractor should study the site carefully for accessibility, mechanical access, etc.
- 4. Completion Schedule: It is the Owner's intention to start construction Spring of 2024 with substantial completion April 22, 2025 later; work sequence by contractors will reflect this schedule.
- The Contractor for the General Contract shall commence work under the Contract on its execution and shall fully complete all work thereunder no later than the time indicated on the Proposal form.

## **B.** Definitions and Standards

- Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The bidding requirements consist of the Advertisement or Invitation to Bid, Instruction to Bidders, Supplementary Instruction to Bidders, the Bid Form and other sample bidding and contract forms. The proposed Contract Documents consist of the Form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.
- 2. Definitions set fourth in the General Conditions of the Contract for Construction, AIA Document A 201, or in other Contract Documents are applicable to the bidding Documents.
- Addenda are written or graphic instruments issued by the Architect prior to the
  execution of the Contract which modify or interpret the Bidding Documents by
  additions, deletions, clarifications or corrections.
- 4. A **Bid** is complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein, submitted in accord with the Bidding Documents.
- 5. The **Base Bid** is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may

be added or from which Work may be deleted for sums stated in Alternate Bids.

- An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work as described in the Bidding Documents, is accepted.
- A Unit Price is an amount stated in the Bid as a price per unit measurement for materials, equipment or services or a portion of the Work as described in the Bidding documents.
- 8. A **Bidder** is a person or entity who submits a Bid.
- 9. A **Sub-bidder** is a person or entity who submits a Bid to a Bidder for materials, equipment or labor for a portion of the Work.
- 10. Interpretation of Trade Names or Titles: Each item listed in the Specifications is intended to be complete and fully workable item or piece of equipment. The Contractor will include in the Proposal this item or equipment in such a manner that the Owner may take it over and find it capable of performing to the intention of its design. This is not intended to make the Contractor responsible for the engineering design of what is shown, intended or indicated, but only to insure the furnishing of complete and functioning installations.
- 11. **Reference to Standard Specifications:** Such reference shall mean latest edition as of time of Advertisement for Bids.
- 12. "Or Equal" Clause: Whenever the Contract Documents designate any article, material or equipment by describing a propriety product, or by using the name of a Manufacturer or vendor, the term "or equal" shall apply. The article, material or equipment so named, shall be understood to define a type, function, minimum standard of design, efficiency and quality desired, and is not intended to eliminate competition. The Contractor may, by complying with the requirements of Paragraph 3 of Section E, Substitutions, of the Instructions to Bidders, use authorized substitutions in the Bid.
- 13. **Match Existing:** When the term "Match Existing" is used, the contractor will supply new materials that will match existing in all aspects including form, function, color, texture, size, etc. Contractor will inform the Architect, prior to bidding, if any existing product cannot be matched as stated above so that the situation can be researched and an addendum issued.

#### C. Qualifications of Bidders

- 1. At the request of the Architect, any Contractor or Subcontractor <u>may be requested</u> to submit all of the information listed below for study by the Owner, in order to determine the ability of the Contractor to perform.
  - a. Performance Record
  - b. Address and Description of Plant
  - c. List of Equipment and Personnel
  - d. List of Completed Projects

- e. Certified Financial Statement
- f. AlA Document A 305, Contractors Qualification Statement, completed in full.
- g. Any additional information that will satisfy the Owner as to the ability of the Bidder to perform the Contract.
- 2. Failure of a Contractor to supply information requested will be grounds for rejection of the Prime Contractors bid or rejection of a Subcontractor listed by a Prime Contractor.
- 3. Should the Owner or the Architect not be familiar with a General Contractor, they will be expected to normally have concrete, masonry and carpentry workers in their permanent employ to qualify as General Contractor and to submit data for qualification.

# D. Examination of Project Requirements

- 1. Each Bidder by making a Bid represents that:
  - a. The Bidder has read and understands the Bidding Documents and the Bid is made in accord therewith.
  - b. The Bidder has read and understands the Bidding Documents or Contractor Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, for other portions of the project, if any, being bid concurrently or presently under construction.
  - c. The Bidder has visited the site, become familiar with the local conditions under which the Work is to be performed and has correlated the Bidder's observations with the requirements of the proposed Contract Documents.
  - d. The Bid is based upon the materials, systems and equipment required by the Bidding Documents without exception.

# **Bidding Documents**

- 1. Copies
  - a. Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bonafide bid and return the Bidding Documents in good condition within ten days after announcement of award or withdrawal of the project. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the deposit will be refunded.
  - b. Bidding Documents will not be issued directly to Sub-bidders or others unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.
  - c. Bidders shall use complete sets of Bidding Documents in preparing Bids. Neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
  - d. The Owner or Architect, in making copies of the Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work

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and do not confer a license or grant for any other use of the Bidding Documents.

# 2. Interpretation or Correction of Bidding Documents

- a. The Bidders shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, and shall examine the site and local conditions, and should Bidders or Sub-bidders find their work impossible to perform as detailed or items impossible to furnish as specified, or resulting installation unusable, unsafe, impracticable, unworkable or unable to perform upon examination of the Bidding Documents or of the Site and local conditions, Bidders will notify Architect prior to submission of Bid, or will assume responsibility of proper performance at no additional cost to the Owner.
- b. Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.
- c. Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.
- d. Where not covered under Article E.2.a.,b. and c. above, a discrepancy between items or materials or equipment indicated and/or specified, the Bidders shall assume the greatest number, the best quality, the most complete indicated or required. Where items are listed in more than one Contract, each listed shall include item in their Proposal.

#### 3. Substitutions

- a. General:
  - The materials, products and equipments described in the Bidding Documents establish a standard or required function, dimension, appearance and quality to be met by any proposed substitution.
  - 2) Where any Contractor provides an item or installation not as specified but as accepted as an equal or as a substitution, the Contractor will assume responsibility for the performance of same and provide for any modifications to architectural, structural or mechanical work as required to accommodate such items.

#### b. Pre-Bid

1) No substitution will be considered prior to receipt of Bids unless written requests for approval have been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including Drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting fourth any changes in other materials, equipment or other portions of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included.

The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

- 2) If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.
- c. With Bid: Substitutions or modifications of specified items suggested by the Bidder as to being equal to or better than as specified, may be stated on the Bid Form by the Base Bid for the Owner's consideration.
- d. After Award: No substitutions will be considered after the Contract award unless specifically provided in the Contract Documents.

#### 4. Addenda:

- a. Addenda will be mailed or delivered to all who are known by the Architect to have received a complete set of Bidding Documents.
- b. Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- c. No Addenda will be issued later than One days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.
- d. Each Bidder shall ascertain prior to submitting a Bid that all addenda issued have been received and shall acknowledge their receipt in the Bid.

# F. Bidding Procedures

- 1. Type of Bid: Bids will be received under the following Contracts:
  - a. General
- 2. Unit Prices: Unit prices requested on the Bid Form shall be given and, if included in the Contract, will be used for additions to or deductions from amount of Work required under the Contract. Unit prices shall include all cost of materials, labor, transportation, insurance, applicable taxes, overhead and profit.
- 3. Subsurface Conditions: Base Bid shall include subsurface soil improvements per either Section 31 20 00 <or> Section 31 66 00.

#### Alternate Bids:

- a. Alternate Bids must be submitted for different items entering into the construction of the building as called for under the different headings in the Specifications and as provided in the Bid Forms under each division of Work. Failure to bid alternates will result in rejection of the Bid.
- b. The Owner reserves the right to accept or reject any alternates that will result in advantage for the Owner.
- c. Allowances: Bidders shall include all items for which cash allowances are specified for the various sections of the Specifications. The amount of the allowances will be part of the Base Bid.
- Allowances: Bidders shall include in their Base Bid a cash allowance of \$125,000. Any unused portion of this Allowance shall be returned to the Owner as a Deduct Change Order at the end of the Project.
- Form and Preparation of Bid
  - a. Bids shall be submitted upon the prescribed bid form furnished within the specification.

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- b. The form shall be completely filled out in ink or type written in words and figures (in case of discrepancy, words shall govern) including applicable phase-of-work.
- c. Any interlineations, alteration or erasure must be initialed by the signer of the Bid.
- d. All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change".
- e. Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the Bid Security, state the Bidders refusal to accept award of less than the combination of Bids the Bidder so stipulates. The Bidder shall make no additional stipulations on the Bid Form nor qualify the Bid in any other manner
- f. List of Subcontractors: Each Bidder is required to submit a complete list of subcontractors with the proposal or within 24 hours after bid due date on the spaces provided on the proposal and as outlined under the Invitation for Bids. This list shall conform to the breakdown form requested in Paragraph 9.2 of the General Conditions. Work and material furnished by the Prime Contractor shall be so listed along with actual subcontractors. This list will meet the requirements of Article 5.2 of the General Conditions.
- g. Requirements for Signing Bids:
  - Each copy of the Bid shall include the legal name of the Bidder, and a statement that the Bidder is a sole proprietor, a partnership, a corporation or other legal entity. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a Contract
  - 2. Bids which are not signed by individuals making them, shall have attached thereto, a Power-of-Attorney evidencing authority to sign the Bid in the name of the person for whom it is signed.
  - 3. Bids which are signed for a partnership, shall be signed by the partners or by an Attorney-in-Fact. If signed by an Attorney-in-Fact, there shall be attached to the Bid, a Power-of-Attorney evidencing authority to sign the Bid, executed by the Partners.
  - 4. Bids which are signed for a Corporation, shall have the correct corporate names thereof and the signature of the President of the Corporation, hand-written below and stamped with the Corporation Seal. A Bid by a Corporation shall further give the State of Incorporation.
  - All Bids must be notarized.

#### 8. Bid Security

- a. A satisfactory Bid Bond executed by the Bidder and Surety Company or a certified check in an amount equal to ten percent of the Bid shall be submitted with each Bid payable to the Owner. Form should be similar to AIA Document A 310. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.
- b. Bidders by submitting a Bid and Bid Bond pledges that the Bidder will enter into a Contract with the Owner, within twenty days after the proposal is accepted by the Owner and the Bidder is given written notice thereof, on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, if required, the amount of the bid security shall be

- forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event that the Owner fails to comply with Subparagraph H.1.
- c. Each surety will determine the ability of each Contractor they bond to meet all the requirements of this Specification.
- d. Bid Bonds or checks of unsuccessful Bidders will be returned within seven days after bids are opened.
- e. The Owner will have the right to retain the Bid Security of Bidders to whom an award is being considered until either the Contract has been executed and bonds, if required, have been furnished, or
- f. The specified time has elapsed so that Bids may be withdrawn, or all bids have been rejected.

# 9. Submission of Bids:

- a. All copies of the Bid, the Bid Security, if any and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope
  - 1. The envelope shall state the Bid, Project, Time for Opening, the Branch of Work and Bidders name and address;
  - 2. If the Bid is sent by mail the sealed envelope shall be enclosed in a separate mailing envelope with the notation 'SEALED BID ENCLOSED' on the face thereof.
- b. Bids shall be deposited at the designated location prior to the time and date for receipt of Bids indicated in Advertisement or Invitation to Bid, or any extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will be returned unopened.
- c. The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.
- d. Oral, telephonic, telegraphic, or electronic Bids are invalid and will not receive consideration.
- e. Any deviation from the exact procedure described above or omission of any item or line of the Bid Form requested may result in rejection of the Bid. Owner assumes no responsibility to open Bids received by mail after the Bid Opening.

## 10. Modification or Withdrawal of Bid

- a. A Bid may not be modified, withdrawn or cancelled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting the Bid.
- b. Prior to the time and date designated for receipt of Bids, any Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder, written confirmation over the signature of the bidder shall be mailed and postmarked on or before the date and time set for receipt of Bids, and it shall be so
- c. Withdrawn Bids may be resubmitted up to the time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.
- d. Bid security, if any is required, shall be in an amount sufficient for the Bid as modified or resubmitted.

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worded as not to reveal the amount of the original Bid.

#### G. Consideration of Bids

- Opening of Bids: Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be opened publicly. An abstract of the Base Bids and Alternate Bids, if any, may be made available to Bidders.
- Rejection of Bids: The Owner shall have the right to reject any or all Bids and to reject a Bid not accompanied by any required Bid security or by other data required by the Bidding Documents, or to reject a Bid which is in any way incomplete or irregular.
- 3. Acceptance of Bid (Award):
  - a. It is the intent of the Owner to award a Contract to the lowest responsible, responsive bidder provided the Bid has been submitted in accord with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive any informality or irregularity in any Bid or Bids received and to accept the Bid or Bids which, in the Owner's judgment, is in the Owner's best interests.
  - b. The low Bidder will be determined solely on the basis of the Base Bid and accepted Alternates. Substitutions, while welcome, will not be used to determine the low bidder. However, should all Contractors submit the same substitution in the same manner, this substitution will then be considered to be an Alternate.
  - c. The Owner shall have the right to accept Alternates in any order or combination, unless otherwise provided, and to determine the low Bidder on the basis of the sum of the Base Bid and the Alternates accepted.
  - d. Formal notice in writing to the awardee from the office of the Architect shall constitute award of the Contract. Acceptance of any substitution by the Owner shall be in writing by the Architect after the award of the Contract to the low bidder, in the form of Change Orders.

#### H. Post Bid Information

- Owner's Financial Capability: The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract.
  - Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Owner-Contractor Agreement.
- 2. Subcontractors and Suppliers
  - a. The Bidder will be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the subcontractors and suppliers listed with the Bid or proposed to furnish and perform the Work described in the Bidding Documents.

- b. Prior to the award of the Contract, the Architect will notify the Bidder in writing if either the Owner or the Architect, after due investigation, has reasonable objection to any such proposed subcontractor or supplier. If the Owner or Architect has reasonable objection to any such proposed subcontractor or supplier, the Bidder has the option to:
  - 1. Withdraw the Bid, or
  - 2. Submit an acceptable substitute subcontractor or supplier with an adjustment in the Bid price to cover the difference in cost occasioned by such substitution. The Owner may, at the Owner's discretion, accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification under this Subparagraph, Bid Security will not be forfeited, notwithstanding the provisions of Paragraph F.8.a.
- c. Subcontractors or suppliers proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection under the provisions of Subparagraph H.2.b. must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and the Architect.

# I. Performance Bond and Labor and Material Payment Bond

# 1. Bond Requirements

- The successful Bidders will take out and pay for a Performance Bond and a Material and Labor Payment Bond in the amount equal to 100 percent of the contract
- b. Prior to execution of the Contract, the Bidder shall furnish bonds covering the faithful performance of the Contract and the payment of al obligations arising thereunder in such form and amount as the Owner may prescribe. Bonds may be secured through the Bidder's usual sources. If the furnishing of such bonds is stipulated, the cost shall be included in the Bid.
- c. If the Owner has reserved the right to require that bonds be furnished subsequent to the execution of the Contract, the cost shall be adjusted as provided in the Contract Documents.
- d. If the Owner requires that bonds be obtained from other than the Bidder's usual source, any change in cost will be adjusted as provided in the Contract Documents.

# 2. Time of Delivery and Form of Bonds

- a. The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract, or if the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.
- b. Unless otherwise required in Article I, the bonds shall be written on AIA Document A 312, Performance Bond and Labor and Material Payment Bond.
- c. The bonds shall be dated on or after the date of the Contract.
- d. The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his/her power-of-attorney.

# J. Execution of Agreement

- 1. The form of Agreement which the successful Bidder, as Contractor, will be required to execute is AIA-A101-Standard form of agreement between Owner and Contractor.
- 2. The Bidder to whom the Contract is awarded by the Owner shall, within 20 days after notice of award and receipt of Agreement forms from the Owner, sign and deliver to the Owner all required copies of the Agreement.
- 3. At or prior to delivery of the signed Agreement, the Contractor shall deliver to the Owner the Performance Bond and the policies of insurance certificates as required by the Contract Documents. All bonds and policies or certificates of insurance shall be approved by the Owner before the successful Bidder may proceed with the Work.
- 4. Failure or refusal to furnish bonds or insurance policies or certificates in the form satisfactory to the Owner shall subject the Bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material.

\* \* \* \* \* \* \* \* \* \* \* \* \*

## **SECTION 00 31 21 INFORMATION AVAILABLE TO BIDDERS**

## A. SOIL REPORT

#### 1. GEOTECHNICAL REPORT

- a. A complete Soil Report has been prepared by Bowser Morner P.O. Box 51 Dayton, Ohio 45401. A copy of this Report is bound within these specifications. Any questions that might arise during the bidding should be directed to Kueny Architects, LLC 262-857-8101.
- A Preliminary Soil Study for Proposed Retaining Wall has been prepared by Bowser Morner.
- c. Phase I Environmental Site Assessment Report has been prepared by MakSolve.
- d. This report was obtained only for the Owner's use in design and is not a part of the Contract Documents and is not a warrant of subsurface conditions.
- e. The Contractor should visit the Site and acquaint himself with all existing conditions. Prior to bidding, Bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions but such subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the Architect.
- f. The Soils Engineer will be retained by the Owner to provide testing and continuous inspection of work in connection with excavating, filling, compacting and grading.

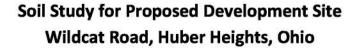
## B. SITE INSPECTION

# 1. PROCEDURE

- a. A pre-bid walk-through will be held for all Prime Bidders at AM starting at City Hall located at Taylorsville Rd. Huber Heights, Ohio 45424. Then going to the site location 5001 Taylorsville Road, Huber Heights, OH 45424. on March 14, 2024 at 10am.
- Bidders will also be welcome to visit the site by appointment with Architect Kueny Architects, LLC jonw@kuenyarch.com, (414) 690-3197

\* \* \* \* \* \* \* \* \* \* \*

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# **Submitted To:**

City of Huber Heights

Attn. Mr. Russ Bergman, P.E. City Engineer
6131 Taylorsville Road

Huber Heights, Ohio 45424

Report No. 208890-0223-038 February 23, 2023

# BOWSER MORNER®

4518 Taylorsville Road—Dayton, Ohio 45424—937.236.8805 www.bowser-morner.com

# BOWSER MORNER.

#### **DAYTON ENGINEERING SERVICES**

P.O. Box 51 Dayton, Ohio 45401-0051 P. 937.236.8805 F. 937.233.2016

www.bowser-morner.com

February 23, 2023

City of Huber Heights 6131 Taylorsville Road Huber Heights, Ohio 45424

Attention: Mr. Russ Bergman, PE City Engineer

Re: Report No. 208890-0223-038; Preliminary Soil

Study for Proposed Development Site, Wildcat

Road, Huber Heights, Ohio

Dear Mr. Bergman:

Bowser-Morner, Inc. is pleased to submit our report of the soil study for the above-referenced project. The purpose of this study is to obtain preliminary subgrade soil conditions and groundwater levels on this site to be used by others for property-purchasing and development considerations. Additional borings, laboratory tests, and engineering analyses may be required to obtain the necessary data for the preparation of the final soil study and to provide the information to be used by others for the design of building foundations, floor slab on-grade, and parking pavement.

The samples collected that were not used to perform the laboratory tests will be kept in our laboratory for 30 days unless you advise us otherwise. If you have any questions or if we can help you in any way on this project or future work, please call us.

Sincerely, BOWSER-MORNER, INC.

Daniel M. Otieno Geotechnical Engineer

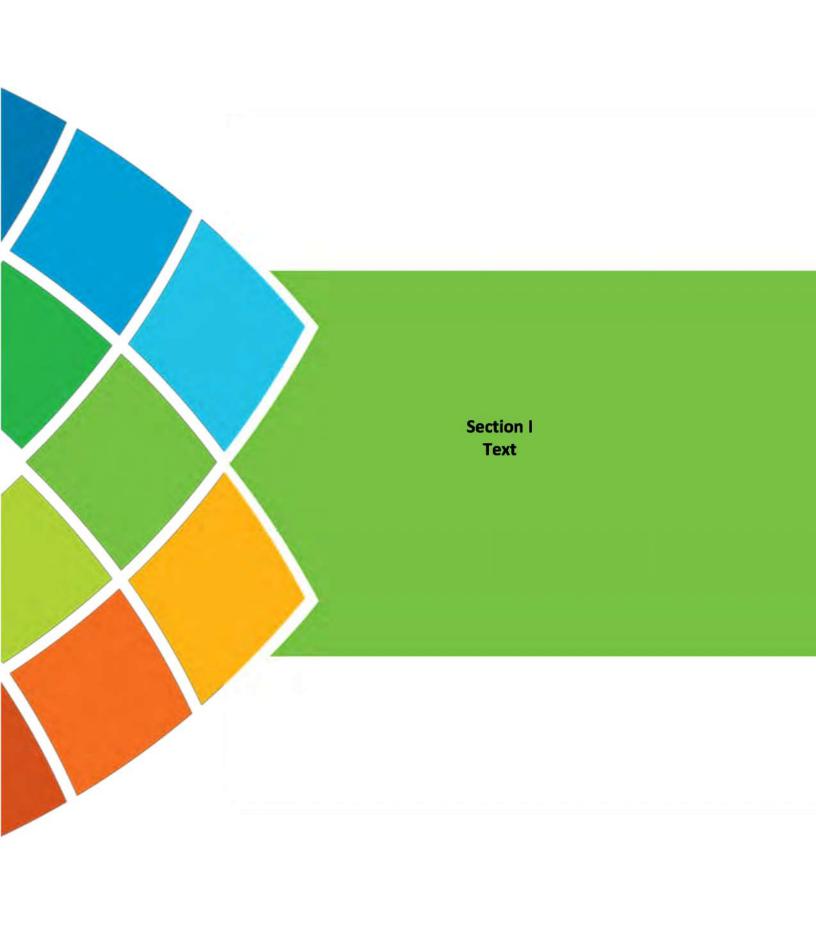
Chris R. Ryan, M.S.C.E., P.E. Sr. Geotechnical Engineer

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# 1.0 INTRODUCTION

A site on the northeast corner of the intersection of Wildcat Road and Taylorsville Road in Huber Heights, Ohio will be developed. A vicinity map (Figure 1) is included in Section III of this report. The design plan for the site has yet to be developed. This soil study was intended to obtain preliminary subgrade soil conditions and groundwater levels to be used by others for property-purchasing and development considerations. Our findings on the preliminary soil conditions and groundwater levels with respect to the potential construction problems, and recommendations for the allowable bearing capacity at each boring location are given in this report.

When the final development plan is available, Bowser-Morner should have an opportunity to review the plan. Additional borings, laboratory tests, and engineering analyses may be needed to obtain the necessary data for the design of the building foundations and floor slabs.

Authorization to proceed with this soil study was given by City of Huber Heights in Purchase Order No. RG230570 dated January 31, 2023. The work was to proceed in accordance with our proposal and agreement, Quotation No. 23-2771-009 dated January 31, 2023.

The draft soil boring logs and preliminary foundation recommendations were emailed to Mr. Russ Bergman of City of Huber Heights on February 16, 2023.

# 2.0 WORK PERFORMED

## 2.1 Field Work

Six soil borings were made at the locations shown on the boring location plan, Figure 2 in Section III. The boring logs and boring location plan are included in Section III. The borings were made with a track-mounted ATV boring rig using hollow-stem augers and standard penetration resistance methods. The standard penetration tests were performed in accordance with ASTM D1586, which includes a 140-pound hammer, 30-inch drops, and two-inch-O.D. split-spoon samplers driven at maximum depth intervals of five feet or at major changes in stratum, whichever occurred first. The disturbed split-spoon samples were visually classified, logged, sealed in moisture-proof jars, and taken to the Bowser-Morner, Inc. laboratory for study. The depths where these "SS"-type split-spoon samples were collected are noted on the corresponding boring logs.

## 2.2 Laboratory Work

One Atterberg limits test was performed in accordance with ASTM D4318 to determine the liquid and plastic limits on the most visibly plastic cohesive soil or as needed for soil classification. In addition, 19 moisture content determinations were made in accordance with ASTM D2216. The moisture contents ranged from 8.8% to 12.5% for the brown silty clay, from 11.1% to 11.5% for the brown sandy clay, and from 9.6% to 12.5% for the gray silty clay. The moisture content for the gray silt was 16.6%. The results of the laboratory tests are summarized in Table 2-1 and included in Section III of this report.



Table 2-1. Summary of Laboratory Test Results

	Moisture				Att	erberg Lim	nits
Boring No.	Depth (ft.)	Content (%)	LL	PL	PI		
1	1.0 - 2.5	8.8					
	3.5 - 5.0	10.0					
	6.0 - 7.5	11.9	23	14	9		
	8.5 - 10.0	12.5					
2	6.0 - 7.5	11.1					
	8.5 - 10.0	10.0					
	13.5 – 15.0	9.8					
3	1.0 – 2.5	11.1					
	6.0 – 7.5	16.6					
	13.5 - 15.0	11.6					
4	3.5 - 5.0	11.1					
	6.0 - 7.5	11.5					
	13.5 - 15.0	10.0					
5	3.5 - 5.0	9.6					
	8.5 - 10.0	12.5					
	18.5 - 20.0	12.2					
6	1.0 – 2.5	9.9					
	3.5 - 5.0	10.5					
	6.0 - 7.5	9.5					

# 3.0 SOIL AND GROUNDWATER CONDITIONS

Based on the information from the six borings made for this study, the subgrade soil conditions are described in descending order below:

- In Borings 1, 2, 4, and 6, two to four inches of topsoil.
- In Borings 1 and 6 and below the topsoil, and in Boring 2, approximately five to 12.5 feet of stiffto-very-stiff brown silty clay with varying amounts of sand.
- In Borings 2 and 4 and below the topsoil, approximately 7.5 to 12.5 feet of stiff-to-very-stiff brown sandy clay.
- In Boring 3 and below the brown silty clay layer, 2.5 feet of very stiff gray silt.
- In Boring 1 and below the brown silty clay layer, and in Boring 3 and below the gray silt layer, more than two to five feet of medium-dense-to-dense gray silty sand. The gray silty sand extended to the bottom of Boring 1 at a depth of 15 feet.
- In Borings 2 and 4 and below the brown sandy clay layer, in Boring 3 and below the gray silty sand layer, in Boring 5, and in Boring 6 and below the brown silty clay layer, more than 2 to 13 feet of stiff-to-hard, gray silty clay. The gray silty clay extended to the bottoms of Borings 2, 3, 4, and 6 at a depth of 15 feet.



- In Boring 5 and below the gray silty clay layer, 1.5 feet of loose gray silty sand.
- In Boring 5 and below the gray silty sand layer, medium stiff gray silty clay extending to the bottom
  of this boring at a depth of 15 feet.

Free groundwater was encountered during the advancement of the borings at the depths and elevations summarized in Table 3-1.

**Depth Groundwater First Groundwater Observations at Boring** Observed (ft) **Completion of Boring** No. Depth Elevation Depth Elevation 1 856.7 No Water 12.0 2 No Water 11.0 855.7 3 No Water 9.0 849.2 4 No Water No Water 5 13.5 12.0 844.1 845.6 6 No Water No Water

Table 3-1. Summary of Groundwater Observations

Free groundwater is defined as water that seeps into an open borehole before it is backfilled. Groundwater observations were made during the boring operations by noting the depth of water on the boring tools and in the open boreholes following withdrawal of the boring augers. However, it should be noted that short-term water level readings are not necessarily a reliable indication of the groundwater level and that significant fluctuations may occur due to variations in rainfall and other factors. For specific questions on the soil conditions, please refer to the individual boring logs in Section III.

# 4.0 DISCUSSION AND RECOMMENDATIONS

# 4.1 Project Description

We understand that the property on the northeast corner of the intersection of Wildcat Road and Taylorsville Road in Huber Heights, Ohio will be developed. We understand that a new Public Works Facility may be constructed on this site. The proposed development site is approximately 8 acres. The design layout of the proposed building(s) and the pavement areas has yet to be prepared. The purpose of this study is to determine the preliminary subgrade soil, depths to bedrock, and groundwater levels at the boring locations to be used by others for property purchasing and development considerations.

After the detailed plan and layout are available, additional borings, laboratory tests, and engineering analysis may be required to obtain the necessary data for the design of buildings and structural foundations and the roadway and parking pavement.

The following recommendations are based on this information. If the above statements are incorrect or changes are made, Bowser-Morner, Inc. should be notified so that the new data can be reviewed and additional recommendations and services can be given if required to meet the needs of your project.



#### 4.2 Foundation Recommendations

Based on the subgrade soil conditions indicated in Borings 1 through 6 made at this site, the site is covered with topsoil and/or weak soil that extends to the approximate depths outlined in Table 4-1. Bedrock was not encountered in these borings within depths of 15 to 20 feet. Based on the results of the standard penetration tests (SPT) in the borings, the recommended net allowable bearing capacities and the depths to bearing strata at each boring are also tabulated in Table 4-1.

		Table 4-1	. Depth	s to Bott	oms of Unr	eliable So	oils
0.000	Halai	March March 1990	50000	600000 0000	N-41	500 BE000	10.70

Boring No.	Depth to Bottom of Unreliable Soil (ft)	Elevation* at Bottom of Unreliable Soil (ft)	Topsoil, Fill, and/or Weak Soil	Net Allowable Bearing Capacity (psf)
1	0.2	868.5	Topsoil	3,500
	3.5	865.2	Topsoil and Weak Soil	4,000
2	0.3	866.4	Topsoil	3,500
	8.0	858.7	Topsoil and Weak Soil	4,000
3	1.0	857.2	Weak Soil	2,000
	3.5	854.7	Weak Soil	3,000
	13.0	845.2	Weak Soil	4,000
4	0.2	873.8	Topsoil	3,500
	8.5	865.5	Topsoil and Weak Soil	4,000
5	1.0	856.6	Weak Soil	3,000**
6	0.3	870.7	Topsoil	2,500
	13.5	857.5	Topsoil and Weak Soil	3,500

<sup>\*</sup>In reference to surface elevation based on Ohio South State Plane Coordinate System.

The topsoil is unreliable to support any building foundations and floor slab on-grade. Within the construction limits for any building and/or pavement areas, the topsoil and any fill encountered should be removed and wasted. The topsoil can be stockpiled for landscaping purposes. The weaker soil can be removed to the suitable depths with the desired allowable bearing capacities as outlined in Table 4-1 and replaced with compacted backfill.

The bottoms of the foundation excavations should extend to the suitable depths with the desired allowable bearing capacities as outlined in Table 4-1. After the foundation excavations extend to the suitable depths, the over-excavation can be filled with compacted backfill. The bottoms of exterior footing foundations for heated structures should be placed at least 32 inches below the final adjacent grades to protect against frost penetration and heaving. Interior footings not subject to frost action may bear at a minimum depth of 18 inches below the floor slab if they are supported on original materials or compacted fill placed in accordance with our recommendations. The bottoms of exterior footing foundations for non-heated structures should be placed at least 36 inches below the final adjacent grades to protect against frost penetration and heaving.



<sup>\*\*</sup>Bearing capacity applies only to foundations placed within a depth of five feet below existing grade. The recommended allowable bearing capacity will have to be reduced to 2,000 psf with foundations to be placed below the depth, because weaker soil layers were encountered at a depth of 14.5 feet below the existing grade.

The base of each excavation should extend one lateral foot for every foot of excavation below the bottom of the footing foundation as shown in Figure 3 in Section III. If an excavation will extend more than five feet below the existing grade, a maximum allowable side slope of 1 (horizontal) to 1 (vertical) should be maintained in any excavation for stability and for the safety of the workers.

After the foundation excavations extend to the desired grade, the top foot at the bottom of each excavation should be compacted to at least 90% of the maximum dry-unit weight as determined by the modified Proctor test (ASTM D1557) before any new fill or foundation is placed. Any soft soil pockets should be undercut and replaced with newly compacted fill. Any lean clay soils to be imported as backfill or removed from the project site probably will have significantly different Proctor values. Consequently, samples to be tested by the Proctor method should be obtained from a representative area and from the same elevation as the design subgrade.

After the bottoms of the excavations have been compacted, structural fill can be placed to bring the bottoms of the excavations to reach the desired final grade. The fill placed below the bottom of the footing foundations should be placed in eight-inch-thick lifts and compacted to at least 95% of the maximum dry-unit weight as determined by the modified Proctor test (ASTM D1557). Fill placed above the bottom of the footing foundations to serve as the subgrade for the floor slab should be compacted to at least 90% of the maximum dry-unit weight as determined by the modified Proctor test (ASTM D1557). Structural fill should be placed in accordance with the recommendations given in Section 4.4.

The soil removed from this site that is free of organic or objectionable materials as defined by a field technician who is qualified in soil material identification and compaction procedures can be reused as fill. Objectionable or undesirable soils are defined as those materials that cannot meet design placement specifications or materials that will deteriorate with time.

When determining the geometric size (the "footprint") of the footing foundation, the total system loads applied to the tops of the foundations should be considered in the bearing pressure calculations.

The bearing capacities recommended in Table 4-1 for foundations supported on structural fill applies to well-graded granular soils, low-to-medium plastic clays, clayey sands, and some silty sands that are placed and compacted in accordance with the recommendations given in this report. However, uniformly graded or gap-graded granular soils (GP or SP), silts (ML), silty fine sands (SM), and high plasticity clays (CH) will be difficult to place and compact, and may result in a reduced bearing capacity. If these soils will be used as backfill, Bowser-Morner should be notified before the soils are placed so that the proposed placement methods and bearing capacity recommendations can be reviewed.

The bearing capacity of a soil is not a unique physical property of the soil. Instead, it depends explicitly on several factors including the footing type, size, and shape; the depth of embedment; the eccentricity and inclination of the applied load; the footing base inclination; the stiffness of the footing; the proximity of the footing to open cuts or slopes; the relative distance between the bottom of the footing and the water table; and the allowable amounts of settlement. The recommended allowable bearing capacity is based on the foundation design parameters given above and the assumptions that the applied load is vertical with no eccentricity, the base is horizontal and level, the footing is rigid, the footing is not close to an open cut or slope, and the water table is below the bottom of footing. If the actual conditions vary from the parameters and assumptions stated above, Bowser-Morner should be notified so that the new information can be



reviewed and additional recommendations and services can be given to meet the needs of your project.

Foundations supported on soil settle as the result of externally applied loads. While the foundations should be expected to settle, the amount of settlement should be within the tolerable limits for the structure.

Alternatively, the weak soil can remain in-place. The weak subgrade soil can be modified by installing Geopiers® for the construction of any buildings. The Geopier® method is a patented method that includes the placement and the compaction of sand and gravel in pre-augered holes. With this method, the sand and gravel fill will be compacted in lifts using a drop hammer. The Geopiers® will be constructed in a pre-set pattern.

The structures can simply be supported on spread-footing foundations over the Geopier®-improved subgrade soil. Any floor slabs on-grade also can be supported over the Geopier®-improved subgrade soil. The spacing for the Geopiers® to be installed beneath the floor slabs ongrade will be much wider than the support for the foundations. If the Geopier® method is selected, the Geopier® Foundation Company, Inc. will perform the design of the Geopier® system including the spacing of the piers and the allowable bearing capacity on top of the Geopiers®.

The footing foundations supported on the Geopier®-improved subgrade can be designed with the allowable bearing capacity specified by the Geopier® Foundation Company, Inc. Based on our experiences with other projects, the allowable bearing capacities are about 4,000 to 6,000 pounds per square foot (psf) with Geopier® modified subgrade soil for these type of projects.

In general, for the selection or the installation of any type of aggregate piers, the compaction performed with a hammer should provide vertical impact to the granular fill. Each lift of aggregate should be less than 12 inches thick and should be placed starting from the bottom of the hole.

If stone-column methods other than the Geopier® method are selected, the compaction of the stone columns should be verified with a dynamic cone-penetration test through the aggregate piers. The "N" values can be obtained continuously through the full length of the aggregate piers. After the tests are completed and the aggregate is still loose, the piers should be recompacted using the installer's equipment. Based on our experience with other projects, a top-feed method of placing the granular material with a vibration device in the open hole cannot achieve the required compaction. The top-feed method with a vibration device is not acceptable and cannot be considered as equal to the Geopiers®.

The Geopier® Foundation Company, Inc. will design the Geopiers® including the length, diameter, and spacing of the piers and the allowable bearing capacities of the improved subgrade soil or with foundations supported directly on top of the piers. If the Geopier® subgrade-improvement method with a displacement mandrel will be used, temporary steel casings will not be needed to extend through the existing fill and weak soil to keep the shafts from caving in. If the Geopier® subgrade-improvement method will be considered, we can contact and provide our study to Geopier® Foundation Company, Inc. on behalf of the client to obtain a preliminary cost estimate for this project.



#### 4.2.1 General Recommendations

When determining the geometric size (the "footprint") of the footing foundation, the total building system loads applied to the tops of the foundations should be considered in the bearing pressure calculations.

The bearing capacity recommended above for foundations supported on structural fill applies to well-graded granular soils, low-to-medium plastic clays, clayey sands, and some silty sands that are placed and compacted in accordance with the recommendations given in this report. However, uniformly graded or gap-graded granular soils (GP or SP), silts (ML), silty fine sands (SM), and high plasticity clays (CH) will be difficult to place and compact, and may result in a reduced bearing capacity. If these soils will be used as backfill, Bowser-Morner, Inc. should be notified before the soils are placed so that the proposed placement methods and bearing capacity recommendations can be reviewed.

The bearing capacity of a soil is not a unique physical property of the soil. Instead, it depends explicitly on several factors including the footing type, size, and shape; the depth of embedment; the eccentricity and inclination of the applied load; the footing base inclination; the stiffness of the footing; the proximity of the footing to open cuts or slopes; the relative distance between the bottom of the footing and the water table; and the allowable amounts of settlement. The recommended allowable bearing capacity is based on the foundation design parameters given above and the assumptions that the applied load is vertical with no eccentricity, the base is horizontal and level, the footing is rigid, the footing is not close to an open cut or slope, and the water table is below the bottom of footing. If the actual conditions vary from the parameters and assumptions stated above, Bowser-Morner, Inc. should be notified so that the new information can be reviewed and additional recommendations and services can be given to meet the needs of your project.

The bottoms of exterior footing foundations should be placed at least 32 inches below the final adjacent grades to protect against frost penetration and heaving. Interior footings not subject to frost action may bear at a minimum depth of 18 inches below the floor slab if they are supported on original materials or compacted fill placed in accordance with our recommendations.

Foundations supported on soil settle as the result of externally applied loads. While the building foundations should be expected to settle, the amount of settlement should be within the tolerable limits for the structure.

# 4.2.2 Site Classification For Seismic Design

Based on the results of the standard penetration tests (SPT) in the borings made for this study, the average "N" values range from 11 to 21 blows per foot for the soil layer within 15 to 20 feet of the existing grade. Based on the results of the average "N" value, it is our opinion that the site will be classified as a "D" type in accordance with the *Ohio Building Code*.



#### 4.3 Considerations for Slabs On-Grade

Based on information from the borings performed, the proposed development site area is covered by a layer of topsoil and/or weak soil that extends to the depths outlined in Table 4-1.

The topsoil is also not reliable to support the floor slab due to the potential for settlement. The bottoms of the floor slab on-grade excavations should extend to the suitable depths with the desired allowable bearing capacities as outlined in Table 4-1. The building floor slab on-grade either can be constructed over the newly compacted backfill or over the Geopier\*-improved subgrade soil. The upper one foot of compacted fill should be a well-graded, granular material such as crushed sand and gravel or crushed stone. To help distribute concentrated loads and equalize moisture conditions under the slab, this granular material should contain less than 5% of fines or particles that can pass through a No. 200 sieve.

Topsoil, fill, and/or other deleterious materials encountered during the site preparation must be removed and replaced with select engineered fill that is compacted to the specifications outlined in Section 4.4 of this report.

We recommend that slabs on-grade "float" by being fully supported on the ground and not structurally connected to walls or foundations. Floating will minimize the possibility of cracking and displacement of the slabs on-grade as a result of differential movements between the slab and the foundations. Although the movements should be within the tolerable limits for structural safety, such movements could be detrimental to the slabs if they were rigidly connected to the foundations.

# 4.4 Compaction Requirements

Structural fill placed below the foundation bearing elevation should be compacted to at least 95% of the maximum dry unit weight with moisture contents within 2% of the optimum moisture content as determined by the modified Proctor test (ASTM D1557). Fill placed above the bottoms of the foundations or under pavement areas should be compacted to at least 90% of the maximum dry unit weight with moisture contents within 2% of the optimum moisture content as determined by the modified Proctor test (ASTM D1557). The compaction should be accomplished by placing the fill in successive, horizontal, approximately six- to eight-inch-thick loose lifts and mechanically compacting each lift to at least the specified minimum dry density. Field density tests should be performed at a minimum rate of one per 2,500 square feet of fill area and for each lift to verify that adequate compaction is achieved. Backfill for utility trenches, foundation excavations, etc., within structures or paved areas, is considered structural fill and should be placed in accordance with these recommendations.

It must be emphasized that the excavation and compaction of soil fill are highly influenced by weather conditions. Performing the earthwork under wet and frozen conditions is generally very difficult. As a result, compaction of wet silty and clayey soil should be avoided during wet and frozen conditions because the wet soil cannot be compacted to the required unit weight without drying or other soil stabilization methods. Alternatively, granular soil can be used as backfill to facilitate the backfill and compaction work during winter and wet weather conditions.

Puddling or jetting of the backfill material, including the utility trenches, should not be allowed as a compaction method. Silty or clayey soils encountered above foundation depth will often soften, and the bearing capacity may be reduced if water ponds in the excavation.



Lean concrete that is placed below the bottom of foundation should have a minimum 28-day compressive strength of 2,000 pounds per square inch (psi).

#### 4.5 Foundation Excavations

During the foundation excavations, the subsurface conditions should be verified. Changes in subsurface conditions other than what are shown on the boring logs warrant additional subsurface investigation before the foundations are constructed.

The foundation excavations should be observed to ensure that the loose, soft, or otherwise undesirable materials are removed and that the foundations will be supported directly on an acceptable surface. At the time of this observation, it may be necessary to use a hand penetration device in the base of the foundation excavation to ensure that the soils immediately below the foundation base are satisfactorily prepared to support the foundations. Please note that such shallow observations do not replace an adequate deep-boring program and structural fill compaction QA/QC records. The overall performance of the foundations is governed by the soils below the bottom of the footing foundation.

If pockets of soft, loose, or otherwise unsuitable materials are encountered in the footing excavations and it is inconvenient to lower the footings, the proposed footing elevations may be reestablished by backfilling after the undesirable materials have been removed. The excavation under each footing should extend to suitable soils, and the base of the excavation should extend one lateral foot for every foot of excavation below the bottom of the footing foundation as shown in Figure 3 in Section III. The entire excavation should then be refilled with well-compacted, engineered fill. Special care should be taken to remove the sloughed, loose, or soft materials near the base of the excavation slopes. Extra care should also be taken to tie-in the compacted fill with the excavation slopes, with benches as necessary, to ensure that no pockets of loose or soft materials are left along the excavation slopes below the foundation bearing level. The contractor should maintain temporary cut slopes in accordance with the current OSHA regulations governing trenching and slope stability.

Soils exposed at the bases of satisfactory foundation excavations should be protected against any detrimental change in condition such as from construction disturbances, rain, and freezing. Surface runoff should be drained away from the excavation and not allowed to pond. If possible, foundation concrete should be placed the same day the excavation is made. If this is not practical, the foundation excavations should be adequately protected. Also, for this reason, proper drainage should be maintained after construction. It must be emphasized that all excavations must conform to all state, federal, and local regulations relative to slope geometry.

#### 4.6 Construction Dewatering

Groundwater was encountered at depths of 9.0 and 13.5 feet in all but Borings 4 and 6 during the boring operations. Any groundwater or surface water that accumulates in the excavations should be lowered by sumps and pumps during the excavations for the construction of the proposed structures. The groundwater will have to be lowered to the bottoms of the excavations and to the top of the clay layer, and to three feet below the bottom of the excavation in the granular soil layer.



For the installation of GeoPiers\*, any groundwater seepage encountered should be considered. If groundwater is encountered, casings may be needed to keep the shafts from caving in the open holes.

The amount and type of dewatering required during construction will depend on the weather and groundwater levels at the time of construction, and the effectiveness of the contractor's techniques in preventing surface runoff from entering open excavations. Typically, groundwater levels are highest during winter and spring, and lower in summer and early fall.

#### 4.7 Drainage

Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation soils during and after construction. The exterior grade including all pavements or parking areas should be sloped away from the new building foundations to keep water from ponding. All permanent foundation, wall, and below-grade floor drains should provide positive discharge away from the building.

## 5.0 CLOSURE

#### 5.1 Basis Of Recommendations

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions. Data used during this exploration included, but were not necessarily limited to:

- Six exploratory borings performed during this study.
- Observations of the project site by our staff.
- The results of the laboratory soil tests.
- The site plan provided by City of Huber Heights.
- Communications with Mr. Russ Bergman and Ms. Hanane Eisentraut of City of Huber Heights.
- Published soil or geologic data of this area.

In the event that changes in the project characteristics are planned, or if additional information or differences from the conditions anticipated in this report become apparent, Bowser-Morner, Inc. should be notified so that the conclusions and recommendations contained in this report can be reviewed and, if necessary, modified or verified in writing.

#### 5.2 Limitations And Additional Services

The preliminary subsurface conditions discussed in this report and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.



Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by designers, or that the construction process has altered the soil conditions. As variations in the soil profile are encountered, additional subsurface sampling and testing may be necessary to provide data required to reevaluate the recommendations of this report. Consequently, after submission of this report, it is recommended that Bowser-Morner, Inc. be authorized to perform additional services to work with the designer(s) to minimize errors and omissions regarding the interpretation and implementation of this report.

Before construction begins, we recommend that Bowser-Morner, Inc.:

- Perform additional borings, laboratory tests, and prepare the final soil study report to be used by others for the design of the building foundations, floor slab, and pavement in this development site.
- Work with the designers to implement the recommended geotechnical design parameters into plans and specifications.
- Consult with the design team regarding interpretation of this report.
- Establish criteria for the construction observation and testing for the soil conditions encountered at this site.
- Review final plans and specifications pertaining to geotechnical aspects of design.

During construction, we recommend that Bowser-Morner, Inc.:

- Observe the construction, particularly the site preparation, fill placement, and foundation excavation or installation.
- Perform in-place density testing of all compacted fill.
- Perform materials testing of soil and other materials as required.
- Consult with the design team to make design changes in the event that differing subsurface conditions are encountered.

If Bowser-Morner, Inc. is not retained for these services, we shall assume no responsibility for construction compliance with the design concepts, specifications or recommendations.

#### 5.3 Warranty

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, express or implied, is made.

The scope of this study did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, within or beyond the site studied. Any statements in the report or on the boring logs regarding odors, staining of soils or other unusual items or conditions observed are strictly for the information of our client.

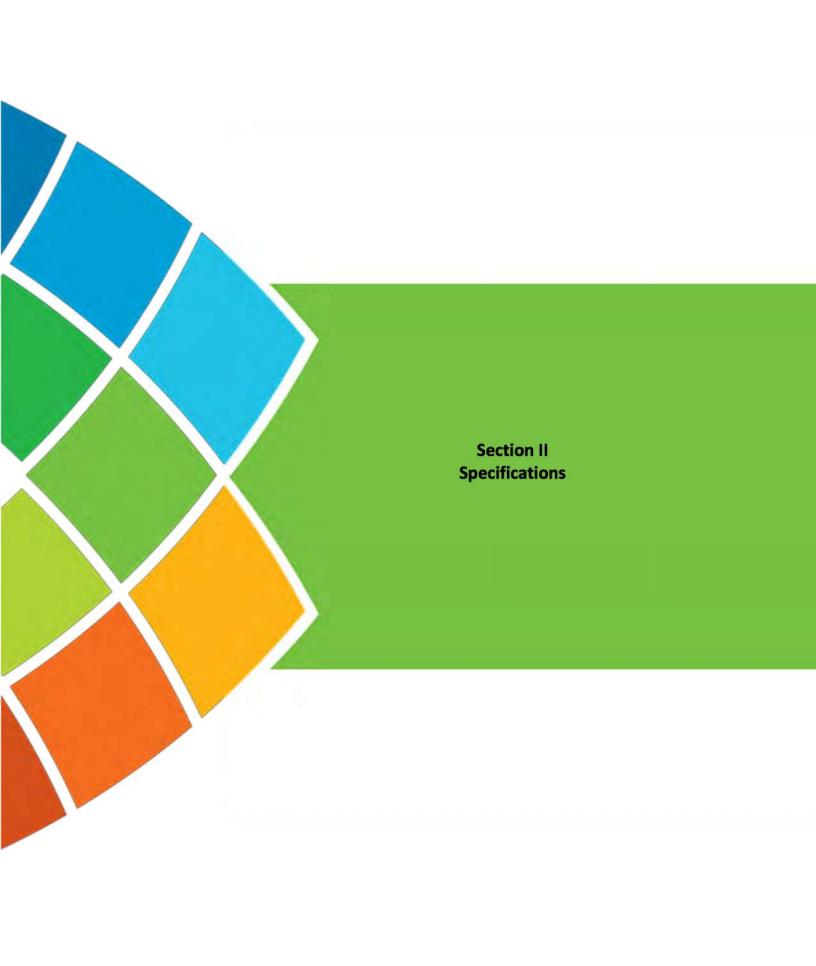
To evaluate the site for possible environmental liabilities, we recommend an environmental assessment, consisting of a detailed site reconnaissance, a record review, and report of findings.



Additional subsurface drilling and sampling, including groundwater sampling, may be required. Bowser-Morner, Inc. can provide this service and would be pleased to provide a cost proposal to perform such a study, if requested.

This report has been prepared for the exclusive use of City of Huber Heights for specific application to the development site on Wildcat Road in Huber Heights, Ohio (see Figure 1 in Section III of this report). Specific design and construction recommendations have been provided in the various sections of the report. The report shall therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. Bowser-Morner, Inc. is not responsible for the independent conclusions, opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.





# **CLEARING AND GRADING SPECIFICATIONS**

# I. GENERAL CONDITIONS

The contractor shall furnish all labor, materials, and equipment, and perform all work and services necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction and grading as shown on the plans and as described therein.

This work shall consist of all clearing and grading, removal of existing structures unless otherwise stated, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the lines, grades, slopes, and specifications.

This work is to be accomplished under the constant and continuous supervision of the Owner or his designated representative.

In these specifications the terms "approved" and "as directed" shall refer to directions to the Contractor from the Owner or his designated representative.

# II. SUBSURFACE CONDITIONS

Prior to bidding the work, the Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work. Borings and/or soil investigations shall have been made. Results of these borings and studies will be made available by the Owner to the Contractor upon his request, but the Owner is not responsible for any interpretations or conclusions with respect thereto made by the Contractor on the basis of such information, and the Owner further has no responsibility for the accuracy of the borings and the soil investigations.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the Owner can investigate the condition.

#### III. SITE PREPARATION

Within the specified areas, all trees, brush, stumps, logs, tree roots, and structures scheduled for demolition shall be removed and disposed of.

All cut and fill areas shall be properly stripped. Topsoil will be removed to its full depth and stockpiled for use in finish grading. Any rubbish, organic and other objectionable soils, and other deleterious material, shall be disposed of off the site, or as directed by the Owner or his designated representative if on site disposal is provided. In no case shall such objectionable material be allowed in or under the fill unless specifically authorized in writing.

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Prior to the addition of fill, the original ground shall be compacted to job specifications as outlined below. Special notice shall be given to the proposed fill area at this time. If wet spots, spongy conditions, or ground water seepage is found, corrective measures must be taken before the placement of fill.

# IV. FORMATION OF FILL AREAS

Fills shall be formed of satisfactory materials placed in successive horizontal layers of not more than eight (8) inches in loose depth for the full width of the cross section. The depth of lift may be increased if the Contractor can demonstrate the ability to compact a larger lift. If compaction is accomplished using hand-tamping equipment, lifts will be limited to 4-inch lose lifts.

All material entering the fill shall be free of organic matter such as leaves, grass, roots, and other objectionable material.

The operations on earth work shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions. The Contractor shall keep the work areas graded to provide the drainage at all times.

The fill material shall be of the proper moisture content before compaction efforts are started. Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. The moisture content of the fill material should be no more than two (2) percentage points higher or lower than optimum unless otherwise authorized. Sprinkling shall be done with equipment that will satisfactorily distribute the water over the disced area.

Compaction operations shall be continued until the fill is compacted to not less than 90% above foundation elevation and 95% below foundation elevation, of the maximum density as determined in accordance with the latest ASTM D-1557 (Modified). Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

In the construction of filled areas, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, additional layers shall be constructed in horizontal planes. If directed, original slopes shall be continuously, vertically benched to provide horizontal fill planes. The size of the benches shall be formed so that the base of the bench is horizontal and the back of the bench is vertical. As many benches as are necessary to bring the site to final grade shall be constructed. Filling operations shall begin on the lowest bench, with the fill being placed in horizontal eight (8) inch loose lifts unless otherwise authorized. The filling shall progress in this manner until the entire first bench has been filled, before any fill is placed on the succeeding benches. Proper

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drainage shall be maintained at all times during benching and filling of the benches, to insure that all water is drained away from the fill area.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the areas. Stones or fragmentary rock larger than four (4) inches in their greatest dimensions will not be allowed in the fill unless specifically authorized in writing. Rock fill shall be brought up in layers as specified or as directed, and every effort shall be exerted to fill the voids with the finer material to form a dense, compact mass. Rock or boulders shall be disposed of as deleterious material per Item III.

Frozen material shall not be placed in the fill nor shall the fill be placed upon frozen material.

The Contractor shall be responsible for the stability of all fills made under the contract, and shall replace any portion, which in the opinion of the Owner or his designated representative, has become displaced due to carelessness or negligence on the part of the Contractor. Fill damaged by inclement weather shall be repaired at the Contractor's expense.

# V. <u>SLOPE RATIO AND STORM WATER RUN-OFF</u>

Slopes shall not be greater than 2 (horizontal) to 1 (vertical) in both cut and fill, and storm water shall not be drained over the slopes.

#### VI. GRADING

The Contractor shall furnish, operate, and maintain such equipment as is necessary to construct uniform layers, and control smoothness of grade for maximum compaction and drainage.

#### VII. COMPACTING

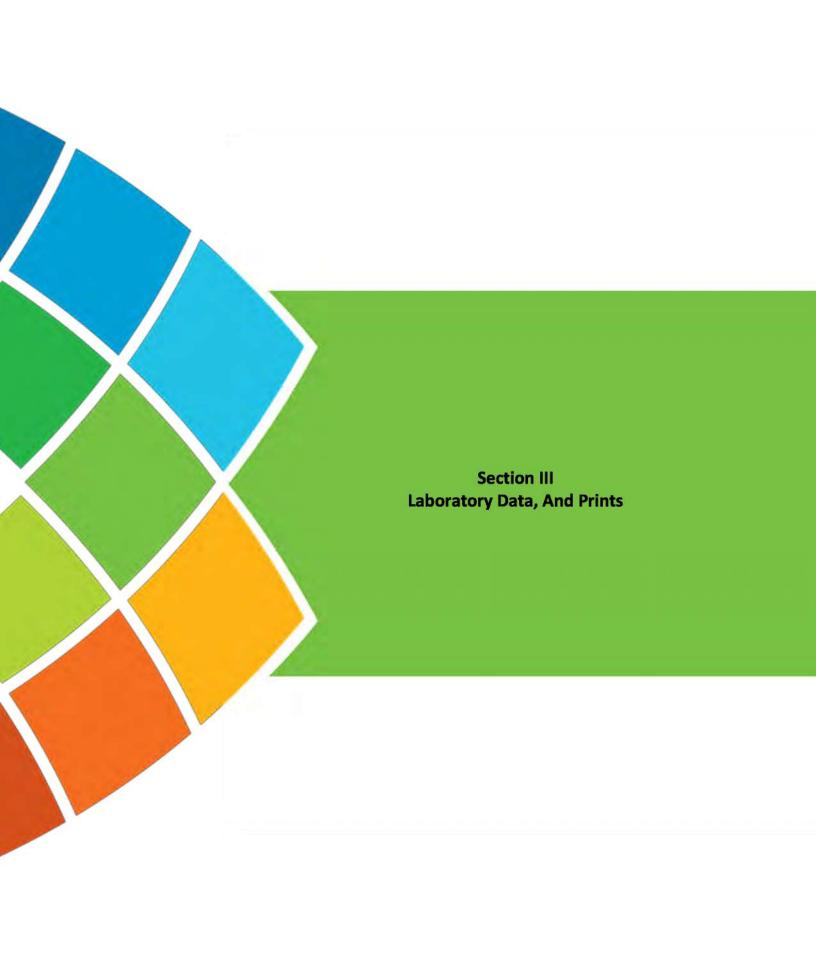
The compaction equipment shall be approved equipment of such design, weight, and quantity to obtain the required density in accordance with these specifications.

#### VIII. TESTING AND INSPECTION SERVICES

Testing and inspection services will be provided by the Owner.

#### IX. SPECIAL CONDITIONS

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#### BORING LOG TERMINOLOGY

# Stratum Depth:

Distance in feet and/or inches below ground surface.

#### **Stratum Elevation:**

Elevation in feet below ground surface elevation.

# **Description of Materials:**

Major types of soil material existing at boring location. Soil classification based on one of the following systems: Unified Soil Classification System., Ohio State Highway Classification System, Highway Research Board Classification System, Federal Aviation Authority Classification System, Visual Classification.

# Sample No.:

Sample numbers are designated consecutively, increasing with depth for each boring.

# Sample Type:

"A" Split spoon, 2" O.D., 1-3/8" I.D., 18" in length.

"B" Rock Core

"C" Shelby Tube 3" O.D. except where noted

"D" Soil Probe

"E" Auger Cuttings

"F" Sonic

# Sample Depth:

Depth below top of ground at which appropriate sample was taken.

# Blows per 6" on Sampler:

The number of blows required to drive a 2" O.D., 1-3/8" I.D., split spoon sampler, using a 140 pound hammer with a 30-inch free fall, is recorded for 6" drive increments. (Example: 3/8/9).

#### "N" Blows/Ft .:

Standard penetration resistance. This value is based on the total number of blows required for the last 12" of penetration. (Example: 3/8/9: N = 8 + 9 = 17)



#### Water Observations:

Depth of water recorded in test boring is measured from top of ground to top of water level. Initial depth indicates water level during boring, completion depth indicates water level immediately after boring, and depth after "X" number hours indicates water level after letting water rise or fall over a time period. Water observations in pervious soil are considered reliable ground water levels for that date. Water observations in impervious soils can not be considered accurate ground water measurements for that date unless records are made over several days' time. Factors such as weather, soil porosity, etc., will cause the ground water level to fluctuate for both pervious and impervious soils.

#### SOIL DESCRIPTION

#### Color:

When the color of the soil is uniform throughout, the color recorded will be such as brown, gray, or black and may be modified by adjectives such as light and dark. If the soil's predominant color is shaded by a secondary color, the secondary color precedes the primary color, such as: gray-brown, yellow-brown. If two major and distinct colors are swirled throughout the soil, the colors will be modified by the term mottled, such as: mottled brown and gray.

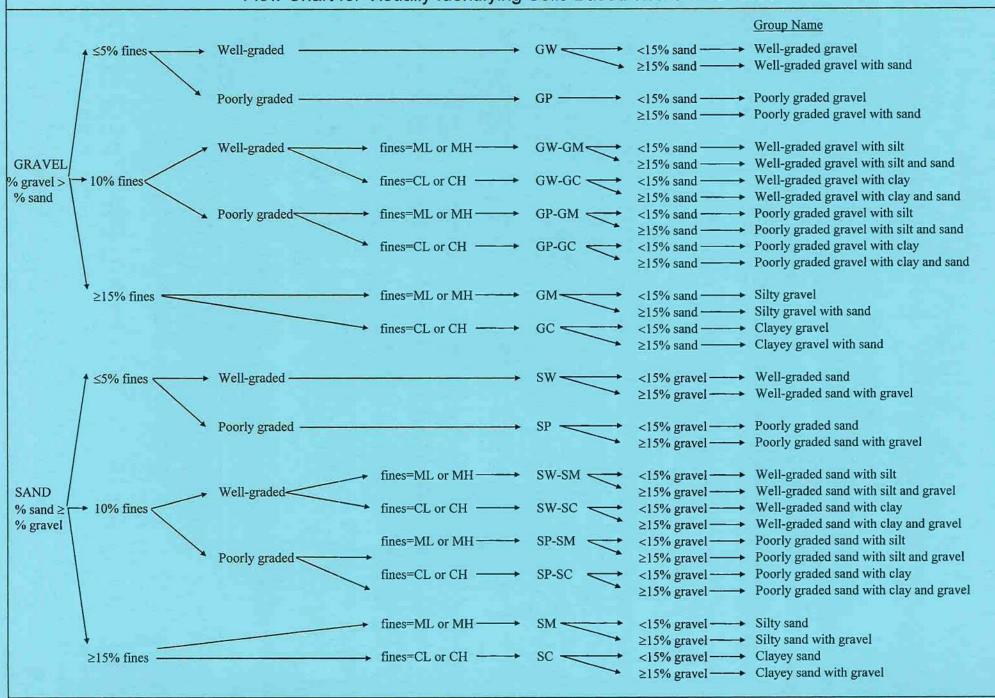
Particle Size		Visual	Soil Components						
Boulde	ers	Larger than 8"	Major Component:	Minor Component Term					
Cobble	es	8" to 3"	Gravel	Trace 1-10%					
Gravel	- Coarse	3" to 3/4"	Sand	Some 11-35%					
	- Fine	2 mm. To 3/4"	Silt	And 36-50%					
Sand	- Coarse	2 mm. – 0.6 mm.	Clay						
		(Pencil lead size)							
	- Medium	0.6 mm. – 0.2mm.	Moist	ure Content					
		Table sugar and salt size)	Term	Relative Moisture					
	- Fine	0.2 mm. – 0.06 mm.	Dry	Powdery					
		(Powdered sugar and	Damp	Moisture content					
		human hair size)	•	below plastic limit					
Silt		0.06 mm. – 0.002 mm.	Moist	Moisture content					
Clay		0.002 and smaller		above plastic limit					
6		(Particle size of both		but below liquid					
		Silt and Clay not visible		limit					
		To naked eye	Wet	Moisture content					
		THE SECOND CO.		Above liquid limit					

	oil Relative to Compactness anular Material	Condition of Soil Relative to Consistency Cohesiv Material							
Very Loose	5 blows/ft. or less	Very Soft	3 blows/ft. or less						
Loose	6 to 10 blows/ft.	Soft	4 to 5 blows/ft.						
Medium Dense	11 to 30 blows/ft.	Medium Stiff	6 to 10 blows/ft.						
Dense	30 to 50 blows/ft.	Stiff	11 to 15 blows/ft.						
Very Dense	51 blows/ft. or more	Very stiff	16 to 30 blows/ft.						
		Hard	31 blows/ft. or more						

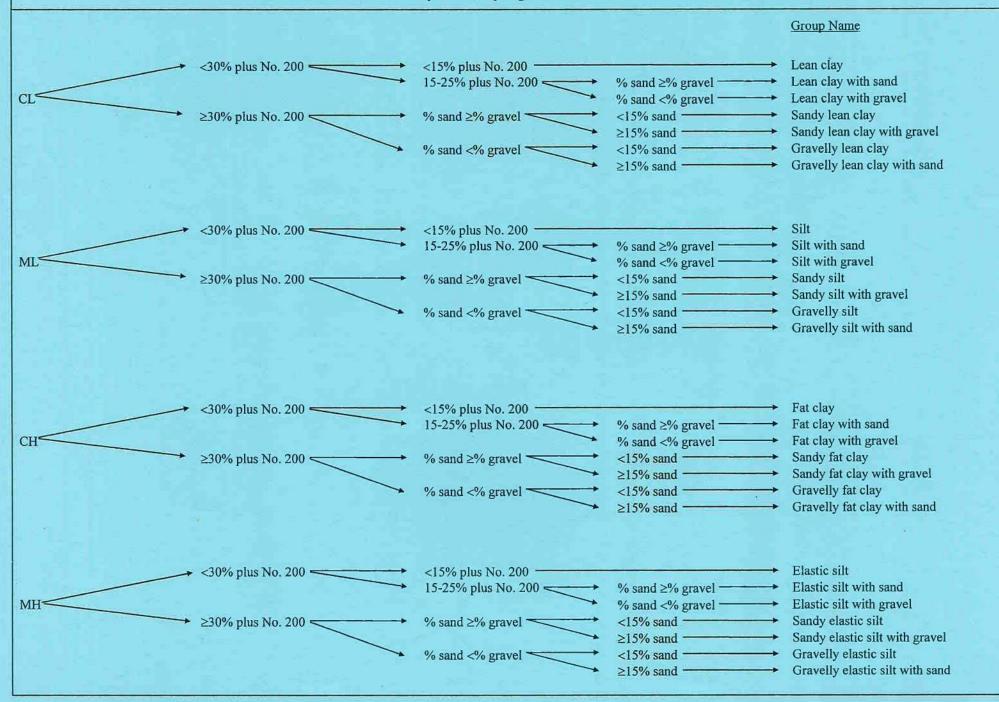


		UNIFIED CL	ASSIFICA	ATION S'	YSTEM
	MAJOR DIVISIONS		GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	000000000000000000000000000000000000000	GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL WITH SAND
	GRAVELLY SOILS	(LITTLE OR NO FINES)		GP	POORLY GRADED GRAVEL POORLY GRADED GRAVEL WITH SAND
COARSE GRAINED	MORE THAN 50% OF COARSE	GRAVELS WITH FINES	1444	GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
SOILS	FRACTION RETAINED ON NO. 4 SIEVE	APPRECIABLE AMT. OF FINES)		GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
MORE THAN 50% OF MATERIAL IS LARGER THAN	SAND AND	CLEAN SAND		sw	WELL-GRADED SAND WELL-GRADED SAND WITH GRAVEL
NO. 200 SIEVE SIZE	SANDY SOILS	(LITTLE OR NO FINES)		SP	POORLY GRADED SAND POORLY GRADED SAND WITH GRAVEL
	MORE THAN 50% OF COARSE FRACTION	SANDS WITH FINES		SM	SILTY SAND SILTY SAND WITH GRAVEL
	PASSING NO. 4 SIEVE	(APPRECIABLE AMT. OF FINES)		sc	CLAYEY SAND CLAYEY SAND WITH GRAVEL
	Lie -			ML	SILT, SILT WITH SAND, SANDY SILT GRAVELLY SILT, GRAVELLY SILT WITH SAND
FINE GRAINED	SILT AND CLAYS	LIQUID LIMIT LESS THAN 50		CL	LEAN CLAY WITH SAND, SANDY LEAN CLAY GRAVELLY LEAN CLAY WITH SAND
SOILS MORE THAN 50% OF MATERIAL IS				OL	ORGANIC CLAY, SANDY ORGANIC CLAY ORGANIC SILT, SANDY ORGANIC SILT WITH GRAVEL
SMALLER THAN NO. 200 SIEVE SIZE				МН	ELASTIC SILT WITH SAND, SANDY ELASTIC SILT GRAVELLY ELASTIC SILT WITH SAND
O/ZE	SILT AND CLAYS	LIQUID LIMIT GREATER THAN 50		СН	FAT CLAY WITH SAND, SANDY FAT CLAY GRAVELLY FAT CLAY WITH SAND
				он	ORGANIC CLAY WITH SAND, SANDY ORGANIC CLAY, ORGANIC SILT, SANDY ORGANIC SILT
	HIGHLY ORG	ANIC SOILS		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
	For classification of fine and fine-grained fraction grained soils.		/	"T.THIE	
	Equation of "A" - line Horizontal at PI=4 to L then PI=0.73 (LL-20)			CH CH	*AT LIME
	Equation of "U" - line Vertical at LL=16 to PI		/	7 OH	
∑ 30 ∑ 30	then PI=0.9 (LL-8)				
PLAST 50	/			MH	OR OH
10	//				
7 4	/////CLIML	ML or	OL		
00	10 16 20	30 40	50 LIQUID LIN		70 80 90 100 110





# Flow Chart for Visually Identifying Soils Based on ASTM D-2488



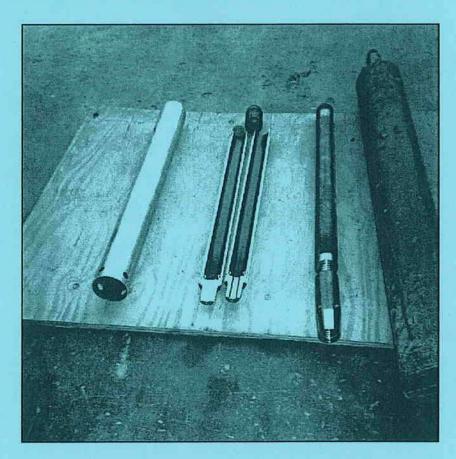
# STANDARD PENETRATION RESISTANCE (ASTM D1586)

The purpose of this test is to determine the relative consistency of the soils in a boring, or from boring over the site. This method consists of making a hole in the ground and driving a 2-inch O.D. split spoon sampler into the soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven 18 inches and the number of blows recorded for each 6 inches of penetration. Values of standard penetration (N) are determined in blows per foot, summarizing the flows required for the last two 6-inche increments of penetration.

Example: 2-6-8; N = 14

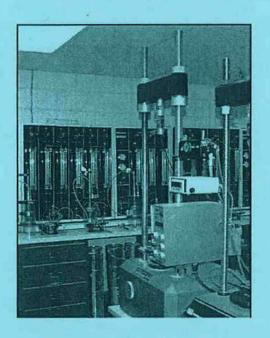
# THIN-WALLED SAMPLER (ASTM D1587)

The purpose of the thin-walled sampler is to recover a relatively undisturbed soil sample for laboratory tests. The sampler is a thin-walled seamless tube with a 3-inch outside diameter, which is hydraulically pressed into the ground, at a constant rate. The ends are then sealed to prevent soil moisture loss, and the tube is returned to the laboratory for tests.



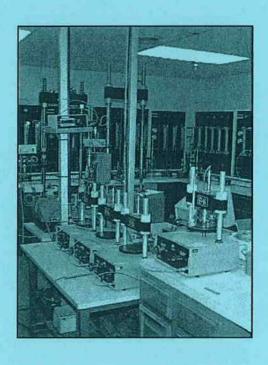


# **UNCONFINED COMPRESSION OR TRIAXIAL TESTS (ASTM D 2166)**



The unconfined compression test and the triaxial tests are performed to determine the shearing strength of the soil, to use in establishing its safe bearing capacity. In order to perform the unconfined compression test, it is necessary that the soil exhibit sufficient cohesion to stand in an unsupported cylinder. These tests are normally performed on samples which are 6.0 inches in height and 2.85 inches in diameter. In the triaxial test, various lateral stresses can be applied to more closely simulate the actual field conditions. There are several different types of triaxial tests. These are, however, normally performed on constant strain apparatus with a deformation rate of 0.05 inches per minute.

# **CONSOLIDATION TEST (ASTM D 2435)**

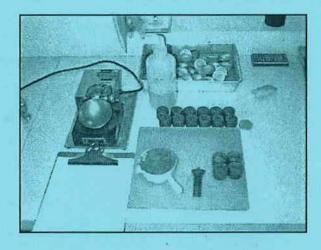


The purpose of this test is to determine the compressibility of the soil. This test is performed on a sample of soil which is 2.5 inches in diameter and 1.0 inch in height, and trimmed from has been relatively "undisturbed" samples. The test is performed with a lever system or an air activated piston for applying load. The loads are applied in increments and allowed to remain on the sample for a period of 24 hours. consolidation of the sample under each individual load is measured and a curve of void ratio vs. Pressure is obtained. From the information obtained in this manner and the column loads of the structure, it is possible to calculate the settlement of each individual building column. This information, together with the shearing strength of the soil, is used to determine the safe bearing capacity for a particular structure.



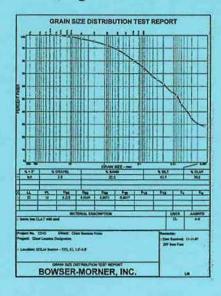
# REVISED TO ASTM D4318 ATTERBERG LIMITS (ASTM D423 AND D424)

These tests determine the liquid and plastic limits of soils having a predominant percentage of fine particle (silt and clay) sizes. The liquid limit of a soil is the moisture content expressed as a percent at which the soil changes from a liquid to a plastic state, and the plastic limit is the moisture content at which the soil changes from a plastic to a semi-solid state. Their difference is defined as the plasticity index (P.I. = L.L. - P.L.), which is the change in moisture content required to change the soil from a "semi-solid" to a liquid. These tests furnish information about the soil properties which is important in determining their relative swelling potential and their classifications.



# MECHANICAL ANALYSIS (ASTM D422)

This test determines the percent of each particle size of a soil. A sieve analysis is conducted on particle sizes greater than a No. 200 sieve (0.074 mm), and a hydrometer test on particles smaller than the No.200 sieve. The gradation curve is drawn through the points of cumulative percent of particle size, and plotted on semi-logarithmic paper for the combined sieve and hydrometer analysis. This test, together with the Atterberg Limits tests, is used to classify a soil.

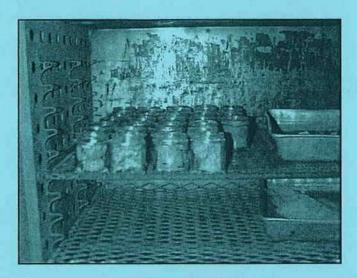






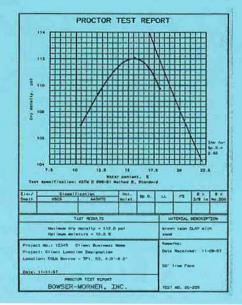
# **NATURAL MOISTURE CONTENT (ASTM D2216)**

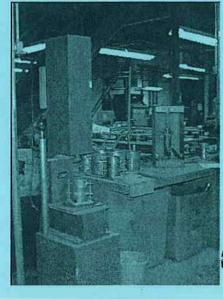
The purpose of this test is to indicate the range of moisture contents present in the soil. A wet sample is weighed, placed in the constant temperature oven at 105° for 24 hours, and re-weighed. The moisture content is the change in weight divided by the dry weight.



# **PROCTOR TESTS**

The purpose of these tests is to determine the maximum density and optimum moisture content of a soil. The Modified Proctor test is performed in accordance with ASTM D1557. The test is performed by dropping a 10-pound hammer 25 times from an 18-inch height on each of 5 equal layers of soil in a 1/30 cubic foot mold, which represents a compaction effort of 56,250 foot pounds per cubic foot. The moisture content is then raised, and this procedure is repeated. A moisture density curve is then plotted, with the density on the ordinate axis and the moisture on the abscissa axis. The moisture content at which the maximum density requirement can be achieved with a minimum compactive effort is designated as the optimum moisture content (O.M.C.). The Standard Proctor test is performed in accordance with ASTM D698. This test is similar to the Modified Proctor test and is performed by dropping a 5.5 pound hammer 25 times from a height of 12 inches on 3 equal layers of soil in a 1/30 cubic foot mold, which represents a compaction effort of 12,375 foot pounds per cubic foot. This test gives proportionately lower results than the Modified Proctor test.







CLIEN	CLIENT City of Huber Heights									JOB NO. 208890											
		ubci	1101	gnts							RING RTEI		2088 /8/23	E	ORIN	T TOTAL	n 2/	8/23			-27
PROJI Preli	nina	ry S	oil S	tudy for P	ropo	sed De	evelopi	ment S	Site,		LLER			ar N	METH(	OD 2 1	./4"	HS	A	Bor	ing No.
Wild	eat F	Road	, Hu	ber Height	s, Ol	io.				TYP	ED B		dn			V	-Marco			Sheet 1 of 1	
				2005	PRO.	JECT LO	OCATIO	N 400014	011337			ММЕ	NTS								
GL)	0.	YPE	90	SURFACE E			ONG. 84		9" W 8.7*	STS	*Surface elevation based on Ohio South State Plane Coordinate System.									uth	w .
(ft. B	LEN	ER T	IIC I	As shown or	BOR n Bor	ING LO	OCATIO	N Plan.		000											REMARKS
DEPTH (ft. BGL)	SAMPLE NO.	SAMPLER TYPE RECOVERY	GRAPHIC LOG	It has been r samples. Th	necess	sary to	interpolicontact	ate betwe	veen	BLOW COUNTS				722-23			10				REM
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3.0										•											
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5	SS2									9		0	18								
5.0										10000											
6.0		V. 1								6			e-5000								
7.0	SS3									10		<b>\$</b>	17								
8.0																					
9.0	SS4									7			19								
10.0		3/2								12		<	<b>}</b>								
11.0																					
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ŭ .		94												41						48	
				Dense, gray	silty S	SAND (t	race grav	vel) - we	t	16											
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	170000000000000000000000000000000000000		TIAL	NONE		2/8/2	2023		$\boxtimes$	ST — SI	HELB	Y TUI	3E	_						RN	
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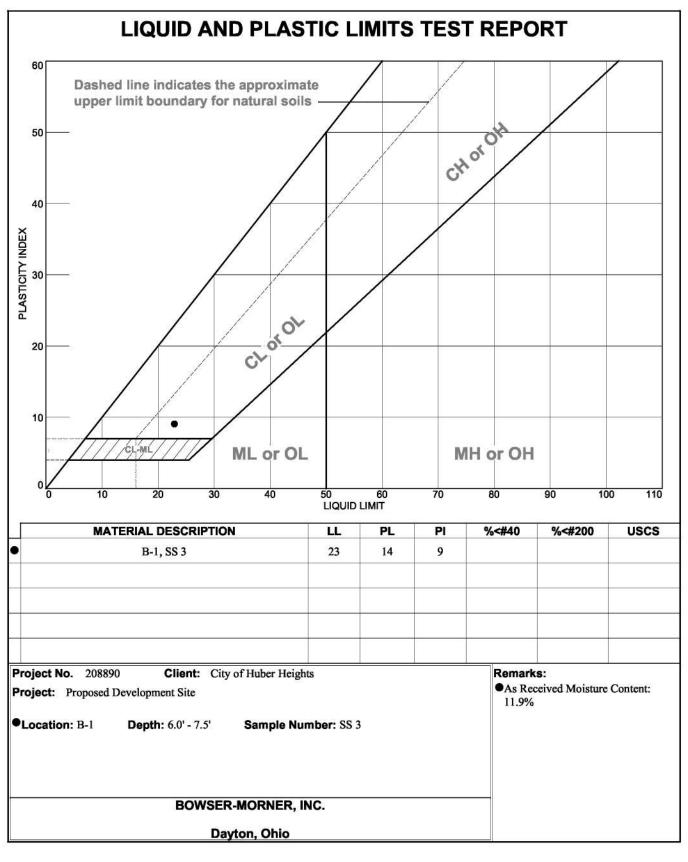
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WIIG	catr	coac	, nu	iber Heights, Onio.		DRILLER Central Star TYPED BY dmo Completed 2/6/25  METHOD 2 1/4" HSA						S	heet	1 of 1			
S.				PROJECT LOCATION LAT. 39°51'53"N LONG. 84°08'49	w			MEN		wati	an ha	and .	an 1	Ohio	Con	4h	
3GL)	ō.	YPE	00	SURFACE ELEVATION 866	NIS	*Surface elevation based on Ohio South State Plane Coordinate System.										S	
I (A. )	SAMPLE NO.	CERT	HIC	BORING LOCATION As shown on Boring Location Plan.		100										-	REMARKS
DEPTH (ft. BGL)	SAM	SAMPLER TYPE RECOVERY	GRAPHIC LOG	It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be take	en	BLOW COUNTS				N V	ALUE,	blow	s/ft.				RE
"		S		absolute. VISUAL CLASSIFICATION OF THE MAT	and the second second	н	1	0 20	0 3	0 4	<b></b> ◇			0 8	 0 9	0	
j				TOPSOIL (4") Stiff, brown sandy CLAY (some silt, trace								1					
1.0		- 41		gravel) - moist		8											
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3.0						0: <b>-</b> .11		500									
4.0		- 40		(Becomes very stiff at 3.5)		8											
15	SS2					6 10		$\diamond^1$	6								
5.0		G Vi				7.00.0											
6.0	-			(Becomes stiff at 6.0')		7_											
7.0	SS3					7 8		$\diamond^1$	5								
8.0				Very stiff, gray silty CLAY (trace sand, trace	æ			-									
9.0	SS4			gravel) - moist		7 10			2	5							
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11.0	-																Ā
12.0																	
1																	
	-			(Becomes hard at 13.5')		11											
	SS5					18 17				$\diamond^3$	5						
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17.0° 18.0° 19.0° 20.0°																	
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22.0				DEPTH DATE		L — SP Q— R0			N VV/S	SUIL	INER		4			NS	
A T	COL		ITIAL	NONE	200000000000000000000000000000000000000	T — SH S — AL				e e				i 🍂	NO	RN	ER.
AI	AT COMPLETION 11.0 ¥ 2/8/2023						ONIC	CUI	IING	3							

City	CLIENT City of Huber Heights								JOB NO. 208890											
		ubci	110	gnts						ING RTED		2080 8/23	P	ORIN	IG LETE	D 2/	8/23			•
PROJE Prelin	nina	ry S	Soil S	Study for P	ropose	d Develoj	pment Sit	e,	DRI	LLER			ar N	1ETH	OD 2 1	/4"	HSA		Bor	ing No.
Wildo	at F	loac	l, Hu	ber Height	s, Ohio				TYP	ED BY		dn						1 6-	Sheet 1 of 1	
				2004	PROJEC	T LOCATI	ON PAODOLADI	1337			име	NTS				c - 1000 to 0 a con 0 a				
GE)	ō.	YPE	90	SURFACE E	LEVATION	ON	84°08'49'' 858.		SIN					on bardina				Sou	uth	S
(ft. B	LEN	ER T	IICT	As shown o	BORIN n Boring	G LOCATION LOCATION	Plan.		COO											REMARKS
DEPTH (ft. BGL)	SAMPLE NO.	SAMPLER TYPE RECOVERY	GRAPHIC LOG	It has been r samples. Th	necessar	y to interpo	olate between	en	BLOW COUNTS				21.27			10				REM
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4.0-				(Becomes g	iay and si	iii ai 3.0 j			3											
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100		S18		: Very stiff gr	ay SILT	with sand se	ams - moist			S		_	32							
6.0	SS3								9											
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8.0-				Medium der	ise, gray	silty SAND	- wet			S.			8							
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i .		9						48					41		ž.				48	
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		- 1	VATE	R LEVEL ME	ASUREN	MENTS		S	S SF	LIT S	P00	N								
				DEDT		DATE			IL — SF IQ— R0				SOIL	LINEF	₹	4	<b>&gt;</b> 1	BO	WS	FR
			ITIAL	•		DATE /8/2023		⊠ s	T — SI	HELBY	/ TUE	3E							RN	
AT	AT COMPLETION 9.0 ¥ 2/8/2023 ☐ OTHER N/A ▼ N/A					AS— AUGER CUTTINGS SC— SONIC														

City of Huber Heights  PROJECT  Preliminary Soil Study for Proposed Development Site, Wildcat Road, Huber Heights, Ohio.  DRILLER Central Star TYPED BY  dmo  Completed 2/8/23 DRILLER Central Star TYPED BY  dmo  Sheet 1 of	
Preliminary Soil Study for Proposed Development Site, Wildcat Road, Huber Heights, Ohio.  DRILLER Central Star Typed By  METHOD 2 1/4" HSA Boring N	
TYPED BY	10
PROJECT LOCATION COMMENTS	
LAT 39°51'53"N LONG 84°08'49"W   *Surface elevation based on Obje South	
BORING LOCATION  BORING LOCATION  As shown on Boring Location Plan.	
SURFACE ELEVATION 874.0* BORING LOCATION As shown on Boring Location Plan. It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as  N VALUE, blows/ft.	
	4
absolute.   VISUAL CLASSIFICATION OF THE MATERIAL   10 20 30 40 50 60 70 80 90   TOPSOIL (2")	
Very stiff, brown sandy CLAY (trace sand, trace	
SS1	
3.0 - (Becomes stiff at 3.5')	
4.0 SS2 SS2 SS2 SS2 SS2 SS2 SS2 SS2 SS2 SS	
5.0	
6.0	
7.0- SS3 6 6 9 5 15 5 5 15 5 5 15 5 5 15 5 5 15 5 5 15 5 5 15 5 5 15 5 5 15 5 5 1	
8.0-	
9.0-	
SS4 SS4 SS4 SS4 SS4 SS5 SS4 SS5 SS5 SS5	
Very stiff, gray silty CLAY (trace sand, tace gravel) - moist	
1555	
15.0 Bottom of boring at 15.0 feet  16.0 Bottom of boring at 15.0 feet	
17.0 18.0 19.0 20.0	
	_
WATER LEVEL MEASUREMENTS SS— SPLIT SPOON	
SL — SPLIT SPOON W/SOIL LINER	
DEPTH DATE NQ— ROCK CORE BOWSER  INITIAL NONE Z 2/8/2023 ST — SHELBY TUBE MORNER.	
WATER LEVEL MEASUREMENTS  SS—SPLIT SPOON  SL—SPLIT SPOON W/SOIL LINER  DEPTH DATE INITIAL NONE Z/8/2023  AT COMPLETION NONE Z/2/8/2023  OTHER N/A N/A  N/A  N/A  SS—SPLIT SPOON  SL—SPLIT SPOON  AS—ACK CORE ST—SHELBY TUBE AS—AUGER CUTTINGS SC—SONIC	

CLIEN City o	T <b>f H</b> ı	ıber	· Hei	ights	JOB	3 NO. <b>20889</b>				
PROJE						RING ARTED 2/8/23	BORING	TODE 7/9/72		_
Prelin	nina	ry S	oil S	Study for Proposed Development Site,		LLER Central Star	METHO	2 1/4" HSA	Bor	ing No.
Wilde	at k	load	l, Hu	iber Heights, Ohio.	TYI	PED BY dmo			The same	1 of 1
DEPTH (ft. BGL)	SAMPLE NO.	SAMPLER TYPE RECOVERY	GRAPHIC LOG	PROJECT LOCATION  LAT. 39°51'53"N LONG. 84°08'49"W  SURFACE ELEVATION 857.6*  BORING LOCATION  As shown on Boring Location Plan.  It has been necessary to interpolate between samples. Therefore, the contacts between	BLOW COUNTS	COMMENTS *Surface elevi State Plane Co	ation bas oordinat	sed on Ohio S e System.		REMARKS
DE	Š	SA	8	the various soil strata should not be taken as absolute.	<u>B</u>	N	VALUE, 1	blows/ft.	a a	_
1.0	SS1			VISUAL CLASSIFICATION OF THE MATERIAL Stiff, gray silty CLAY (trace sand, trace gravel) - moist	5 6 6	\$\displaystyle{12}	40 50	60 70 80	90	
3.0-		- AT			5					
4.0	SS2				6	♦14				
5.0-						2007				
6.0	SS3				7					
7.0-					8	\$ <sup>14</sup>				
8.0					4					
9.0-	SS4	9757			6	♦14				
10.0-										
11.0										22
12.0-										Ā
13.0-		9	m	Loose, gray silty SAND - wet	3				45	立
5.00	SS5		mm	Medium stiff, gray silty CLAY (trace sand, trace	5	8				
15.0				gravel) - moist	3					
17.0-										
18.0										
17.0— 18.0— 19.0— 20.0—	SS6				3 4 _	9				
20.0-			22222	Bottom of boring at 20.0 feet	5	9				:
22.0	<u>L</u>		<u> </u>		<u> </u>					
					00 5	DI IT ODGG!	1			
21.0	COM	IN IPLE	ITIAL TION THER	DEPTH DATE 13.5	SL — SF NQ— R ST — SI	PLIT SPOON PLIT SPOON W/SO OCK CORE HELBY TUBE UGER CUTTINGS ONIC	IL LINER		ows orn	

CLIEN	CLIENT City of Huber Heights								JOB NO. <b>208890</b>									
PROJ				<b>5</b>					ING RTED	2/8/2	3 E	ORING	ETED	2/8	3/23		6	
Preli	mina	ry S	oil S	tudy for Pro	posed Devel	lopment S	Site,		LLER	tral S	tar	ИЕТНО	D 2 1/4	4" I	HSA	Ē	6 Boring No	<u> </u>
Wild	cat F	toad	, Hu	ber Heights,	Onio.			TVDCD DV						1 Course	eet 1 of	<b>1</b>		
					ROJECT LOCA	TION	o"w			MENTS		nerrossa ane	4200000		\.	C 41		
(JD)	ō.	YPE	90°	SURFACE ELE	EVATION	87	1.0*	SIN	*Sur State	face el Plane	evati Coo	on ba rdina	sed o te Sy	on C ster	)hio n.	South		
(ft. B	LEN	ER T	HCL	As shown on	BORING LOCA Boring Location	on Plan.		noo									REMARKS	
DEPTH (ft. BGL)	SAMPLE NO.	SAMPLER TYPE RECOVERY	GRAPHIC LOG	It has been ne samples. The	cessary to inter refore, the con	rpolate between	veen en	BLOW COUNTS				47.110	•	10			REM	
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3.0								•		<b>*</b>								
4.0	-	- 400						6										
2000000	_ SS2	Г						7	<	>14								
5.0		GVii 		Very stiff, gra	y silty CLAY (tr	ace sand, trac	ce				8		-					
6.0		State		gravel) - mois		, i		6		13 13								
7.0	SS3							8	10	\$16								
8.0																		
9.0	SS4			(Becomes stiff	f at 8.5')			3 5		11								
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Deed: N								SL — SF			/SOIL	LINER		4		OW	SER	
o Lode		INI	TIAL	NONE .	DATE		$\boxtimes$	NQ— RO ST — SH	HELBY 7	TUBE							NER.	
All All						AS — AUGER CUTTINGS SC — SONIC												



Tested By: HMR Checked By: BLC

# Moisture Content of Soil ASTM (D-2216)



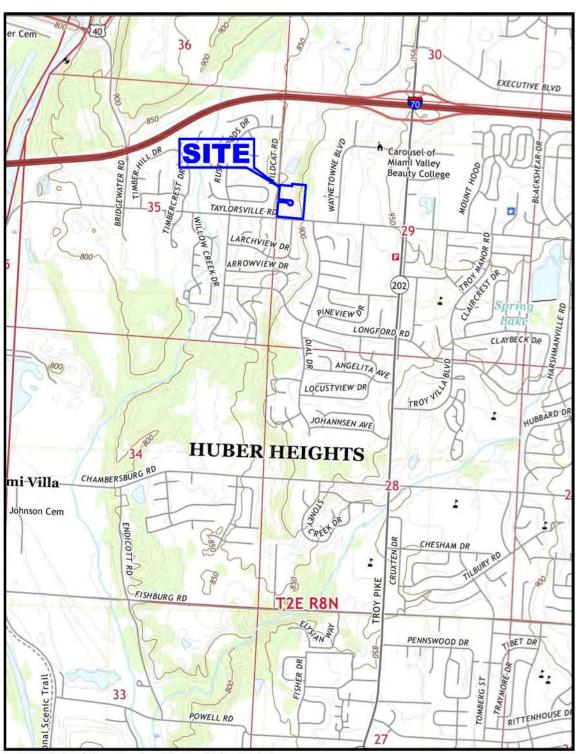
Client: City of Huber Heights

Project: Proposed Development Site

Work Order No.: 208890

Date: 02/17/23

Boring	Sample	D 11 /60		
Number	Number	Depth, (ft)	Depth, (m)	Moisture Content, (%)
B-1	SS 1	1.0 - 2.5	0.3 - 0.8	8.8
	SS 2	3.5 - 5.0	1.1 - 1.5	10.0
	SS 3	6.0 - 7.5	1.8 - 2.3	11.9
	SS 4	8.5 - 10.0	2.6 - 3.0	12.5
	SS 5	13.5 - 15.0	4.1 - 4.6	Not Tested
B-2	SS 1	1.0 - 2.5	0.3 - 0.8	Not Tested
	SS 2	3.5 - 5.0	1.1 - 1.5	Not Tested
	SS 3	6.0 - 7.5	1.8 - 2.3	11.1
	SS 4	8.5 - 10.0	2.6 - 3.0	10.0
	SS 5	13.5 - 15.0	4.1 - 4.6	9.8
B-3	SS 1	1.0 - 2.5	0.3 - 0.8	11.1
	SS 2	3.5 - 5.0	1.1 - 1.5	Not Tested
	SS 3	6.0 - 7.5	1.8 - 2.3	16.6
	SS 4	8.5 - 10.0	2.6 - 3.0	Not Tested
	SS 5	13.5 - 15.0	4.1 - 4.6	11.6
B-4	SS 1	1.0 - 2.5	0.3 - 0.8	Not Tested
	SS 2	3.5 - 5.0	1.1 - 1.5	11.1
	SS 3	6.0 - 7.5	1.8 - 2.3	11.5
	SS 4	8.5 - 10.0	2.6 - 3.0	Not Tested
	SS 5	13.5 - 15.0	4.1 - 4.6	10.0
B-5	SS 1	1.0 - 2.5	0.3 - 0.8	Not Tested
	SS 2	3.5 - 5.0	1.1 - 1.5	9.6
	SS 3	6.0 - 7.5	1.8 - 2.3	Not Tested
	SS 4	8.5 - 10.0	2.6 - 3.0	12.5
	SS 5	13.5 - 15.0	4.1 - 4.6	Not Tested
	SS 6	18.5 - 20.0	5.6 - 6.1	12.2
B-6	SS 1	1.0 - 2.5	0.3 - 0.8	9.9
	SS 2	3.5 - 5.0	1.1 - 1.5	10.5
	SS 3	6.0 - 7.5	1.8 - 2.3	9.5
	SS 4	8.5 - 10.0	2.6 - 3.0	Not Tested
	SS 5	13.5 - 15.0	4.1 - 4.6	Not Tested
			92 E1000 1012 E8	



USGS QUAD: Dayton North, Ohio (2019) Latitude: 39°51'53"N Longitude: 84°08'49"W

# VICINITY MAP

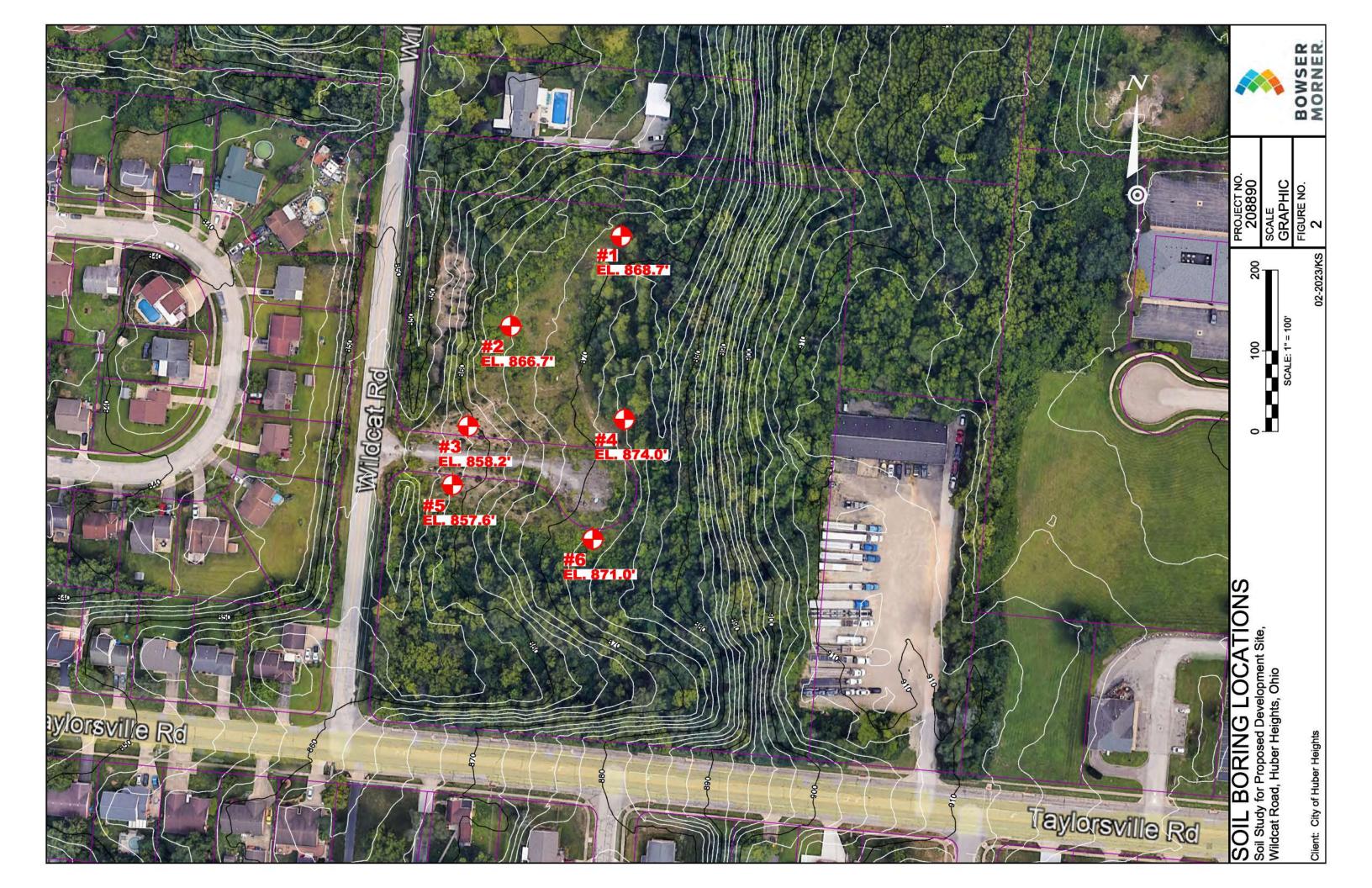
Soil Study for Proposed Development Site, Wildcat Road, Huber Heights, Ohio

Client: City of Huber Heights

PROJECT NO. 208890 SCALE 1"=2000' FIGURE NO. 1

02-2023/KS



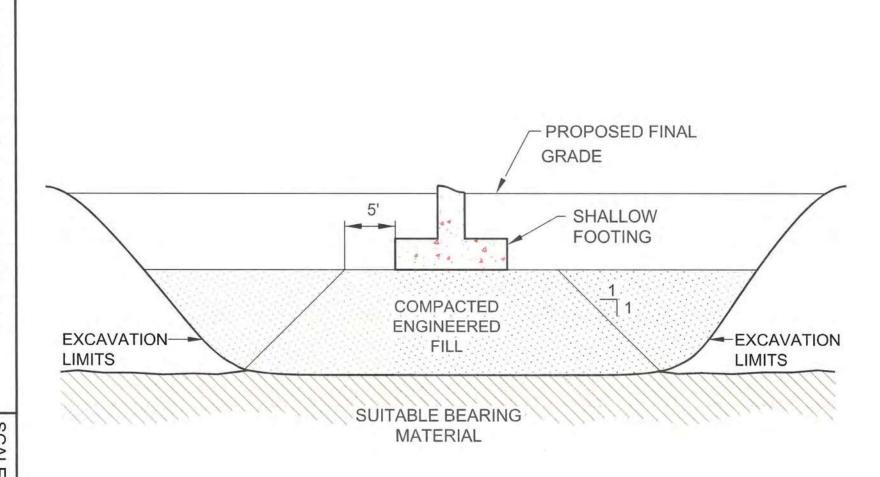


# UNDERCUT DIE SIGN LUS RATION

SCALE

FIGURE NO.





#### **ENGINEERING & ENVIRONMENTAL SERVICES:**

Geotechnical Engineering Subsurface Exploration Civil Engineering Environmental Services Due Diligence Permitting

# **LABORATORY SERVICES:**

Geotechnical Laboratories Construction Materials Laboratories Mineral Aggregates Concrete

Stone & Masonry

Asphalt

**Analytical Services Laboratories** 

**Industrial Minerals** 

**Product Testing** 

Mechanical/Metallurgical Testing

Calibration Services

**Chemistry Laboratory** 

**Consulting Geology** 

Radon Reference Laboratory

#### **CONSTRUCTION SUPPORT SERVICES:**

General Construction
Construction Quality Assurance
Building Code Special Inspections
Transportation Projects:

- Contractor QA/QC
- Material Supplier QA/QC
- Owner Quality Assurance

Materials Consulting:

- Construction Engineering



# **Phase I Environmental Site Assessment Report**

Proposed Public Works 5001 Taylorsville Road Huber Heights, OH 45404

## **Prepared For**

City of Huber Heights 6131 Taylorsville Road Huber Heights, OH 45424

#### **Prepared By**

MakSolve 261 Regency Ridge Drive Dayton, OH 45459

February 20, 2023 Project Number 006-23



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#### GENERAL INFORMATION

Project Information: Proposed Public Works Project Number:

006-23

Consultant Information:

MakSolve

261 Regency Ridge Drive

Dayton, OH 45459

Phone:

937-815-6349

E-mail Address: Inspection Date: john@maksolve.com February 8, 2023

Report Date:

Site Access Contact: Client Information:

Site Information:

Proposed Public Works

5001 Taylorsville Road

Huber Heights, OH 45404 County: Montgomery Latitude, Longitude:

39.864430, -84.146248

Russ Bergman, P.E.

City of Huber Heights Russ Bergman, P.E.

6131 Taylorsville Road Huber Heights, OH 45424

February 20, 2023

Site Assessor

Jeff LaBianco Geologist

Senior Reviewer

John Bowen Project Manager

#### Certification:

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in 40 CFR Part 312. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

John Bowen - Project Manager

John Bourn



#### 1.0 EXECUTIVE SUMMARY

MAKSolve was retained by City of Huber Heights, to perform a Phase I Environmental Site Assessment (ESA) of the property known as Proposed Public Works property located at 5001 Taylorsville Road in Huber Heights, Montgomery County, OH 45404 (subject property). MAKSolve performed the ESA in conformance with the Scope of Work and the provisions of the ASTM Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process E 1527-21. Any exceptions to, or deletions from, this practice are described within this report.

The Phase I Environmental Site Assessment (ESA) is designed to provide City of Huber Heights with an assessment concerning environmental conditions as they may exist at the subject property. This assessment was conducted utilizing generally accepted ESA industry standards in accordance with the "All Appropriate Inquiries" rule, promulgated by the EPA (40 C.F.R. Part 312) and the American Society of Testing Materials ("ASTM") Standard E1527, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, version E1527-21 and if applicable, the client's scope of work as discussed in the Reliance section of this report. This executive summary is provided for convenience only and is not a substitute for a thorough reading of the entire report, including all appendices. The Phase I Environmental Site Assessment (ESA) is designed to provide City of Huber Heights with an assessment concerning environmental conditions as they may exist at the subject property.

MakSolve visited the site on 02/08/2023. At the time of the site visit, weather conditions were clear and approximately 50 degrees Fahrenheit.

To sum up our assessment, MAKSolve identified no RECs, no HRECs, no CRECs, one De Minimis Condition and no significant Data Gaps during the completion of this report.

#### 1.1 Environmental Report Summary Table

Report	Section	No Further Action	REC	HREC	CREC	Issue / Further Investigation	Comments
2.5	Data Gaps	X					
3.0	User-Provided Information	Х					
6.1	Site Reconnaissance  Regulatory Records	X				х	Evidence of trash, debris and illegal dumping was observed on the subject property. The refuse did not appear to represent significant environmental concern and is considered a De Minimis condition.
6.1	Review	_ ^					
6.2	Historical Records Review	Х					
6.5	Vapor Encroachment Evaluation	Х					
7.0	Interviews & Local Government Records	Х					
8.0	Non-Scope Considerations	Х					Non-Scope Considerations were not assessed as part of this report.



# 1.2 Recognized Environmental Conditions (RECs)

This assessment has revealed no evidence of recognized environmental conditions in connection with the subject property.

## 1.3 Historic Recognized Environmental Conditions (HRECs)

This assessment has revealed no evidence of historic recognized conditions in connection with the subject property.

## 1.4 Controlled Recognized Environmental Conditions (CRECs)

This assessment has revealed no evidence of controlled recognized environmental conditions in connection with the subject property.

## 1.5 De Minimis Conditions

This assessment identified a De Minimis Condition at the subject property:

 Illegally dumped trash and debris, including tires, unidentifiable material and general refuse was observed.

# 1.6 Data Gaps

Data gaps were encountered, however, none impacted the Environmental Professional's ability to assess recognized environmental conditions.

## 1.7 Business Environmental Risks (BERs)

BERs were not considered as part of this assessment.

## 1.8 Opinion

Based on the the above referenced information, MAKSolve's opinion is the following:

Proper removal and disposal of discarded debris and refuse appears warranted.

#### 1.9 Key Dates of Report Components

Report Component	Date Conducted	Expiration Date	
Interviews	01/09/2023	07/09/2023	
Freedom of Information Act	02/01/2023	08/01/2023	
Requests	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	The second secon	
Government Database Search	01/19/2023	07/19/2023	
Site Reconnaissance	02/08/2023	08/08/2023	
EP Declaration	02/20/2023	08/20/2023	
Report Date	02/20/2023	08/20/2023	



#### 2.0 INTRODUCTION

MakSolve performed a Phase I Environmental Site Assessment (Phase I ESA) of the Proposed Public Works property located at 5001 Taylorsville Road in Huber Heights, Montgomery County, OH (subject property). This report documents the methods and findings of the Phase I ESA performed in general conformance with 42 U.S.C. §9601(35)(b) — Standards and Practices for All Appropriate Inquiries (AAI), and ASTM International — Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Processes E1527-21, the specific scope of work provided, and generally accepted industry standards. The purpose of the Phase I ESA is to identify Recognized Environmental Conditions (RECs), historical recognized environmental conditions (HRECs), and/or controlled recognized environmental conditions (CRECs) at the subject property and potential impacts from nearby facilities. If requested by the client, ASTM scope and non-scope considerations may also be addressed.

# 2.1 Scope of Work

The Phase I ESA conducted at the subject property was in general accordance with ASTM Standard E 1527-21 and included the following:

- · A site reconnaissance and visual survey of properties proximate to the subject property,
- Review of records and interviews with regulatory officials and representatives regarding current and former operations at the subject property,
- A review of historical resources, such as: property records, topographic maps, fire insurance maps, city directories, and aerial photographs,
- · Review of previous environmental site assessments, if made available,
- · Review of State and Federal environmental database information, and
- Evaluation of information and preparation of the report provided herein.

Typically, a Phase I ESA does not include sampling or testing of air, soil, groundwater, surface water, or building materials. These activities would be carried out under separate cover, if necessary.

#### 2.2 Reliance

This ESA report is prepared for the exclusive use and reliance of City of Huber Heights. No other party, known or unknown to MAKSolve, is intended as a beneficiary of this work product, its content or information embedded therein. City of Huber Heights may choose to share the contents of this report with any third party. However, third parties use this report at their own risk. Third party reliance letters may be issued on request to MAKSolve subject to approval of City of Huber Heights, and payment to MAKSolve of a fee for such letters. Reliance on the ESA by the client and all authorized parties will be subject to the terms, conditions and limitations stated in the proposal, ESA report, and MAKSolve's Contract. The limitation of liability defined in the Contract is the aggregate limit of MAKSolve's liability to the client and all relying parties.

If the ESA will be used by a different user (third party) than the user for whom the ESA was originally prepared, the third party must also satisfy the user's responsibilities in Section 6 of ASTM E 1527-21.



# 2.3 Limitations and Exceptions

This Phase I ESA is intended to reduce, but not eliminate, uncertainty regarding the potential for RECs, HRECs, and CRECs to be present at the subject property. Not every property warrants the same level of assessment. Consistent with good commercial or customary practice, the appropriate level of assessment was guided by the type of property subject to assessment and the information developed in the course of inquiry.

Certain additional services considered optional by ASTM Standard E1527-21, such as asbestos-containing building materials, biological agents, cultural and historic resources, ecological resources, endangered species, health and safety, industrial hygiene, lead-based paint, lead in drinking water, mold, radon, and wetlands, if not included in this report, were not included in the scope of work.

The findings and conclusions presented in this Phase I ESA are the result of professional interpretation of the information collected at the time of this study. This Phase I ESA was not an exhaustive search of all available records. MAKSolve cannot "certify" or guarantee that the subject property is free of environmental impairment; no warranties regarding the environmental quality of the subject property are expressed or implied. Significant limitations to our conclusions as a result of information gaps or incomplete information are documented in various sections of the report.

The findings of this report, to the best of our knowledge, are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether due to natural processes or the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate regulations and standards may occur, whether they result from legislation, from the broadening of knowledge, or from other reasons. Per the E1527-21 Standard (the Standard), a Phase I ESA completed less than 180 days prior to the date of acquisition of the subject property is presumed valid. A Phase I ESA for which the information was collected or updated within one year of the date of acquisition of the subject property may be used, provided that the report is updated within 180 days of the date of purchase or intended transaction. Per the Standard, if a Phase I ESA or Phase I ESA Update is not completed within 12 months of the information collected, a new Phase I ESA is required.

Specified information contained in this report has been obtained from publicly available sources and other secondary sources of information. Although care has been taken in compiling this information, MAKSolve disclaims any and all liability for any errors, omissions, or inaccuracies in the data provided by third parties in such information and data.

The work was performed using the degree of care and skill ordinarily exercised under similar circumstances by environmental consultants practicing in this or similar localities at the time these services were provided. No other warranty or guarantee, expressed or implied, is made as to the findings, opinions, and conclusions included in this report. If in the opinion of the client, or any third party claiming reliance on MAKSolve's report or services, that MAKSolve was negligent or in breach of contract, such aforementioned parties shall have one year from the date of MAKSolve's site visit to make a claim.

#### 2.4 Deviations

In performance of this Phase I ESA, MAKSolve has not identified potential exceptions or deviations from the E1527-21 standard of practice except where noted.



## 2.5 Data Gaps

The actions and investigations undertaken as part of the ESA are property-specific and limited to the legally defined subject property boundaries as defined by the user. All pertinent information has been reasonably obtained in a good faith effort from the appropriate government agencies, landowner or occupant and through investigative property visit and other all appropriate inquiries. However, the following limiting conditions or deviations were encountered:

- Data gaps in excess of the recommended 5-year interval were encountered. This data gap is not critical and does not alter the conclusions or recommendations of this assessment.
- MAKSolve has not received responses from all of our FOIA requests, specifically the
  water department and fire department. This data gap is not considered to represent a
  significant data gap with regard to the findings of this report as the information
  generally obtained is also usually obtained from other resources.

# 2.6 Significant Assumptions

It is assumed that any and all information provided, either via interview, records review or historical resources search is true and accurate, without predisposition.

## 2.7 Special Terms and Conditions

This Phase I Environmental Assessment was prepared in accordance with the stated and agreed upon Scope of Work. This report was specifically and only prepared for the identified specific clients (users) and for their specific purpose; no other person or entity for any other purpose may use or rely on this report or its contents unless specifically authorized in writing by MAKSolve. No other special terms and conditions are applicable to this Phase I Environmental Assessment.

#### 2.8 Definitions

For the purpose of this report, and as defined by ASTM Standard E1527-21, a recognized environmental condition (REC) is defined as "the presence of hazardous substances or petroleum products in, on, or at the subject property due to a release to the environment; (2) the likely presence of hazardous substances or petroleum products in, on, or at the subject property due to a release or likely release to the environment; or (3) the presence of hazardous substances or petroleum products in, on, or at the subject property under conditions that pose a material threat of a future release to the environment."

A controlled recognized environmental condition (CREC) is defined as a "recognized environmental condition affecting the subject property that has been addressed to the satisfaction of the applicable regulatory authority or authorities with hazardous substances or petroleum products allowed to remain in place subject to implementation of required controls (for example, activity and use limitations or other property use limitations)." A CREC is considered a REC under ASTM.

A historical recognized environmental condition (HREC) is defined as "a previous release of hazardous substances or petroleum products affecting the subject property that has been addressed to the satisfaction of the applicable regulatory authority or authorities and meeting unrestricted use criteria established by the applicable regulatory authority or authorities without subjecting the subject property to any controls (for example, activity and use limitations or other property use limitations)." An HREC is not considered a REC under ASTM.



A de minimis condition is defined as "a condition related to a release that generally does not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. A condition determined to be a de minimis condition is not a recognized environmental condition nor a controlled recognized environmental condition."

A data gap is defined as "a lack of or inability to obtain information required by this practice despite good faith efforts by the environmental professional to gather such information."

A business environmental risk (BER) is defined as "a risk which can have a material environmental or environmentally-driven impact on the business associated with the current or planned use of commercial real estate, not necessarily related to those environmental issues required to be investigated in this practice."

ASTM 1527-21 states the term *environment* "shall have the same meaning as the definition of environment in CERCLA 42 U.S.C. • 9601(8))", which is defined as "(A) the navigable waters, the waters of the contiguous zone, and the ocean waters of which the natural resources are under the exclusive management authority of the United States under the Magnuson-Stevens Fishery Conservation and Management Act [16 U.S.C. 1801 et seq.], and (B) any other surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air within the United States or under the jurisdiction of the United States."

A vapor encroachment condition (VEC) is defined as "the presence or likely presence of chemical of concern vapors in the subsurface of the target property caused by the release of vapors from contaminated soil and/or groundwater either on or near the target property."

Other ASTM terms used in this report are further clarified in the ASTM E1527-21 standard which can be obtained from ASTM International (astm.org).



#### 3.0 USER-PROVIDED INFORMATION

In accordance with ASTM Standards E1527-21, MAKSolve requested that the User of this Phase I ESA provide information that would assist in identifying the potential for RECs in connection with the subject property. Information received from the User is contained in the appendices of this report and is summarized below. Issues identified by MAKSolve during the review of the information along with related comments are also presented.

The EP maintains the responsibility for developing opinions and documenting findings about "recognized environmental conditions," however, the user of the ESA shares in the burden of providing information regarding known environmental concerns. To assist in the EP's development of findings and opinions and to not jeopardize the user's qualification for any of the LLPs to CERCLA liability, the user is required to consider the following and recommended to notify the EP of the findings, if applicable.

# 3.1 Activity/Use Limitations

Environmental lien records recorded against the subject property were not provided by the City of Huber Heights. At the direction of the City of Huber Heights, performance of a review of these records was not included as part of the scope of services and unless notified otherwise, MAKSolve assumes that the client is evaluating this information outside of the context of this report.

## 3.2 Specialized Knowledge

MakSolve was provided no information regarding specialized knowledge of the subject property, other than the fact that there may be shallow bedrock on the property, outside of the research which was conducted and reported as part of this report.

All individuals who were interviewed as part of this investigation, have not reported any specialized knowledge of this subject property outside of what is contained in this report.

## 3.3 Valuation Reduction for Environmental Issues

MakSolve has not been provided with information related to a valuation reduction due to environmental issues.

#### 3.4 Owner, Subject Property Manager, and Occupant Information

No written or verbal communication with the subject property owner, manager and tenants revealed information which suggested that there are RECs associated with the subject property.

## 3.5 Reason For Performing Phase I ESA

MakSolve understands that the findings of this study will be used to evaluate a pending financial transaction in connection with the subject property.



## 4.0 PHYSICAL SETTING

General site settings including topography, surface water bodies, geology and hydrology are detailed in the following sections.

# 4.1 Topography

The topography of the subject property appears somewhat level in the western portions, however contains a significant western facing slope in the eastern portions. The regional topographic gradient is to the southwest toward the Great Miami River. According to the United States Geological Survey (USGS) topographic map (Dayton North, Ohio, 2019) the subject property has an elevation of approximately 868 feet above mean sea level (AMSL) (see Figure 1, Property Location Map).

#### 4.2 Surface Water Bodies

The nearest surface water in the vicinity of the subject property is an unnamed tributary to the Great Miami River, located approximately 1,500 feet to the southwest of the subject property.

## 4.3 Geology

The subject property is located in the Southern Ohio Loamy Till Plain area of the Central Lowlands section of the Interior Plains physiographic region of Ohio. The Southern Ohio Loamy Till Plain is described as having surface of loamy till; end and recessional moraines, commonly associated with boulder belts, between relatively flat-lying ground moraine, cut by steep-valleyed large streams; stream valleys filled with outwash and alternate between broad floodplains and narrows. The Southern Ohio Loamy Till Plain consists of loamy, high-lime Wisconsinan-age till, outwash, and loess over Lower Paleozoic-age carbonate rocks and, in the east, shales.

#### 4.4 Soils

According to the United States Department of Agriculture, Web Soil Survey, the subject property is underlain by Milton silty loam, Ritchey silt loam, and Brookston silt loam. The Milton series consists of moderately deep, well drained soils formed in loess and the underlying till and residuum from limestone or dolomite. They are on till plains. Mean annual precipitation is about 940 mm (37 inches), and mean annual air temperature is about 11 degrees C (52 degrees F). The Ritchey series consists of shallow, well drained soils formed in till over limestone or dolostone bedrock on till plains. Slope ranges from 0 to 60 percent. Mean annual precipitation is 915 mm (36 inches), and the mean annual air temperature is 11 degrees C (51 degrees F). The Brookston series consists of very deep, poorly drained soils formed in as much as 51 cm (20 inches) of silty material and the underlying loamy till in depressions on till plains and moraines. Slope ranges from 0 to 3 percent. Mean annual precipitation is about 889 mm (35 inches), and mean annual temperature is about 10.0 degrees C (50 degrees F).

## 4.5 Hydrology

The Ground Water Resources of Montgomery County map, prepared by James J. Schmidt and generated by the Ohio Department of Natural Resources in 1986, shows the Property is located in an area which average yields for wells developed in basal Silurian limestone bedrock ranges from 4 to 6 gallons per minute. drilling deeper than 80 feet is not advisable owing to the presence of the non-water-bearing Ordovician shaly limestone bedrock. Cisterns and/or storage may be necessary for peak periods of water demand



#### 5.0 SITE RECONNAISSANCE

Jeff LaBianco, representing MAKSolve performed a site reconnaissance on 02/08/2023 to observe current conditions. MAKSolve was unaccompanied at the time of the property visit. The weather was clear and about 50 degrees Fahrenheit.

The site reconnaissance consisted of observing the boundaries and systematically traversing the subject property to provide an overlapping field of view, wherever possible. The site reconnaissance consisted of walking the subject property perimeter, interior and exterior areas. The adjacent properties were visually observed from public thoroughfares, but were not entered.

# 5.1 Subject Property Information

As part of the site reconnaissance, MakSolve looked for evidence of the presence of hazardous substances and/or petroleum products used, stored, or discarded at and near the subject property. A summary of the site reconnaissance is provided below. Locations of pertinent observations are depicted on the figures provided in Appendix A of this report. Photographs of pertinent findings and features observed during the site reconnaissance are provided in Appendix B. Certain information obtained during the site visit, such as the number of structures, descriptions of roadways and parking facilities, utility services, and other general observations, may be presented in other sections of this report

## 5.1.1 Subject Property

A description of the subject property is provided below:

#### Exterior

At the time of the site reconnaissance, the subject property was developed with a cul-de-sac. There were no other structures or improvements present on the subject property. The subject property is accessed from Wildcat Road located directly west of the subject property. The subject property is vegetated with trees and scrub brush and unvegetated land.

#### Interior

No structures were observed on the subject property.

#### 5.1.2 Adjoining Property Information

Adjacent properties were viewed from the subject property, walking subject property boundaries, and via adjacent public thoroughfares. The following table describes the use of each adjacent property.

Adjoining Property Information					
Direction From Subject Property	Address	Occupant	Use	REC	
North	7638 Wildcat Rd.	Residential	Residential	No	
East	5201 Taylorsville Rd.	1st Choice Home Improvment	Commercial	No	
South	5140 Taylorsville Rd.	Residential	Residential	No	
South	4928 Taylorsville Rd.	Residential	Residential	No	
South	5036 Taylorsville Rd.	Residential	Residential	No	
South	5171 Taylorsville Rd.	Residential	Residential	No	
South	5170 Taylorsville Rd.	Residential	Residential	No	



Direction From Subject Property	Address	Occupant	Use	REC
West	4881 Lodgeview Dr.	Residential	Residential	No
West	4885 Lodgeview Dr.	Residential	Residential	No
West	4889 Lodgeview Dr.	Residential	Residential	No
West	4904 Meadowvista Dr.	Residential	Residential	No
West	4896 Meadowvista Dr.	Residential	Residential	No
West	4888 Meadowvista Dr.	Residential	Residential	No
West	4887 Meadowvista Dr.	Residential	Residential	No

# 5.1.3 General Subject Property Setting

The subject property consists of approximately 8.12 acres. The ground surface at the subject property slopes gently downward to the southwest. Groundcover consists primarily of wooded and grassy areas, a paved road (Middletown Court) and sparsely vegetated soil. The subject property is accessed from the west via an entrance from Wildcat Road.

# 5.2 Site Reconnaissance Findings

Condition, Feature or Operation Observed or Identified?	Yes	No
Structures and Other Improvements		X
Roads	X	
Potable Water Supply		X
Sewage Disposal		X
Hazardous Substances		X
Petroleum Products		X
Underground Storage Tanks (USTs)		X
Aboveground Storage Tanks (ASTs)		X
Strong, Pungent, or Noxious Odors		X
Standing Surface Water and Pools or Sumps Containing Liquids Likely to be Hazardous Substances or Petroleum Products  Output  Description:		X
Drums, Totes, and Intermediate Bulk Containers		X
Hazardous Substance and Petroleum Product Containers Not in Connection With Identified Uses		X
Unidentified Substance Containers		X
PCB-Containing Items		X
Heating and Cooling Systems		X
Stains or Corrosion on Floors, Walls, or Ceilings		X
Drains and Sumps		X
Pits, Ponds, or Lagoons	X	
Stressed Vegetation	X	
Solid Waste	X	
Stained Soil or Pavement		X
Water/Wastewater		X
Wells		X
Other		X

# 5.2.1 Pits, Ponds, or Lagoons

A drainage ditch was observed along the western and southern boundaries of the subject property. No evidence of environmental impairment was noted.



## 5.2.2 Stressed Vegetation

Limited stressed vegetation was observed on the subject property at the time of the property visit. This included an area of grass at the northwest corner of the property. The grass only sparsely covered the soil in this area. The stressed vegetation does not appear to be the result of a chemical release or spill, but likely due to the inert nature of the soil in that area.

#### 5.2.3 Solid Waste

Evidence of surficial solid waste dumping was identified on the subject property during the site reconnaissance. While not considered an environmental concern, the trash and debris is considered a De Minimis condition and should be properly removed and disposed.

	Feature				
Feature Identified	Quantity/Size	Details			
Used Tires	7	6 small tires were found in the center of the subject property as well as one large heavy machinery tire on the eastern portion of the subject property.			
General trash	100+ pcs	Cups, cans, plastic food wrappers, Styrofoam, etc.			
Furniture	3	Three pieces of rotting furniture located in the center of the subject property.			



## 6.0 RECORDS REVIEW

The purpose of the records review is to obtain and review records that will help identify RECs in connection with the subject property.

## 6.1 Regulatory Records Review

MAKSolve contracted Environmental Data Resources, Inc. (EDR) to conduct a search of Federal and State databases containing known and suspected sites of environmental contamination. The number of listed sites identified within the approximate minimum search distance (AMSD) from the Federal and State environmental records database listings specified in ASTM Standard E 1527-21 are summarized in the following table. Detailed information for sites which could materially affect the environmental condition of the subject property (on-property, up-gradient, adjacent properties, and/or releases within 500 feet) will be detailed below, along with an opinion about the significance of the listing to the analysis of recognized environmental conditions in connection with the subject property. The table below identifies all of the database hits within their AMSD.

Map Findings Summary								
Database	Subject Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Plotted
NPL	0	1	0	0	0	0	NR	0
Proposed NPL	0	1	0	0	0	0	NR	0
NPL LIENS	0	1	0	0	0	0	NR	0
Delisted NPL	0	1	0	0	0	0	NR	0
FEDERAL FACILITY	0	0.5	0	0	0	NR	NR	0
SEMS	0	0.5	0	0	0	NR	NR	0
SEMS-ARCHIVE	0	0.5	0	0	0	NR	NR	0
CORRACTS	0	1	0	0	0	1	NR	1
RCRA-TSDF	0	0.5	0	0	0	NR	NR	0
RCRA-LQG	0	0.25	0	0	NR	NR	NR	0
RCRA-SQG	0	0.25	0	0	NR	NR	NR	0
RCRA-VSQG	0	0.25	0	1	NR	NR	NR	1
LUCIS	0	0.5	0	0	0	NR	NR	0
US ENG CONTROLS	0	0.5	0	0	0	NR	NR	0
US INST CONTROLS	0	0.5	0	0	0	NR	NR	0
ERNS	0	0.001	0	NR	NR	NR	NR	0
LUCIS	0	0.5	0	0	0	NR	NR	0
FEMA UST	0	0.25	0	0	NR	NR	NR	0
SWF/LF	0	0.5	0	0	0	NR	NR	0
LUST	0	0.5	0	0	7	NR	NR	7
UNREG LTANKS	0	0.5	0	0	0	NR	NR	0
UST	0	0.25	0	0	NR	NR	NR	0
AST	0	0.25	0	0	NR	NR	NR	0
ENG CONTROLS	0	0.5	0	0	1	NR	NR	1
INST CONTROL	0	0.5	0	0	1	NR	NR	1
VCP	0	0.5	0	0	1	NR	NR	1
BROWNFIELDS	0	0.5	0	0	0	NR	NR	0
HIST ENG CONTROLS	0	0.5	0	0	0	NR	NR	0
DERR	0	1	0	0	1	0	NR	1
HIST INST CONTROLS	0	0.5	0	0	0	NR	NR	0
INDIAN LUST	0	0.5	0	0	0	NR	NR	0
INDIAN UST	0	0.25	0	0	NR	NR	NR	0
INDIAN VCP	0	0.5	0	0	0	NR	NR	0



#### 6.2 Historical Records Review

As part of this Phase I ESA, MAKSolve attempted to develop a history of the previous uses of the subject property, adjacent properties, and the surrounding area to help identify past uses that may have resulted in one or more RECs at the subject property. Efforts were made to identify the uses of the subject property back to the subject property's first use, or back to 1940, whichever is earlier.

## 6.2.1 Historical Narrative Summary

From the early 1900s through the 1950s, the subject property appears as a partially westerly facing sloped, primarily grass covered tract of land. By the 1970s, the hillside portion appears mostly as wooded land, with western portions exhibiting sparsely wooded vegetation. In the early 1980s the western portions appear to have been scraped of vegetation and there is evidence of soil or other material being stockpiled on the property. The land clearing and deposition of soil appears to coincide with the construction of a large pond on the northern adjoining property. In the mid-1990s a road had been added to the subject property with a cul-de-sac, which accessed Wildcat Road, however no further development was noted. The asphalt paving remained on the property during the property visit. Throughout the 2000s, these areas remained as disturbed land. By 2015, much of the land had overgrown again and transformed to its present condition.

From the early 1900s through the 1950s, the adjoining properties appear mostly in agricultural, grass land or light residential use. In the mid1950s, the northern adjoining property was developed for use as a residence. Between 1970 and 1984 a large pond was added to the northern adjoining property. No significant changes have occurred since that time.

Beyond Taylorsville Road, since the early 1900s, the southern adjoining property was undeveloped wooded and/or agricultural land. The western adjoining property, beyond Wildcat Road was similar. Between 1970 and 1984, the current residential subdivisions were added. The eastern adjoining property was originally wooded and in agricultural use. Between 1970 and 1984, a commercial structure was added, with the remaining areas as wooded land. No significant changes have occurred since that time.

#### 6.2.2 Historical Records Sources and Availability

The table below summarizes the historic resources reviewed or consulted as part of this Phase I ESA.

Resources	Source Checked	Source	Date
Aerial Photographs	Yes	EDR	1940, 1949, 1956, 1964, 1970, 1984, 1994, 2000, 2006, 2011, 2015, 2019
Fire Insurance Maps	Yes	EDR	No coverage.
USGS Topographic Maps	Yes	EDR	1904, 1906, 1955, 1965, 1973, 1981, 1984, 1992, 1996, 2013, 2016, 2019
City Directories	Yes	EDR	1994, 1999, 2003, 2004, 2009, 2014, 2017
Property Tax Files	Yes	Montgomery County Auditor	2013
Building Department Records	Yes	City of Huber Heights	No response to information request.
Zoning/Land Use Records	Yes	City of Huber Heights	2022
Interviews	Yes	City of Huber Heights	No information regarding current or past owners was provided.



Resources	Source Checked	Source	Date
Chain of Title, AULs and Environmental Liens	No	Not provided	NA
Recorded Land Title Records	No	Not provided	NA
Previous Reports	Yes	Not provided	NA

# 6.2.3 Subject Property Historical Uses

The table below summarizes the historic uses of the subject property.

Subject Property					
Decade	Resources	Description of Use			
Pre-1900	Not available	NA			
1900	Historic Topographic Map (1904)	Appears as vacant land, with a western facing slope.			
1910	Not available	NA			
1920	Not available	NA			
1930	Not available	NA			
1940	Historic Aerial Photographs (1940, 1949)	Appears mostly as grass land and sparsely wooded.			
1950	Historic Aerial Photographs (1956) Historic Topographic Map (1955)	No significant changes noted.			
1960	Historic Aerial Photographs (1964) Historic Topographic Map (1965)	Increase in wooded vegetation along the sloped portions to the east.			
1970	Historic Aerial Photographs (1970) Historic Topographic Map (1973) No City Directory Listings	Eastern and southern portions appear as wooded land, with the western portions as grass land and sparse wooded vegetation.			
1980	Historic Aerial Photographs (1980, 1984) Historic Topographic Map (1984) No City Directory Listings	The western, flat portion have been cleared of vegetation and there appears to be stockpiled soil likely from the construction of a large pond on the northern adjoining property.			
1990	Historic Aerial Photographs (1994) Historic Topographic Map (1992) No City Directory Listings	Stockpiled soils have been graded out or removed and what appears to be the outline of a roadway and cul-de-sac is visible.			
2000	Historic Aerial Photographs (2000, 2006) No City Directory Listings	More grading and earthmoving is apparent in the central and northern portions and a roadway appears.			
2010	Historic Aerial Photographs (2011, 2015, 2019) No City Directory Listings	All former graded areas appear to be filling in with vegetation.  Remaining areas are densely wooded.			
2020	Property Visit	No significant changes noted.			



# 6.2.4 Adjacent Property Historical Uses

The table below summarizes the adjacent properties historic uses.

Describe.	The same of the sa	Adjacent Property Uses	Occument
Decade	Resources	Description of Use	Occupant
re-1900	Not available	NA	NA
1900	Historic Topographic Map (1904)	NA	NA
1910	Not available	NA	NA
1920	Not available	NA	NA
1930	Not available	NA	NA
1940	Historic Aerial Photographs (1940, 1949)	North: Mostly wooded and grass land, with one residence. South: Taylorsville Road, then wooded and grass land and residences. East: Wooded and grass land, with one farmstead. West: Wildcat Road, then grass land.	Not available
1950	Historic Aerial Photographs (1956) Historic Topographic Map (1955)	No significant changes noted.	Not available
1960	Historic Aerial Photographs (1964) Historic Topographic Map (1965)	No significant changes noted.	Not available
1970	Historic Aerial Photographs (1970) Historic Topographic Map (1973) No City Directory Listings	North: Increase in wooded vegetation. South: Increase in wooded vegetation. East: Increase in wooded vegetation. West: No significant changes noted.	Not available
1980	Historic Aerial Photographs (1980, 1984) Historic Topographic Map (1984) No City Directory Listings	North: Improved with a residence and a large pond has been created.  South: Beyond Taylorsville Road, a residential neighborhood has been added.  East: Improved with a commercial building along Taylorsville Road, with undeveloped land to the north. West: Beyond Wildcat Road, a residential neighborhood has been added.	Not available
1990	Historic Aerial Photographs (1994) Historic Topographic Map (1992) City Directories (1994, 1999)	North: Occupied by a residence and business. South: No significant changes noted. East: No significant changes noted. West: No significant changes noted.	North: Residential and E&J Fence Service South: Residential East: Not listed West: Not listed
2000	Historic Aerial Photographs (2000, 2006) City Directories (2003, 2004, 2009)	North: Occupied by a residence. South: No significant changes noted. East: No significant changes noted. West: No significant changes noted.	North: Residential South: Residential East: Not listed West: Not listed
2010	Historic Aerial Photographs (2011, 2015, 2019) City Directories (2014, 2017)	No significant changes noted.	North: Residential South: Residential East: Huber Investments West: Not listed



Decade	Resources	Description of Use	Occupant
2020	Property visit	No significant changes noted.	North: Residential South: Residential East: Huber Investments West: Not listed

#### 6.2.5 Interviews

MAKSolve was provided contact information for the property owner representative and broker, Ms. Tracey Herron. Ms. Herron was interviewed about the history of the subject property via telephone. According to Ms. Herron, the subject property has always been vacant. She had no information regarding any environmental concerns associated with the subject property.

#### 6.2.6 Title Records

A copy of the subject property's Chain-of-Title has not been provided to MAKSolve for review.

## 6.2.7 Property Tax Files

Property tax files are reviewed to gather information regarding past ownership, appraisals, maps, photos, etc. According to the Montgomery County Auditor, the subject property is located in the City of Huber Heights, is identified as parcel number P70 01922 0001, is approximately 8.12 acres in size, and is owned by Luke Smith TR since 2022. According to the information presented, previous owners included TJH Holdings and Huber Properties as of 2013.

The land use for the property is labeled as: Commercial Vacant Land.

MAKSolve reviewed online tax assessor records for the subject property. General information obtained is included in various sections of this report. No environmentally related information was discovered.

#### 6.2.8 Building Department Records

Building Department records were not reasonably obtainable as of the publication of this report.

#### 6.2.9 Zoning/Land Use

According to the City of Huber Heights online zoning map, the subject property is zone I-1, Light Industrial and Mixed Use.

#### 6.2.10 Other Historical Records

MAKSolve was provided easement documentation related to the subject property. Within the documents, a plat plan showing Middleton Court and building set backs, along with all the property boundaries and adjoining property owners. The plan is dated February 1980, demonstrating that at that time it was planned for the subject property to be developed with this public roadway and for future building construction.



# 6.2.11 Previous Environmental Reports

MAKSolve was provided with a copy of a preliminary geotechnical report conducted at the subject property in February 2023. See below:

	Other Environmental Re	ports
Report Name, Date, Project Number, Preparer	Scope of Work	Findings, Conclusions
Preliminary Soil Study for Proposed Development Site, Wildcat Road, Huber Heights, Ohio, February 16, 2023, Job Number 208890 by Bowser-Morner	The purpose of the study is to determine the preliminary subgrade soil, depths to bedrock, and groundwater levels at the boring locations to be used by others for property purchasing and development considerations. To accomplish this, six soil borings were advanced at random locations throughout the property, from which soil physical characteristic data was obtained.	concerning staining or odor was noted. In addition, according to the soil descriptions, the soils beneath the subject property appear to be native brown silty and sandy clays.

#### 6.3 Additional Environmental Record Resources

Information Missing - enter data or select from Default Language.

# 6.4 Environmental Liens and Activity/Use Limitations

Environmental lien records recorded against the subject property were not provided by the client. At the direction of the client, performance of a review of these records was not included as part of the scope of services and unless notified otherwise, MAKSolve assumes that the client is evaluating this information outside of the context of this report.

## 6.5 Vapor Encroachment Evaluation

No activity and use limitations at the subject property indicating vapor encroachment were identified during this assessment. No significant release of chemicals of concern is known to have occurred on the subject property or the adjacent properties. Therefore, vapor encroachment does not appear to be a potential concern to the subject property.



# 7.0 INTERVIEWS & LOCAL GOVERNMENT RECORDS

		Co	rresponde	nce
Resource	Date of Contact	Type of Contact	Response Received	Remarks
Property Owner Representative	February 17, 2023	Telephone Interview	Yes	Response discussed below
Key Site Manager	Contact information not provided	N/A	No	Contact information not provided
Client (User)	January 6, 2023	Questionnaire	Yes	Response discussed below
Occupant	Not occupied	N/A	No	N/A
Major Occupant	Not occupied	N/A	No	N/A
Local Health Department	February 1, 2023	Email	Yes	Response discussed below
Local Fire Department	February 1, 2023	Email	Yes	Response discussed below
Local Building and Zoning Department	February 1, 2023	Email	No	No response received. Based on the other information obtained, the lack of response is not considered a significant data gap.
Local Water and Sewer Department	February 1, 2023	Email	No	No response received. Based on the other information obtained, the lack of response is not considered a significant data gap.
Ohio EPA	February 1, 2023	Email	Yes	Response discussed below
Bureau of Underground Storage Tank Regulations (BUSTR)	February 1, 2023	Online Request	Yes	Response discussed below
Other Interviews	None	N/A	No	N/A

# 7.1 Interviews & Local Government Records Review

MAKSolve reviewed the information provided from the above identified sources,

	Interviews
Role:	Owner
Title:	Broker
Name:	Tracey Herron
Company:	Exit Realty
Method:	Telephone
Comments:	Ms. Herron had no knowledge of environmental concerns associated with the subject property. Ms. Herron had limited information regarding the history of the subject property and mentioned the current owners acquired the property as part of an auction.

Role:	Client
Title:	User/City Engineer
Name:	Russ Bergman
Company:	City of Huber Heights
Method:	Completed Questionnaire
Comments:	Mr. Bergman had no knowledge of environmental concerns associated with the subject property. Mr. Bergman stated that there may be shallow bedrock in the area.



Role:	Local Gov't Official
Title:	Environmental Health Senior Manager
Name:	Jason Turner
Company:	Dayton and Montgomery County Health Department
Method:	Email Response
Comments:	According to Mr. Turner, the health department has no records for the subject property.
Role:	Local Gov't Official
Title:	Administrative Professional
Name:	Regina Susong
Company:	Huber Heights Fire Division
Method:	Email Response
Comments:	According to Ms. Susong, the fire department has no records for the subject property.
Role:	Local Gov't Official
Title:	Administrative Professional
Name:	Penny Prather-Dix
Company:	Ohio EPA
Method:	Email Response
Comments:	According to Ms. Prather-Dix, the Ohio EPA has no records for the subject property.
Role:	Local Gov't Official
Title:	Administrative Professional
Name:	Marla Reichanbach
Company:	Bureau of Underground Storage Tank Regulations (BUSTR)
Method:	Email Response
Comments:	According to Ms. Reichenbach, the BUSTR has no records for the subject property.



## 8.0 NON-SCOPE CONSIDERATIONS

Non-scope considerations were not assessed as part of this report.



#### 9.0 FINDINGS

The findings section identifies features, activities, uses, and conditions that may indicate the presence or likely presence of hazardous substances or petroleum products at the subject property. Some findings may be indicative of the presence of RECs, CRECs, HRECs, or de minimis conditions.

The assessed subject property consists of approximately 8.12 acres located in a residential area, is accessed from Wildcat Road to the west, is improved with an asphalt-paved cul-de-sac, identified as Middleton Court, is located in Huber Heights, Ohio and is listed as being owned by Luke Smith TR. The key components of this Phase I Environmental Site Assessment (ESA) of the Proposed Public Works facility located at 5001 Taylorsville Road in Huber Heights, Montgomery County, OH (the Subject Property) are site reconnaissance, records review, and interviews.

Data gaps were encountered, however, none impacted the Environmental Professional's ability to assess recognized environmental conditions.



#### 10.0 CONCLUSIONS

We have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E1527-21 of 5001 Taylorsville Road Huber Heights, OH. Any exceptions to, or deletions from, this practice are described in Section 2.3 of this report.

This assessment has revealed no recognized environmental conditions.

One De Minimis Condition was noted in connection with the subject property:

 Illegally dumped trash and debris, including tires, unidentifiable material and general refuse was observed.



# 11.0 OPINIONS

Based on the above referenced information, MAKSolve's opinion is the following:

· Proper removal and disposal of discarded debris and refuse appears warranted.



#### 12.0 REFERENCES

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The following references were used in the completion of this report.

#### 12.1 Published References

<u>CERCLIS</u> - Comprehensive Environmental Response, Compensation, and Liability Information System, United States Environmental Protection Agency (U.S. EPA), List-8: State/Event Listing (EDR),

CORRACTS - U.S. EPA, Office of Solid Waste and Emergency Response (EDR),

<u>Emergency Response Notification System</u> - U.S. EPA, Office of Solid Waste and Emergency Response (EDR),

<u>Hazardous Waste Handlers and TSD Facilities</u> - U.S. EPA Division of Hazardous Waste Management (EDR),

<u>LUST Data</u> - Ohio Division of State Fire Marshal, Bureau of Underground Storage Tank Regulations (BUSTR) (EDR),

National Priorities List — U.S. EPA (EDR),

Ohio Spills List - Ohio Environmental Protection Agency (OEPA), Division of Emergency Response,

Solid Waste Facilities - OEPA, Division of Solid and Infectious Waste (EDR),

U.S. EPA - Enforcement Compliance History (ECHO) online database,

UST Data - Ohio Division of State Fire Marshal, BUSTR (EDR).

#### 12.2 Maps, Aerial Photographs, and other Geographic References

Aerial Photographs - EDR,

County Tax Map - Montgomery County Auditor's Office,

Historical City Directories — EDR,

Historical Topographic Maps — EDR,

Sanborn Fire Insurance Maps — EDR (No Coverage)

<u>Soil Survey of Montgomery County, Ohio</u> - United States Department of Agriculture, Soil Conservation Services (EDR) and USDA Web Soil Survey, and

<u>U.S. Geological Survey 7.5-Minute and 15-Minute Series Topographic Maps</u> — Dayton North , Ohio (EDR).

Preliminary Soil Study for Proposed Development Site, Wildcat Road, Huber Heights, Ohio, February 2023 by Bowser-Morner



# Preliminary Report

# **BOWSER-MORNER**

4518 Taylorsville Road • P.O. Box 51 • Dayton, Ohio 45401-0051 Phone (937) 236-8805 Fax (937) 233-2016

With other offices in: Toledo, Ohio

Phone: (419) 255-8200 Fax: (419) 255-7935

To: Mr. Russ Bergman; Mr. Jon Wallenkamp From: Mr. Chris Ryan, ext. 283

Client: City of Huber Heights; Kueny Architects, Date: February 8, 2024

LLC

Phone No: (937) 237-5816; (262) 857-810 No. of Pages: 10

Email: rbergman@hhoh.org; Job No.: 213502

JonW@kuenyarch.com

Re: Soil Study for Proposed Retaining Wall, Wildcat Road, Huber Heights, Ohio

## **INTRODUCTION**

We understand that you propose to construct a retaining wall as part of the development of the property on the northeast corner of the intersection of Wildcat Road and Taylorsville Road in Huber Heights, Ohio. The proposed retaining wall will be approximately 25 feet in height and will be approximately 475 feet long. This study is intended to determine the subgrade soil, depths to bedrock, and groundwater levels at the boring locations to be used by others for their design and construction of the retaining wall. No design loading information was provided.

Bowser-Morner Report No. 208890-0223-038, dated February 23, 2023 discusses the soil conditions at this site. A total of six soil borings were performed for that study.

Two (2) soil borings were made for this study at the locations shown on the attached boring location plan. The boring logs, a preliminary boring location plan, and our recommendations for the above-referenced project are presented in this preliminary report. The final report will be issued after the results of the laboratory test tests are available.

**BOWSER-MORNER** is an accredited independent testing laboratory and engineering consultant providing services in geotechnical engineering, environmental consulting, construction monitoring and testing, analytical sciences, and subsurface exploration and sampling.

## FOUNDATION RECOMMENDATIONS

Based on the information from the borings made for this study, auger refusal occurred in both borings. The depths and elevations to the top of the apparent bedrock are tabulated in Table 1.

Table 1. Depths to Bottoms of Unreliable Soil Layer

Boring No.	Depth to Top of Bedrock (ft)	Elevation* at Top of Bedrock (ft)	Depth to Auger Refusal (ft)	Elevation at Auger Refusal (ft)				
1	23.0	854.7	28.9	848.8				
2	28.0	850.3	38.9	839.4				

<sup>\*</sup>In reference to surface elevation based on Ohio South State Plane Coordinate System.

Based on the results of the standard penetration tests (SPT) in the borings, the depths and elevations to bearing strata at those boring locations and the recommended net allowable bearing capacities on the original soil strata and/or on bedrock are outlined in Table 2.

Table 2. Depths to Bottoms of Unreliable Soil Layer

Boring No.	Depth to Bottom of Unreliable Soil (ft)	Elevation* at Bottom of Unreliable Soil (ft)	Weak Soil, and/or Rock	Allowable Bearing Capacity (psf)
1	1.0	876.7	Weak Soil	2,000
	8.5	869.2	Weak Soil	4,000
	28.9	848.8	Rock	10,000
2	1.0	877.3	Weak Soil	1,500
	3.5	874.8	Weak Soil	4,000
	38.9	839.4	Rock	10,000

<sup>\*</sup> In reference to surface elevation based on Ohio South State Plane Coordinate System.

Based on the subgrade soil conditions indicated in Table 2 above, the weak soil is unreliable to support the proposed retaining wall. The foundation excavations should be extended through the weak soil layers to be extended onto the suitable depths and elevations with the desired bearing capacity outlined above. Any non-organic soil removed from the site can be stock-piled to be used as backfill for the preparation of the subgrade for the retaining wall. The soil backfill behind the retaining wall should be a free drain sand and gravel to prevent the accumulation of water behind the wall. Consequently, the silty and clayey soil should not place directly behind the proposed retaining wall. However, the silty and clayey soil can be used as the seal layer over the top of the granular backfill behind the wall to reduce the surface water infiltration into the granular backfill.

The bottoms of retaining wall foundation/base should be placed at least 36 inches below the final adjacent grades to protect against frost penetration and any potential heaving problem.

After the excavation extends to the desired grade, the top foot at the bottom of the excavation on soil, should be compacted to at least 90% of the maximum dry-unit weight as defined by the modified Proctor test (ASTM D1557) before any new fill or foundation is placed. Any soft soil pockets should be undercut and replaced with compacted fill. After the bottoms of the excavations have been compacted, structural fill, if needed, can be placed to bring the bottom of the excavations to the desired grade. The fill placed below the bottoms of the foundations should be placed in eight-inch-thick horizontal lifts and compacted to at least 95% of the maximum dry-unit weight with moisture contents within 2% of the optimum moisture content as determined by the modified Proctor test (ASTM D1557). Fill placed above the bottoms of the foundations should be compacted to at least 90% of the maximum dry-unit weight with moisture contents within 2% of the optimum moisture content as determined by the modified Proctor test (ASTM D1557) to minimize the potential settlement of the ground surface around the wall foundation. The granular backfill to be placed within two feet behind the retaining wall should be hand tamped to reduce the lateral pressure against the newly constructed wall.

Again, the undocumented and uncontrolled non-organic soil removed from this site that is free of organic or objectionable materials as defined by a field technician who is qualified in soil material identification and compaction procedures can be reused as fill or backfill below the bottom of the wall foundation or as the seal layer over the granular backfill behind the newly constructed wall. Objectionable or undesirable soils are defined as those materials that cannot meet design placement specifications or materials that will deteriorate with time.

The wall foundations can be supported on the original subgrade soil, newly compacted backfill, or bedrock extending to the depths outlined in Table 2. The foundations can be designed with the corresponding net allowable bearing capacities outlined in Table 2. For the recommended allowable bearing capacities outlined in Table 2 for the original soil layer or for the newly compacted backfill, the total estimated amount of settlement of the foundations will be about one inch.

The retaining-wall backfill should consist of free-draining sand and gravel backfill that will keep water from accumulating behind the wall. A drainage collection pipe that provides positive discharge away from the wall should be installed at the bottom of the backfill along the full length of the foundation. Weep holes should also be provided on the face a concrete retaining wall. A layer of non-woven, needle-punched, filter fabric should be placed behind the retaining wall before the granular fill is placed. If water is allowed to accumulate behind the wall, full hydrostatic pressures should be included in the design of the retaining wall.

The base of the retaining wall should be at least 36 inches below the final grade, and the free-draining granular backfill should be more than three feet thick to protect against frost penetration and heaving from the front face of the retaining wall.

Soil and/or rock anchors can be installed to provide the lateral resistance to prevent the sliding of the wall. A global-stability analyses should be performed by the wall designer, and is beyond the scope of our study.

#### LATERAL EARTH PRESSURE FOR THE RETAINING WALL

The retaining wall should be designed to resist the lateral earth pressure. Free-draining granular materials should be placed behind the retaining wall. Water should not be allowed to accumulate behind the retaining wall. With the retaining walls to be backfilled with free-draining granular backfill, an "at-rest," lateral earth-pressure coefficient of 0.5 should be used to compute the lateral earth pressure against the retaining wall. A lateral soil pressure of 63 pounds per square foot per foot depth can be used in the design of the retaining wall. If water will be allowed to accumulate behind the retaining wall, a static water pressure of 62.4 psf per foot depth should be added onto the design lateral pressure against the retaining wall. The design of the retaining wall is beyond the scope of the study.

# **GROUNDWATER**

Free groundwater was encountered in both borings at depths of 13.5 to 18.0 feet below the existing grade during the boring operations. Any groundwater encountered in the excavations should be lowered to the bottom of the maximum excavation using sumps and pumps. Sumps can consist of perforated pipes or drums installed vertically in the relatively permeable granular soils

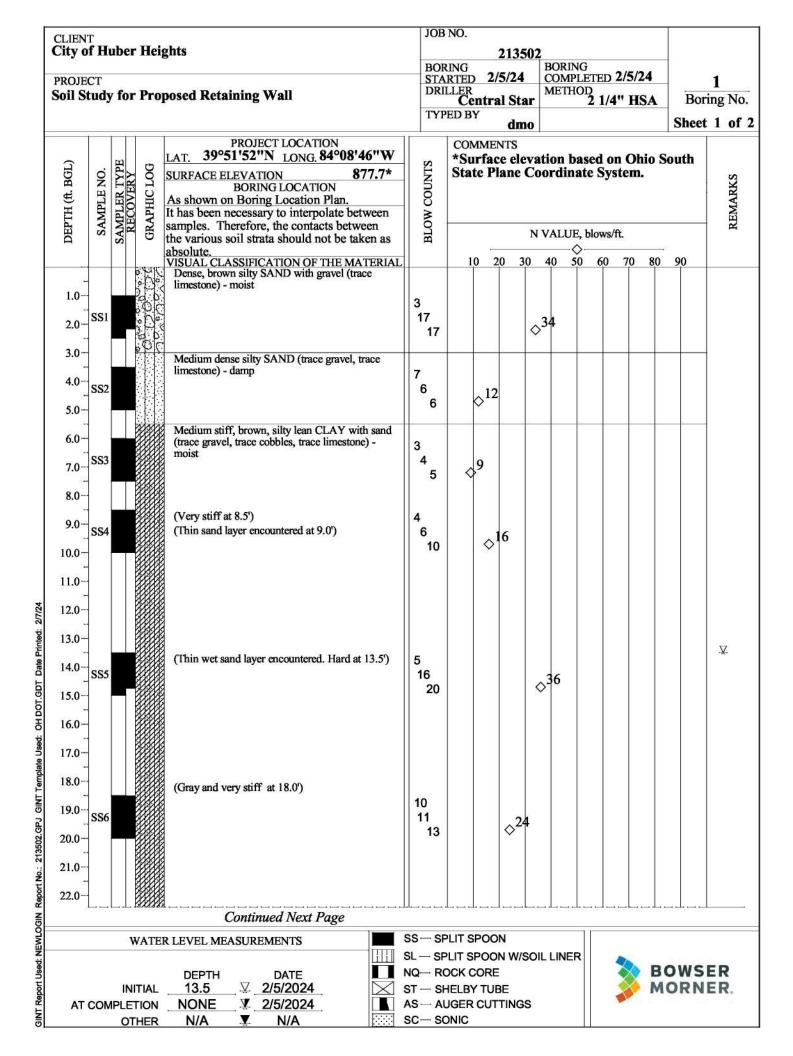
and surrounded with free-draining sand and gravel. The perforations of the pipe should be covered with a layer of filter fabric to keep silt and fine sand from pumping through the sumps. Care must be exercised when pumping from sumps that extend into silts or other granular soils since general deterioration of the bearing soils and a localized "quick" condition could result. The groundwater should be kept at a level below the fill operation during the placement and compaction of the backfill materials during the construction of the foundations.

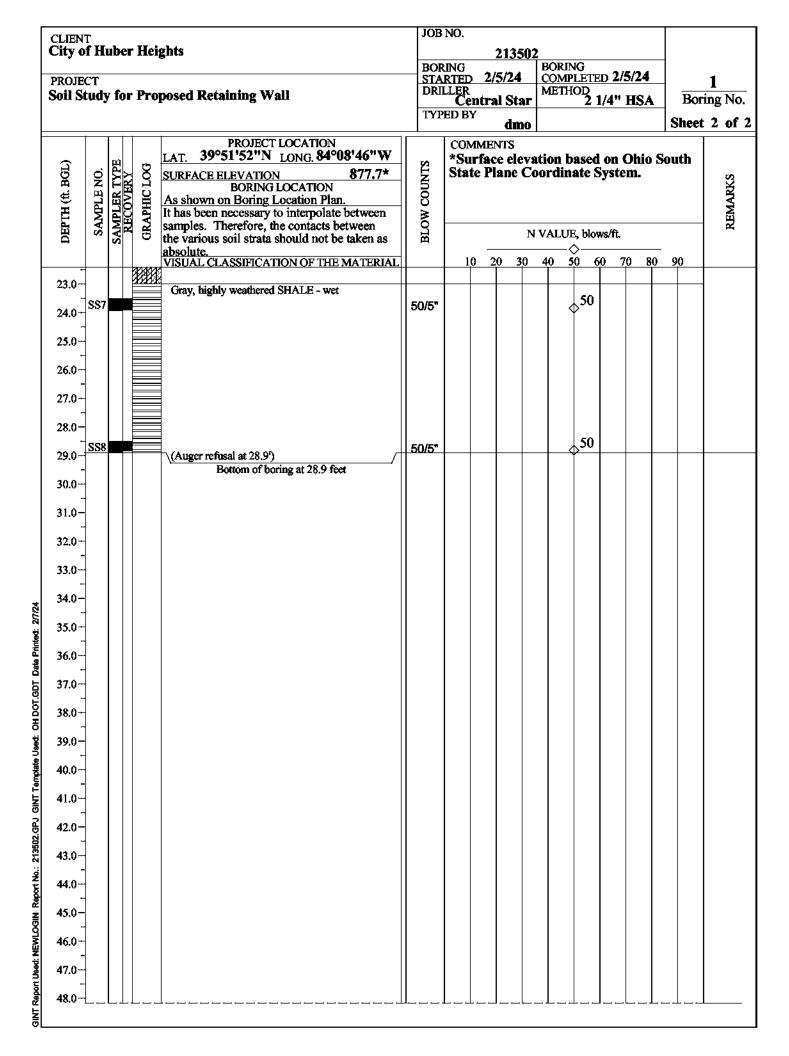
The amount and type of dewatering required during construction will depend on groundwater levels and the effectiveness of the contractor's techniques in preventing surface runoff from entering open excavations. Typically, groundwater levels are highest during winter and spring, and lower in summer and early fall.

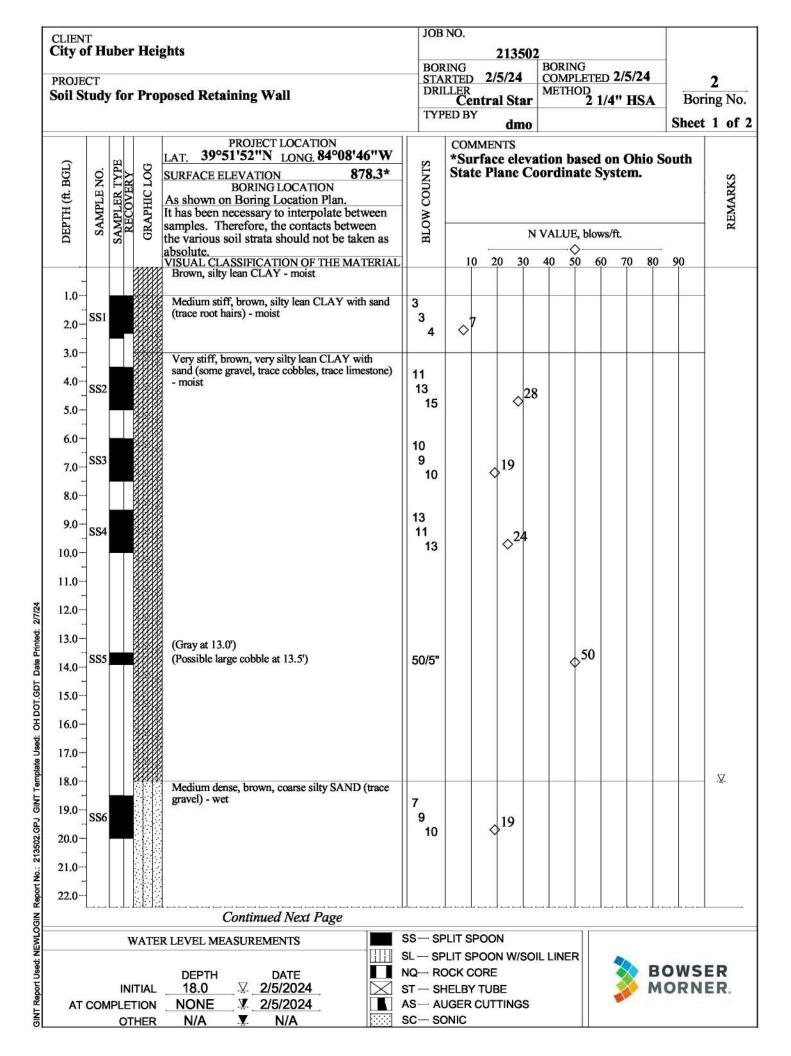
## **SITE CLASSIFICATION FOR SEISMIC DESIGN**

Based on the results of the standard penetration tests (SPT) in the borings made for this study, the average "N" is 28 to 31 blows per foot for the soil layer within 28.9 to 38.9 feet of the existing grade. Bedrock was encountered at depths of 23.0 to 28.0 feet below the existing grade in these borings. Because the bedrock was encountered within relatively shallow depths, we have the opinion that the site will be classified as a "C" type in accordance with the *Ohio Building Code*. If the proposed wall foundation will be supported directly on bedrock, the site can be re-classified as a "B" type.

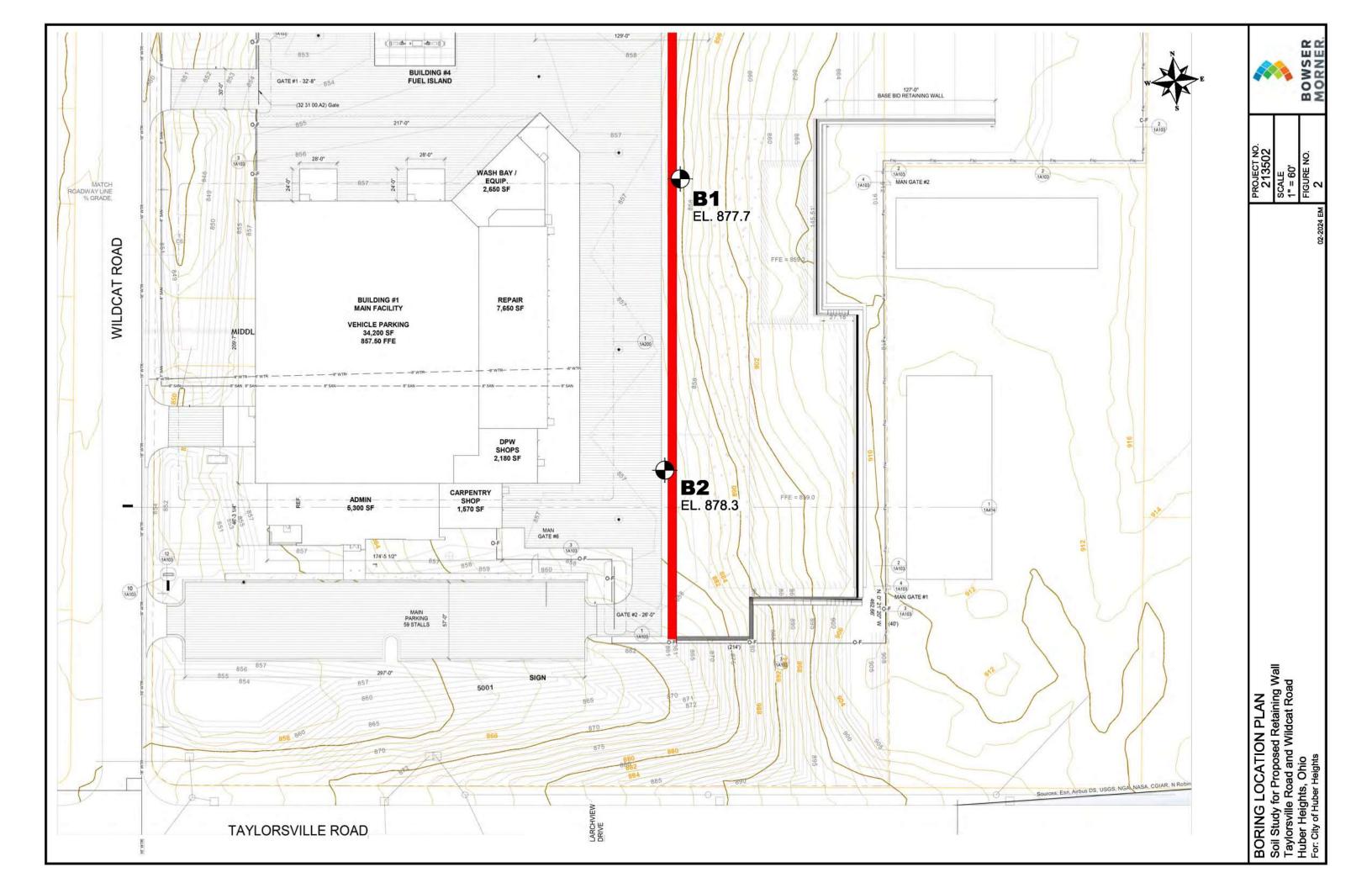
The final report will be issued on a later day after all of the laboratory test results are available. If you have any questions, please give us a call.







CLIEN City (	T of H	ube	r H	eig	ghts		NO.		213	502							
	PROJECT Soil Study for Proposed Retaining Wall				BORING STARTED 2/5/24 DRILLER Central Star TYPED BY BORING COMPLETED 2 METHOD 2 1/4"					o 2/5. /4" F	/5/24 ' HSA Bo			2 oring No.			
						1141	EDB	Y	dı	no					Sł	ieet	2 of 2
DEPTH (ft. BGL)	SAMPLE NO.	SAMPLER TYPE	GRAPHIC LOG		PROJECT LOCATION LAT. 39°51'52"N LONG. 84°08'46"W  SURFACE ELEVATION 878.3* BORING LOCATION As shown on Boring Location Plan. It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.	* State Plane Coordinate System.							REMARKS				
	+	H			VISUAL CLASSIFICATION OF THE MATERIAL		1	0	20	30 4	0 5	0 60	, 70	80	90		
23.0~ 24.0~ 25.0~ 26.0~ 27.0~	SS7				Very stiff, gray, silty lean CLAY with sand (trace gravel, trace cobbles) - moist	6 7 9		<b>\$</b>	16								
28.0-																	
29.0~	SS8				Gray, highly weathered SHALE - moist	25 50/6*						50					
30.0~																	
31.0-	-																
32.0-																	
33.0																	
34.0	SS9					37 50/3*					<	50					
35.0 - 35.0 - 35.0 - 36.0 - 37	-																
36.0° 8 .	1																
37.0~	-																
38.0÷	SS10					50/4"					,	50					
<b>39.0−</b> 5 .	551				\(\(\text{(Auger refusal at 38.9')}\)  Bottom of boring at 38.9 feet	JU/4											
₩ 40.0~																	
41.0~	-																
원 42.0- 발	-																
43.0~																	
44.0~																	
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46.0÷																	
47.0	-																
48.0~	L_	LL	L_		l	<u>L</u>	L	L	J	L	L		L	L			
<u>z</u>																	



		BID FORM
	Со	ontractor: Division of Work:
Cit	y of Hu	ber Heights
Fo	r: Hube	er Heights – New Public Works Facility
Α.	of the Bidder Bond, prepar propos labor, service	ndersigned, having familiarized themselves with the local conditions affecting the cost Work, and with the Bidding Documents including Invitation for Bids, Instructions to rs, Bid Form, Bid Bond, Agreement, Performance Bond, Labor and Material Payment Certificate of Insurance, Plans and Specifications, including all Addenda thereto; as red by Kueny Architects, LLC, and on file at the office of the Architect; hereby ses to perform everything required to be performed and to provide and furnish all materials, necessary tools, expendable equipment and al utilities and transportation es necessary to complete in a workmanlike manner all Work listed below, as follows:
	а.	Base Bid  All labor, materials, services and equipment necessary for completion or the Work required for the (Huber HeightsNew Public Works the Sum of
		Dollars (\$)
	b.	Alternate No. 1  ADD to the base bid amount to <b>Fuel Island</b> , the Sum of
		Dollars (\$)
	C.	Alternate No. 2
		ADD to the base bid amount to Salt Storage, the Sum of
		Dollars (\$

February 6, 2024 00 41 00-1

d.	Alternate No. 3
	ADD to the base bid amount for <b>5 Ton Hoist Crane</b> , the Sum of
	Dollars (\$)
e.	Alternate No. 4
	ADD to the base bid amount to <b>Vehicle Lift (a)</b> , the Sum of
	Dollars (\$)
	ADD to the base bid amount to <b>Vehicle Lift (b),</b> the Sum of
	Dollars (\$)
	ADD to the base bid amount to <b>Vehicle Lift (c),</b> the Sum of
	Dollars (\$)
	ADD to the base bid amount to <b>Vehicle Lift (d)</b> , the Sum of
	Dollars (\$)
	ADD to the base bid amount to <b>Vehicle Lift (e),</b> the Sum of
	Dollars (\$

# 2. Unit Prices - FOR ALL GENERAL CONSTRUCTION

Should more or less Work of the following categories be required, adjustment will be made to the Contract Sum at the following unit prices, which shall include all expenses, transportation, trucking, restocking charges and overhead profit.

	1).	Unit Price 1A (Section	on 31 20 00)		
		•	d of soil excavated, for ac adation walls and wall foc		to reach good
		per cubic yard, or	Dollars (\$ omitting same.		_)
	2).	. Unit Price 1B (Secti	ion 31 20 00)		
		Price per cubic yard paving, the amount	d of compacted backfill, in of	n place, at floor slabs o	r asphalt
		per cubic yard.	Dollars (\$		_)
	3).	Unit Price 1C (Sect	ion 03 30 00)		
			d of additional concrete, folace) required for additio		n Walls, the
		per cubic yard or or	Dollars (\$ mitting same.		_)
В.		npanying this Propos ed by the Instructions	al is a Bid Bond in the ar s to Bidders.	nount of ten percent (1	0%) of the Bid, as
C.			Instructions to Bidders, he amount shown for each		
		Item Specified	Substitutio	n Rec	luce Bid
_					

February 6, 2024 00 41 00-3

D.	. It will require the following number of calendar days to complete the Work required by this Contractdays.		
E.	Receipt of the following Addenda to the Contract Documents are acknowledged:		
	Number and Date	Number and Date	
_			
_			

- F. In Submitting this Proposal, it is understood that the Owner reserves the right to reject any or all Proposals, to waive technicalities, and to advertise for new Proposals, but that this Bid shall remain open and shall not be withdrawn for a period of 90 days from the date prescribed for its opening.
- G. If written notice of the acceptance of this Bid is mailed or delivered personally to the undersigned within 30 days after the date set for opening of this Bid, or at any time thereafter before it is withdrawn, the undersigned Bidder will execute and deliver the Contract Documents to the Owner in accord with this Bid as accepted, and will also furnish an deliver to the Owner all required Bonds and proof of insurance coverage required, all within 20 days after personal delivery or deposit in the mail of a notification of acceptance of this Bid.
- H. Notice of acceptance or request for additional information may be addressed to the undersigned at the address set fourth below.

# City of Huber Heights - New Public Works Facility

discrepancy between words and figures the words shall prevail. J. I hereby certify that all statements are made on behalf of (Name of Corporation, Partnership or Individual submitting Bid) of the city of\_\_\_\_\_, State of\_\_\_\_\_, that I have examined and carefully prepared this Proposal from the Plans and Specifications and have checked same detail before submission; that I have fully authority to make such statements, and Proposal in (its, their, my) behalf, and that said statements are true and correct. Please check one Signed Contractor of the following: Sole Owner Address \_\_\_\_\_ Corporation\_\_\_\_ Partnership Name of Partners: By State of: County of: Subscribed and sworn to before Me this day of , 20\_\_\_\_ Notary Public: My commission expires: \_\_\_\_\_

I. Wherever in this proposal an amount is stated in both words and figures, in case of

February 6, 2024 00 41 00-5 BID FORM

List of Subcontractors: Each Bidder is required to submit a complete list of subcontractors with the proposal or within 24 hours after bid due date.

K. Pursuant with the requirements of the Instructions to Bidders, the Bid is based on the following subcontractors (list on name for each branch or subtitle of Work to be subcontracted):
 WORK CONTRACTOR CITY

<u>work</u>	CONTRACTOR	<u>011 1</u>

# DRAFT AIA Document A101 - 2017

# Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « » (In words, indicate day, month and year.)

#### **BETWEEN** the Owner:

(Name, legal status, address and other information)

« City of Huber Heights 6131 Taylorsville Rd. Huber Heights, Ohio 45424 »« »

#### and the Contractor:

(Name, legal status, address and other information)

« TBD »« »
« »
« »
« »

## for the following Project:

(Name, location and detailed description)

« City of Huber Heights Ohio - New Public Works Facility »
« The facility is expected to house, Streets, Storm Sewer, Traffic Signs, Vehicle Repair and Buildings & Grounds Departments. Outbuildings include a detached cold equipment storage building of approximately 13,650 square feet, a 5,000-ton capacity salt storage

#### The Architect:

(Name, legal status, address and other information)

«Kueny Architects, LLC 10505 Corporate Drive Suite 100 Pleasant Prairie, WI 53158 »« »

The Owner and Contractor agree as follows.

#### ADDITIONS AND DELETIONS:

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

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

The parties should complete Al01®-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.



ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

#### TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

#### EXHIBIT A INSURANCE AND BONDS

# ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

#### ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

#### ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

[ « » ] The date of this Agreement.

[ « » ] A date set forth in a notice to proceed issued by the Owner.

[ « X » ] Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

«Date of Commencement to be determined by Owner and Contractor Substantial completion to be determined by Owner and Contractor »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

#### § 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

[ «	[ « » ] Not later than « » ( « » ) calendar days from the date of commencement of the Work.		
[ «	» ] By the following date: « »		
§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:			
	Portion of Work	Substantial Completion Date	
	the Contractor fails to achieve Substantial C all be assessed as set forth in Section 4.5.	ompletion as provided in this Sec	etion 3.3, liquidated damages,
ARTICLE 4 CONTRACT SUM § 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » (\$ « » ), subject to additions and deductions as provided in the Contract Documents.			
§ 4.2 Alte § 4.2.1 A	rnates Iternates, if any, included in the Contract Sur	n:	
	Item Alternates #	Price	
§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. (Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)			
(Insert be	low each alternate and the conditions that m	ust be met for the Owner to accep	pt the alternate.)
(Insert be	Item  N/A  Dwances, if any, included in the Contract Sureach allowance.)	Price Price Price Price	pt the alternate.)
§ 4.3 Allo (Identify a	Item  N/A  Dwances, if any, included in the Contract Surech allowance.)	Price  Price  Price  1. Price  \$125,000	conditions for Acceptance
§ 4.3 Allo (Identify a	Item  N/A  Downces, if any, included in the Contract Sureach allowance.)  Item  General Allowance  t prices, if any: the item and state the unit price and quantity	Price  Price  Price  1. Price  \$125,000	conditions for Acceptance
§ 4.3 Allo (Identify a	Item  N/A  owances, if any, included in the Contract Sureach allowance.)  Item  General Allowance  t prices, if any: the item and state the unit price and quantity	Price  Price  Price  \$125,000  limitations, if any, to which the u	conditions for Acceptance  unit price will be applicable.)
§ 4.3 Allo (Identify a state of the state of	Item  N/A  Downces, if any, included in the Contract Sureach allowance.)  Item  General Allowance  t prices, if any: the item and state the unit price and quantity	Price Price \$125,000  limitations, if any, to which the u	conditions for Acceptance  unit price will be applicable.)
§ 4.3 Allo (Identify a state of the state of	Item  N/A  Owances, if any, included in the Contract Sureach allowance.)  Item  General Allowance  t prices, if any: the item and state the unit price and quantity  Item  Exhibit #1 Bid Form  uidated damages, if any:	Price Price \$125,000  limitations, if any, to which the usual to the second of the sec	conditions for Acceptance  unit price will be applicable.)
§ 4.3 Allo (Identify a § 4.4 Unit (Identify a § 4.5 Liq (Insert tet) (Insert tet) § 4.6 Oth	Item  N/A  Owances, if any, included in the Contract Sureach allowance.)  Item  General Allowance  t prices, if any: the item and state the unit price and quantity  Item  Exhibit #1 Bid Form  uidated damages, if any: trms and conditions for liquidated damages, if O per Calendar Day as detailed in the Contra	Price Price \$125,000  limitations, if any, to which the u Units and Limitations  f any.)	conditions for Acceptance  unit price will be applicable.)  Price per Unit (\$0.00)

#### ARTICLE 5 PAYMENTS

#### § 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the "twentieth (20)" day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the "final" day of the "following" month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than "thirty" ( "30") days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

- § 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.
- § 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.
- § 5.1.6 In accordance with AIA Document A201<sup>TM</sup>–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:
- § 5.1.6.1 The amount of each progress payment shall first include:
  - .1 That portion of the Contract Sum properly allocable to completed Work;
  - .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
  - .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.
- § 5.1.6.2 The amount of each progress payment shall then be reduced by:
  - .1 The aggregate of any amounts previously paid by the Owner;
  - .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
  - .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
  - .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
  - .5 Retainage withheld pursuant to Section 5.1.7.

#### § 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

«5% retainage will be held from Application for Payment »

§ 5.1.7.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

 $\ll N/A \gg$ 

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

 $\ll N/A \gg$ 

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

(Insert any other conditions for release of retainage upon Substantial Completion.)

 $\ll N/A \gg$ 

- § 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.
- § 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

# § 5.2 Final Payment

- § 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when
  - .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
  - .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

«Contractor has fully completed all of its obligations under the Contract Documents, and Owner is in receipt of a Certificate of Occupancy, as-built drawings, Final Payment is due once the punch list is completed and signed off by Architect and Owner »

# § 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

«5 » % « »

#### ARTICLE 6 DISPUTE RESOLUTION

#### § 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker. (If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

 $\stackrel{<\!\!<\!\!N/A}{\sim\!\!\!>}$ 

« »
§ 6.2 Binding Dispute Resolution For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:  (Check the appropriate box.)
[ « » ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017
[ « X » ] Litigation in a court of competent jurisdiction
[ « » ] Other (Specify)
« »
If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.
ARTICLE 7 TERMINATION OR SUSPENSION § 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.
§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows: (Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)
«N/A »
§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.  ARTICLE 8 MISCELLANEOUS PROVISIONS § 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.
§ 8.2 The Owner's representative: (Name, address, email address, and other information)
City of Huber Heights » Michael Gray Public Works Manager » 7020 Brandt Pike Huber Heights, OH 45424 » MGray@hhoh.org »
§ 8.3 The Contractor's representative: (Name, address, email address, and other information)
«TBD »

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User Notes:

« » « » « » § 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

#### § 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101<sup>TM</sup>\_2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101<sup>TM</sup>–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203<sup>TM</sup>–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

 $\ll N/A \gg$ 

§ 8.7 Other provisions:

« »

#### ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101<sup>TM</sup>\_2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101<sup>TM</sup>–2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201<sup>TM</sup>–2017, General Conditions of the Contract for Construction
- 4 AIA Document E203<sup>TM</sup>–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

(Insert the date of the E203-2013 incorporated into this Agreement.)



.5 Drawings

Number Title Date Drawing Index

.6 Specifications

Section Title Date Pages
Exhibit #3 Table of Content

.7 Addenda, if any:

Number Date Pages Addendum #

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ « » ] AIA Document E204<sup>TM</sup>–2017, Sustainable Projects Exhibit, dated as indicated below:

	« »				
	[ « » ] The Sustainability	Plan:			
	Title	Date	Pages		
	[ « X » ] Supplementary an	d other Conditions of the Contract:			
	Document 00 73 00	Title Supplementary General Condition	Date Pages		
.9	Other documents, if any, listed below: (List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201 <sup>TM</sup> –2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)				
	« »				
his Agreen	nent entered into as of the day	and year first written above.			
OWNER (	Signature)	CONTRACTOR	(Signature)		
« »« »	7.4.7	« »« »			
(Printed r	name and title)	(Printed name o	and title)		

(Insert the date of the E204-2017 incorporated into this Agreement.)

# Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the day of in the year (In words, indicate day, month and year.)

for the following **PROJECT**:

(Name and location or address)

City of Huber Heights - New public Works Facility 6131 Taylorsville Rd. Huber Heights, Ohio 45424

THE OWNER:

(Name, legal status and address)

City of Huber Heights 6131 Taylorsville Rd. Huber Heights, Ohio 45424

THE CONTRACTOR:

(Name, legal status and address)

**TBD** 

TABLE OF ARTICLES

A.1 GENERAL

A.2 OWNER'S INSURANCE

A.3 CONTRACTOR'S INSURANCE AND BONDS

A.4 SPECIAL TERMS AND CONDITIONS

# ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201<sup>TM</sup>\_2017, General Conditions of the Contract for Construction.

# ARTICLE A.2 OWNER'S INSURANCE

#### § A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

# § A.2.2 Liability Insurance

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

#### **ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

This document is intended to be used in conjunction with AIA Document A201®–2017, General Conditions of the Contract for Construction. Article 11 of A201®–2017 contains additional insurance provisions.

# § A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss Sub-Limit N/A N/A

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows: (Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage Sub-Limit N/A N/A

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

# § A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

# § A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.) § A.2.4.1 Loss of Use. Business Interruption, and Delay in Completion Insurance, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss. § A.2.4.2 Ordinance or Law Insurance, for the reasonable and necessary costs to satisfy the minimum [ ] requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project. [ ] § A.2.4.3 Expediting Cost Insurance, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property. § A.2.4.4 Extra Expense Insurance, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred. [ ] § A.2.4.5 Civil Authority Insurance, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance. [ ] § A.2.4.6 Ingress/Egress Insurance, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage. § A.2.4.7 Soft Costs Insurance, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses. § A.2.5 Other Optional Insurance. The Owner shall purchase and maintain the insurance selected below. (Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.) § A.2.5.1 Cyber Security Insurance for loss to the Owner due to data security and privacy breach,

including costs of investigating a potential or actual breach of confidential or private information. (Indicate applicable limits of coverage or other conditions in the fill point below.)

# [ ] § A.2.5.2 Other Insurance

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

# ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

#### § A.3.1 General

- § A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner, the Architect, and the Architect's consultants as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.
- § A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.
- § A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04. The additional insurance shall be evidenced in the form of a Policy Endorsement acceptable to the Village.

#### § A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below: (If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

N/A

#### § A.3.2.2 Commercial General Liability

- § A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than One Million Dollars (\$ 1,000,000 ) each occurrence, Two Million Dollars (\$ 2,000,000 ) general aggregate, and One Million Dollars (\$ 1,000,000 ) aggregate for products-completed operations hazard, providing coverage for claims including
  - .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
  - .2 personal injury and advertising injury;
  - .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;

- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.
- § A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:
  - .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
  - .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
  - .3 Claims for bodily injury other than to employees of the insured.
  - .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
  - .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
  - .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
  - .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
  - .8 Claims related to roofing, if the Work involves roofing.
  - .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
  - .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
  - .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.
- § A.3.2.3 Automobile Liability covering vehicles owned, hired, and non-owned vehicles used, by the Contractor, including the loading and unloading thereof, with policy limits of not less than One Million Dollars (\$ 1,000,000) per occurrence, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.
- § A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.
- § A.3.2.5 Workers' Compensation at statutory limits.
- § A.3.2.6 Employers' Liability with policy limits not less than One Million Dollars (\$ 1,000,000) each accident, One Million Dollars (\$ 1,000,000) each employee, and One Million Dollars (\$ 1,000,000) policy limit.
- § A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks
- § A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than Two Million Dollars (\$ 2,000,000 ) per claim and Two Million Dollars (\$ 2,000,000 ) in the aggregate.
- § A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than Two Million Dollars (\$ 2,000,000) per claim and Two Million Dollars (\$ 2,000,000) in the aggregate.
- **§ A.3.2.10** Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than Two Million Dollars (\$ 2,000,000 ) per claim and Two Million Dollars (\$ 2,000,000 ) in the aggregate.

- § A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than N/A (\$ N/A ) per claim and N/A (\$ N/A ) in the aggregate.
- § A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than N/A (\$ N/A) per claim and N/A (\$ N/A) in the aggregate.

### § A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[ X ] § A.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in

Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

- [ ] § A.3.3.2.2 Railroad Protective Liability Insurance, with policy limits of not less than (\$ ) per claim and (\$ ) in the aggregate, for Work within fifty (50) feet of railroad property.
- [ ] § A.3.3.2.3 Asbestos Abatement Liability Insurance, with policy limits of not less than (\$ ) per claim and (\$ ) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.
- [ ] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.
- [X] § A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the

Contractor and used on the Project, including scaffolding and other equipment.

# [ ] § A.3.3.2.6 Other Insurance

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage

Limits

# § A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows: (Specify type and penal sum of bonds.)

Type

Payment Bond Performance Bond Penal Sum (\$0.00)

100% of the Contract Documents 100% of the Contract Documents

Payment and Performance Bonds shall be AIA Document A312<sup>TM</sup>, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312<sup>TM</sup>, current as of the date of this Agreement.

#### ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

- § A.4.1 The obligations of the contractor under the provisions of this Article shall not extend to the liability of the Architect, his agents, or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs, or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, his agents or employees to the extent that such giving or failure to give is the cause of the injury or damage.
- § A.4.2 The property insurance for the work as described in Paragraph A.2.3.1, which will be purchased by the Owner, requires a deductible of \$1,000, which deductible shall be paid by the Contractor.
- § A.4.3 All insurance coverages shall be provided by insurance companies having policy holder ratings no lower than "A" and financial rating not lower than "XII" In the Best's Insurance Guide" latest edition in effect as of the date of the Contract.
- § A.4.4 The Contractor is responsible for determining that Subcontractors are adequately insured against claims arising out of relating to the Work. The premium cost and charges for such insurance shall be paid by each Subcontractor.
- § A.4.5 The limits of liability as stated may be arrived by using a Split-Limit or a Combined Single Limit basis. However, the total limit of liability shall not be less than that stated in the requirements.





# General Conditions of the Contract for Construction

# for the following PROJECT:

(Name and location or address)
City of Huber Heights - New Public Works Facility
6131 Taylorsville Rd.
Huber Heights, Ohio 45424

#### THE OWNER:

(Name, legal status and address)
City of Huber Heights
6131 Taylorsville Rd.
Huber Heights, Ohio 45424

#### THE ARCHITECT:

(Name, legal status and address)

Kueny Architects, LLC 10505 Corporate Drive Suite 100 Pleasant Prairie, WI 53158

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- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
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- 15 CLAIMS AND DISPUTES

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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#### ARTICLE 1 GENERAL PROVISIONS

# § 1.1 Basic Definitions

#### § 1.1.1 The Contract Documents

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

# § 1.1.2 The Contract

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

#### § 1.1.3 The Work

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

#### § 1.1.4 The Project

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

#### § 1.1.5 The Drawings

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

#### § 1.1.6 The Specifications

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

# § 1.1.7 Instruments of Service

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

#### § 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

## § 1.2 Correlation and Intent of the Contract Documents

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

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining

provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

- § 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.
- § 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

#### § 1.3 Capitalization

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

## § 1.4 Interpretation

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

# § 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

- § 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Subsubcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.
- § 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

#### § 1.6 Notice

- § 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.
- § 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

# § 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203<sup>TM</sup>—2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

# § 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203<sup>TM</sup>\_2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202<sup>TM</sup>\_2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building

information model, and each of their agents and employees.

# ARTICLE 2 OWNER

#### § 2.1 General

- § 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.
- § 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

# § 2.2 Evidence of the Owner's Financial Arrangements

- § 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.
- § 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.
- § 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.
- § 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

# § 2.3 Information and Services Required of the Owner

- § 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.
- § 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.
- § 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.
- § 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the

site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

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

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

#### § 2.4 Owner's Right to Stop the Work

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

# § 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

#### ARTICLE 3 CONTRACTOR

#### § 3.1 General

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

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

#### § 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's

capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

- § 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.
- § 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

# § 3.3 Supervision and Construction Procedures

- § 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.
- § 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.
- § 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

# § 3.4 Labor and Materials

- § 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.
- § 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.
- § 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

#### § 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes

remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

#### § 3.6 Taxes

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

#### § 3.7 Permits, Fees, Notices and Compliance with Laws

- § 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.
- § 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.
- § 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

## § 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

#### § 3.8 Allowances

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

- § 3.8.2 Unless otherwise provided in the Contract Documents,
  - .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
  - .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.
- § 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

#### § 3.9 Superintendent

- § 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.
- § 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.
- § 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

#### § 3.10 Contractor's Construction and Submittal Schedules

- § 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.
- § 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.
- § 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

# § 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

#### § 3.12 Shop Drawings, Product Data and Samples

- § 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.
- § 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.
- § 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

- § 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.
- § 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.
- § 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
- § 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.
- § 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.
- § 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.
- § 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.
- § 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.
- § 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the

time and in the form specified by the Architect.

## § 3.13 Use of Site

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

## § 3.14 Cutting and Patching

- § 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.
- § 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

#### § 3.15 Cleaning Up

- § 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.
- § 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

#### § 3.16 Access to Work

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

## § 3.17 Royalties, Patents and Copyrights

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

## § 3.18 Indemnification

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

## ARTICLE 4 ARCHITECT

## § 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

#### § 4.2 Administration of the Contract

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

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

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

#### § 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under

- Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.
- § 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.
- § 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.
- § 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.
- § 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.
- § 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.
- § 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.
- § 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

## § 5.1 Definitions

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

## § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

- § 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.
- § 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.
- § 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the

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

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

# § 5.3 Subcontractual Relations

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

## § 5.4 Contingent Assignment of Subcontracts

- § 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that
  - .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
  - .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

- § 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.
- § 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

## § 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

- § 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.
- § 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.
- § 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate

Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

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

## § 6.2 Mutual Responsibility

- § 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.
- § 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.
- § 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.
- § 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.
- § 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

## § 6.3 Owner's Right to Clean Up

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

## ARTICLE 7 CHANGES IN THE WORK

#### § 7.1 General

- § 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.
- § 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.
- § 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

# § 7.2 Change Orders

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

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

## § 7.3 Construction Change Directives

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

- § 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.
- § 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
  - .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation:
  - .2 Unit prices stated in the Contract Documents or subsequently agreed upon:
  - .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
  - .4 As provided in Section 7.3.4.
- § 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:
  - .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
  - .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
  - .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
  - .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
  - .5 Costs of supervision and field office personnel directly attributable to the change.
- § 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.
- § 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.
- § 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.
- § 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.
- § 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The

Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

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

## § 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

## ARTICLE 8 TIME

#### § 8.1 Definitions

- § 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.
- § 8.1.2 The date of commencement of the Work is the date established in the Agreement.
- § 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.
- § 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

# § 8.2 Progress and Completion

- § 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.
- § 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.
- § 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

## § 8.3 Delays and Extensions of Time

- § 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.
- § 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.
- § 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

## § 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable

by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

#### § 9.2 Schedule of Values

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

## § 9.3 Applications for Payment

- § 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.
- § 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.
- § 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.
- § 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.
- § 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

## § 9.4 Certificates for Payment

- § 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.
- § 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The

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

## § 9.5 Decisions to Withhold Certification

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

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.
- § 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.
- § 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.
- § 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

#### § 9.6 Progress Payments

- § 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.
- § 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.
- § 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.
- § 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers

to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

- § 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.
- § 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.
- § 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.
- § 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

# § 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

## § 9.8 Substantial Completion

- § 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.
- § 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.
- § 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.
- § 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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

## § 9.9 Partial Occupancy or Use

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

- § 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.
- § 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

## § 9.10 Final Completion and Final Payment

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

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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constitute a waiver of Claims.

- § 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from
  - .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
  - .2 failure of the Work to comply with the requirements of the Contract Documents;
  - .3 terms of special warranties required by the Contract Documents; or
  - .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.
- § 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

## § 10.1 Safety Precautions and Programs

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

## § 10.2 Safety of Persons and Property

- § 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to
  - .1 employees on the Work and other persons who may be affected thereby;
  - .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
  - .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
- § 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.
- § 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.
- § 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.
- § 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.
- § 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.
- § 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

# § 10.2.8 Injury or Damage to Person or Property

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

#### § 10.3 Hazardous Materials and Substances

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

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

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

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

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

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

## § 10.4 Emergencies

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

#### ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the

endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

- § 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.
- § 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.
- § 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

## § 11.2 Owner's Insurance

- § 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.
- § 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Subsubcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.
- § 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Subsubcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

## § 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, subsubcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The

Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and subsubcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

# § 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

## §11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

## § 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

## § 12.2 Correction of Work

# § 12.2.1 Before Substantial Completion

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

Contractor's expense.

## § 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

- § 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.
- § 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.
- § 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.
- § 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.
- § 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

## § 12.3 Acceptance of Nonconforming Work

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

# ARTICLE 13 MISCELLANEOUS PROVISIONS

## § 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

## § 13.2 Successors and Assigns

- § 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.
- § 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

## § 13.3 Rights and Remedies

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

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

#### § 13.4 Tests and Inspections

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

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

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

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

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

#### § 13.5 Interest

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

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### § 14.1 Termination by the Contractor

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

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- 4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

- § 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.
- § 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.
- § 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

## § 14.2 Termination by the Owner for Cause

- § 14.2.1 The Owner may terminate the Contract if the Contractor
  - .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
  - .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
  - .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
  - A otherwise is guilty of substantial breach of a provision of the Contract Documents.
- § 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:
  - .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
  - .2 Accept assignment of subcontracts pursuant to Section 5.4; and
  - .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.
- § 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.
- § 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

## § 14.3 Suspension by the Owner for Convenience

- § 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.
- § 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent
  - .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
  - .2 that an equitable adjustment is made or denied under another provision of the Contract.

#### § 14.4 Termination by the Owner for Convenience

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

- § 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall
  - .1 cease operations as directed by the Owner in the notice;
  - .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
  - .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

#### ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

#### § 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

## § 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

## § 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

#### § 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

## § 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

## § 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section

15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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

# § 15.1.7 Waiver of Claims for Consequential Damages

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

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### § 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

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

- § 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.
- § 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.
- § 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

## § 15.3 Mediation

- § 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.
- § 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.
- § 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.
- § 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

## § 15.4 Arbitration

- § 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.
- § 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.
- § 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.
- § 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly

consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

## § 15.4.4 Consolidation or Joinder

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

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

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

## SUPPLEMENTARY GENERAL CONDITIONS

- 1. The General Conditions of the Contract for Construction, AIA Document A 201 2017, Articles 1 through 15 inclusive, is a part of this Contract.
- 2. The following supplements shall modify, delete and or add to the General Conditions. Where any article, paragraph or subparagraph in the General Conditions is supplanted by one of the following paragraphs, the provisions of such article, paragraph, or subparagraph shall remain in effect and the supplemental provisions shall be considered as added thereto. Where any article, paragraph or subparagraph is supersede by any of the following paragraphs, the provisions of such article, paragraph or subparagraph, no so amended, voided or superseded shall remain in effect

## **ARTICLE 1 GENERAL PROVISIONS**

#### 1.2 Correlation and Intent of the Contract Documents

To Subparagraph 1.2.3, add the following Clause 1.2.3.1.

- .1 In clarifying ambiguities or settling disputes, the following order of precedence of the Contract Documents shall be used:
  - a. The Agreement Between Owner and Contractor.
  - b. Modifications to the above Agreement.
  - c. Addenda.
  - d. Supplementary General Conditions.
  - e. General Conditions.
  - f. Drawings:
    - 1. Written Dimensions.
    - 2. Scaled Dimensions.
    - 3. Detailed Drawings.
    - 4. General Drawings

In the case of an inconsistency between Drawings and Specification or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accord with the Architect's interpretation.

## **ARTICLE 2 OWNER**

**2.1.2** Delete this Paragraph in its entirety.

# 2.2 Evidence of the Owner's Financial Arrangements

Delete this Section in its entirety.

# 2.3 Information and Services Required of the Owner

Delete Subparagraph 2.3.6 and substitute the following:

**2.3.6** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor electronic files of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

#### **ARTICLE 3 CONTRACTOR**

# 3.3 Supervisor and Construction Procedures

Add the following sentence to Subparagraph 3.3.1:

When the Contract Documents give specific instructions concerning construction methods and means, the Contractor will review such instructions (including those recommended by Manufacturers) and advise the Architect if the specified procedures deviate from good construction practice; will affect any warranties, including the Contractor's general warranty or of any objections the Contractor may have to the procedure and to propose any alternative procedure which the Contractor will warrant.

#### 3.4 Labor and Materials

Add the following Subparagraph 3.4.1.1 to 3.4.1:

.1 Contractor shall pay the prevailing wage rates for this work, and provide certification of this to the Owner.

Add the following Subparagraph 3.4.2.1 and 3.4.2.2 to 3.4.2:

- **3.4.2.1** After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified, only under the conditions set forth in the General Requirements of the Specifications (Division 1).
- **3.4.2.2** By making requests for substitutions based on Clause 3.4.2.1 above the Contractor:
  - .1 Represents that he/she has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
  - .2 Represents that he/she will provide the same warranty for the substitution that would be provided for that specified.
  - .3 Certifies that the cost data presented is complete and include all related costs under this Contract but excludes costs under separate contracts, and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
  - .4 Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
- 3.6 Taxes: (No State Sales Taxes are required for this project)

Add the following Subparagraph 3.6.1 to 3.6:

- **3.6.1** The Contractors need not include sales tax on all products purchased for this project. A State tax I.D. number will be available upon request.
- 3.7 Permits, Fees, Notices and Compliance with Laws

Delete Subparagraph 3.7.1 and substitute the following:

- **3.7.1** The Owner shall secure and pay for the building, mechanical, electrical, and plumbing plan review permits, the environmental impact fees due to water and sewer connections, and the zoning regulation fees and permits as required by the jurisdiction listed elsewhere in the specification. The Contractor shall secure and pay for all <u>building construction permits</u>, other permits and governmental fees, licenses and inspections necessary for proper execution of and completion of their Contract which are legally required when bids are received, or negotiations concluded.
- 3.8 Allowances Bidders shall include a \$125,000 cash allowance in the base Bid
- **3.8.2.3** Add the following to the end of Clause 3.8.2.3:
- . . .except when installation is specified as part of the allowance in the General Requirements (Division 1 of the Specifications).

# 3.9 Superintendent

**3.9.1** Add the following sentence to this Subparagraph:

The Superintendent shall have a minimum of ten years of experience with commercial construction projects of similar size and complexity. The Superintendent shall not also perform the functions of a Project Manager. The Project Manager tasks shall be performed as described in Section 01 30 00. This superintendent will also be responsible for resolving all Punch List items after inspection by the Owner and Architect.

#### **ARTICLE 4 ARCHITECT**

## 4.2 Administration of the Contract

**4.2.4** Add the following to the end of Subparagraph 4.2.4:

Any direct communication between Owner and Contractor that affect the performance or administration of the Contract shall be made or confirmed in writing, with copies to the Architect, and that any such communications that represent a modification of the Contract requirements will be documented appropriately. Any communications among the Architect and Subcontractors should be confirmed in writing to the Contractor.

# **ARTICLE 5 SUBCONTRACTORS**

#### 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

To Subparagraph 5.2.1, add the following Clauses 5.2.1.1 and 5.2.1.2:

- .1 Not later than 14 days from the Contract Date, the Contractor shall provide a list showing the name of the Manufacturers proposed to be used for each of the products identified in the General Requirements of the Specifications (Division 1) and, where applicable, the name of the installing Subcontractor.
- .2 The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposal.

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If adequate data on any proposed Manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection. Failure to object to a Manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents, and all products furnished by the listed Manufacturer must conform to such requirements.

#### **ARTICLE 7 CHANGES IN THE WORK**

# 7.2 Change Orders

Add the following Subparagraphs 7.2.2 through 7.2.5:

- **7.2.2** For each change in the Work with an increase or decrease in the Contract Sum, the Contractor shall submit a Potential Change Request prior to starting any work for review by the Architect.
- **7.2.3** Each Potential Change Request shall include the detailed documentation as specified in Subparagraphs 7.3.4.1 through 7.3.4.5. The allowance for overhead and profit shall be as specified in Subparagraph 7.3.11 of this Section.
- **7.2.4** The Contractor shall not begin the Work of a Potential Change Request until notified by the Architect unless a written Construction Change Directive is issued. Work of a Potential Change Order undertaken without an approved Construction Change Directive will be at the Contractor's own risk.
- **7.2.5** A Change Order will be issued comprised of one or more approved Potential Change Requests at appropriate intervals.

## 7.3 Construction Change Directives

**7.3.4** In the first sentence, delete the words "...an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount." and substitute "an allowance for overhead and profit in accord with the schedule set forth in Clause 7.3.11.1 through 7.3.11.5 below."

Add the following Subparagraph 7.3.11 to 7.3:

- **7.3.11** In Subparagraph 7.3.7 the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:
  - .1 For the Contractor, for any Work performed by the Contractor's own forces, 5 percent of the cost.
  - **.2** For the Contractor, for Work performed by the Contractor's Subcontractor, **2.5** percent of the amount due the Subcontractor.
  - **.3** For each Subcontractor or Sub-subcontractor involved, for any Work performed by the Subcontractor's own forces, five percent of the cost.
  - .4 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontractors. Labor and materials shall be itemized in the manner prescribed above.

- Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over \$500.00 be approved without such itemization.
- .5 The Architect will have access to all records and costs from prime contractors, subcontractors, and suppliers for the base bid work, alternatives and change orders in order to evaluate certificates of payment and change order requests.

## **ARTICLE 8 TIME**

#### 8.1 Definitions

Delete Subparagraph 8.1.4 in its entirety and substitute the following:

**8.1.4** The term "day" as used in the Contract Documents shall mean calendar day.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

- 9.3 Applications for Payment
- **9.3.1** Amend to read 15 days in lieu of 10 days.
- **9.3.1** Add the following sentence to Subparagraph 9.3.1:

The form of Application for Payment shall be notarized AIA Document G 702, Application and Certification for Payment, supported by AIA Document G 703, Continuation Sheet.

Add the following Clauses 9.3.1.3 through 9.3.1.5 to 9.3.1:

- .3 Until the Work is 90 percent complete; the Owner will pay 95 percent of the amount due the Contractor on account of progress payments. At the time the Work is 90 percent complete and thereafter, if the manner of completion of the Work and its progress are and remain satisfactory to the Architect, and in the absence of other good and sufficient reasons, the Architect will (on presentation by the Contractor of Consent of Surety for each Application) authorize any remaining partial payments to be paid in full.
- .4 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect (or if the Surety withholds its consent) or for other good and sufficient reasons.
- .5 After the Work is substantially complete and the Architect has determined that the list of items to be completed and corrected is acceptable, the retention shall be adjusted so that the sum has a direct relation to the value of the Work included on the list.
- **9.3.3** Add the following Clause 9.3.3.1 to 9.3.3:
  - .1 (New Paragraph) The first payment application shall be accompanied by the Contractor's partial waiver of lien only, for the full amount of the payment. Each subsequent monthly payment application shall be accompanied by the Contractor's partial waiver, and by the partial waivers of Subcontractors and suppliers who were included in the immediately preceding payment application to the extent of the payment. Application for final payment shall be accompanied by final waivers of lien from the Contractor, Subcontractors and Suppliers who have not previously furnished such final waivers.

# 9.8 Substantial Completion

Add the following Clause 9.8.1.1 to 9.8.1:

- .1 Completion Liquidated Damages-Bonus Clause: The Agreement for the project contains a Liquidated Damages Clause. Substantial Completion must occur prior to the project being considered complete. No extensions for weather or other items known to the Contractor prior to bidding will be considered. Extensions for strikes or any unforeseen items will be determined by the Architect.
- **9.8.4** Replace the last sentence in this clause with the following:

Warranties required by the Contract Documents shall commence on the date of Final Acceptance by City Council.

# 9.10 Final Completion and Final Payment

Add the following Clause 9.10.1.1 to 9.10.1

.1 In addition to the Architects final certificate for payment, the work must be accepted by City Council.

# 9.11 Liquidated Damages

Add the following Paragraph 9.11 to Article 9:

9.11.1 The Owner may suffer financial loss if the Project is not Substantially Compete on the date set forth in the Contract Documents. The Contractor (and the Contractor's Surety) shall be liable for and shall pay to the Owner the sums hereinafter stipulated and fixed, agree and liquidated damages for each calendar day of delay until the Work is Substantially Complete

\$250.00 per calendar day

## **ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY**

# 10.2 Safety of Persons and Property

Add the following Subparagraphs 10.2.1.4 and 10.2.1.5 to Paragraph 10.2.1.

- .4 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Subparagraph 10.2.5.
- .5 The Owner shall be responsible for obtaining the services of a licensed laboratory to verify a presence or absence of the material or substance is found to be present, to verify that it has been rendered harmless.

Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualification of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection.

Add to Subparagraph 10.2.4 the following Clause 10.2.4.1

.1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the Owner reasonable advance notice.

## 10.3 Hazardous Materials and Substances

Add the following Subparagraphs 10.3.3.1 to Paragraph 10.3.3.

.1 Notwithstanding the foregoing, nothing contained within this Contract is intended to be waiver or estoppel of the City of Huber Heights or its insurer's ability to rely upon the limitations, defenses and immunities set forth under Ohio law, including, but not limited to, those contained in Ohio Statute Sections 893.80, 895.52 and 345.05. To the extent that indemnification is available and enforceable, the City of Huber Heights or its insurer shall not be liable, in indemnity or contribution, for an amount greater than the limit of the liability for municipal claims established under Ohio law. The City's obligation to indemnify hereunder is subject to the availability and limits of applicable insurance coverage. Under no circumstances shall the City of Huber Heights be required to indemnify the Contractor, Subcontractor or Architect, or their agents or employees, for their own negligent or intentional conduct. This language must apply to all indemnity obligations that are sought against the City in this Contract.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

# 12.2 Correction of Work

**12.2.5** Add the following: Warranty requirements shall be extended to all corrected work

# **ARTICLE 13 MISCELLANEOUS PROVISIONS**

Add the following Paragraph 13.6 to Article 13:

## 13.6 Equal Opportunity

- **13.6.1** The Contractor shall maintain policies of employment as follows:
  - .1 The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or age. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, national origin or age.

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Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates or pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

.2 The Contractor and all Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin or age.

## **ARTICLE 15 CLAIMS AND DISPUTES**

**15.1.6.2** Add the following sentence to Clause 15.1.6.2:

Normal weather shall be determined based on records for the nearest station of the United States Environmental Data Service. Claims for additional time based on adverse weather will only be allowed in the event that they have a material effect on the exterior construction portions of the project.

To Subparagraph 15.1.6, add the following Clause 15.1.6.3:

.1 The time for completion stated on the Bid Form shall be consecutive calendar days with no allowance assumed for unusual weather.

The Architect will maintain a daily weather record to verify any claims for an extension of time of an increase in the Contract sum because of bad weather. The Contractor will be expected to have included in his Bid a sum to cover working continuously in the normal temperature conditions found at the building site. Contractor is not expected to work in the rain or snow.

Below is the Website you can use to obtain the prevailing wages

https://ohio.gov/jobs/resources/prevailing-wage





## **SECTION 01 10 00 SUMMARY OF WORK**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section

INDEX 1.1 Work Covered by Contract Documents 1.4 Work Sequence

1.2 Contracts 1.5 Contractors use of Premises

1.3 Work by Others

## **PART 1 GENERAL**

# **1.1** Work Covered by Contract Documents

A. The project consists of Construction of a New 54,000 square foot Public Works Facility. The facility will house, the complete Public Works Department. Outbuildings include a 7,200 square foot Salt Storage Facility and Fuel Island.

All work is to be done in strict compliance with the plans and specifications prepared by Kueny Architects, L.L.C., of Pleasant Prairie, Wisconsin, which have heretofore been approved by the City Council, and are on file for public examination in the Office of the City Clerk.

- B. Bids under the **GENERAL CONTRACTOR** will include plumbing, heating and ventilation and the electrical work.
- C. Related Requirements Specified Elsewhere: The Conditions of the Contract General and Supplementary, and these General Requirements shall apply with equal force and effect to all Contractors engaged in this Work.
- D. Contractor's Duties
  - 1. Except as specifically noted, provide and pay for:
    - a. Labor and materials, tools and equipment. (See General Conditions).
    - b. Water, heat and utilities required for construction.
    - c. Other facilities and services necessary for proper execution and completion of Work.
  - 2. Taxes: (No Sales Taxes are required for this project)
  - 3. Permits, fees licenses, notices: the Contractor is required to obtain all permits.
  - 4. Comply with codes, ordinances, rules, regulations, orders and other requirements of public authorities which bear on performance of Work.
  - 5. Promptly submit written notice to Architect of observed variance of Contract Documents from legal requirements. It is not the Contractor's responsibility to make certain that Drawings and Specifications comply with codes and regulations:
    - a. Appropriate modifications to Contract Documents will adjust necessary changes.
    - b. Assume responsibility for work known to be contrary to such requirements, without notice.
  - 6. Enforce strict discipline and good order among employees. Do not employ Work of:
    - a. Unfit persons.
    - b. Persons not skilled in assigned tasks.
  - 7. It will be the Contractor's responsibility to call the utility companies prior to and while Work is in progress to obtain utility locations and clearances within the work limits.

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# 1.2 Contracts: (See General Conditions)

- A. Construct Work under one single prime Contract:
  - 1. General Construction

# 1.3 Work by Owner

A. Various Furnishings and Equipment

# 1.4 Work Sequence

A. Construct Work in stages: The General Contractor will determine the schedule. All Contractor's will be required to keep up with General Contractor's schedule.

## 1.5 Contractor's use of Premises

- A. Confine operations at site to areas permitted by:
  - 1. Law
  - 2. Ordinances
  - 3. Permits
  - 4. Contract Documents
- B. Do not unreasonably encumber site with materials or equipment. Do not interfere with other projects underway during the same time period.
- C. Do not load structure with weight that will endanger structure.
- D. Assume full responsibility for protection and safe keeping of products stored on premises.
- E. Move any stored products which interfere with operations of Owner or other Contractors.
- F. Obtain and pay for use of additional storage or work areas needed for operations.
- G. Use Site: The Contractor is required to work with and around Owner's existing operations.

\* \* \* \* \* \* \* \* \* \* \* \*

## **SECTION 01 20 00 PAYMENT AND CHANGE ORDER PROCEDURES**

Applicable provisions of the General and Supplementary Conditions and SCOPE Division 1 govern Work under this Section.

INDEX 1.1 Description 2.2 Changes in the Work

1.2 Submittals 3.1 Applications for Payment 1.3 Availability of Forms 3.2 Change Order Procedures

2.1 Application and Certificate Payment 3.3 Dispositions of Forms by the

Architect

## **PART 1 GENERAL**

# 1.1 Description

A. Work Included: To insure prompt and proper payment of all bills and to expedite processing of Change Orders, procedures, as outlined in this Section, have been established by the Architect and must be followed.

## B. Related Work Described Elsewhere

**Owner-Contractor Agreement** 1. Lump Sum and Unit Prices 2. Progress Payments, Retainage General and Supplementary and Final Payments Conditions 3. Changes in the Work **General Conditions** 4. Schedule of Values Section 01 30 00 5. Substitutions Section 01 60 00 Section 01 70 00 6. Contract Closeout

## C. Definitions

- 1. Change Order: See General Conditions
- 2. Construction Change Authorization, A written order to Contractor, signed by the Owner and the Architect, which amends the Contract Documents as described. and authorizes Contractor to proceed with a change which affects the Contract Sum or the Contract Time, for inclusion in a subsequent Change Order.
- 3. Architect's Supplemental Instructions, A written order, instruction or interpretation, signed by the Architect making minor changes in the Work not involving a change in Contract Sum or Contract Time.

## 1.2 Submittals

- A. Applications for Payment: Submit requests for payment on forms called for in this Section and in accord with the Schedule established in the Owner-Contractor Agreement. Submit a minimum of three copies.
- B. Change Orders: Submit request for changes with supporting data as outlined in the General Conditions.

# 1.3 Availability of Forms

A. Forms required under the provisions of this Section may be obtained from the American Institute of Architects <a href="https://www.aia.org">www.aia.org</a>

## **PART 2 PRODUCTS**

# 2.1 Application and Certificate for Payment

- A. The Contractor must make all requests for payment on AIA Document G 702, or similar Application and Certificate for Payment, completely filled out as described on the back of the form.
- B. Each request for payment shall include AIA Document G 703, or similar Continuation Sheet, completely filled out as described on the back of the form.
- C. Requests for payment not properly submitted will be returned to the Contractor for resubmittal.

# 2.2 Changes in Work

- A. The Contractor will submit to the Architect the supporting data for any changes in the Work, as described in the General Conditions, Article 7, and in Section 00 73 00 Supplementary Conditions, for all changes initiated by the Contractor or upon request of the Owner or Architect.
- B. The Architect will use the above to prepare a Change Order on AIA Document G 701, Change Order or similar. The Contractor will not prepare form G 701 unless instructed to do so by the Architect.

## **PART 3 EXECUTION**

## 3.1 Applications for Payment

- A. Preparation of Application for each Progress Payment
  - 1. Application and Certificate Form
    - a. Submit Application on form specified in this Section, in accord with Form Instructions. All data must be typewritten. All computations must be correct.
    - b. Fill in summary of dollar values to agree with the respective totals indicated on continuation sheet.
    - c. Execute Application with the signature of responsible officer of the contracting firm.
    - d. All applications must be notarized.
    - e. All items of the Architect's Certificate will be filled out by the Architect.
  - 2. Continuation Sheets (AIA Form G 703 or similar)
    - a. Submit itemized data and values on form specified in this Section in accord with example bound into this Section. All data must be typewritten. All computations must be correct.
    - b. Fill in total list of all scheduled component items of Work, with item number and the scheduled dollar value for each item based on actual Contract Sum listed on Owner-Contractor Agreement.

- c. Fill in the dollar value in each column for each scheduled line item when Work has been performed or products stored. The Architect will not allow payment on any line item until after Shop Drawings, for that item, have been reviewed.
- d. List each Change Order executed prior to the date of current application, at the end of the last continuation sheet. List by Change Order number, and description, as for original component item of Work.
- e. Use as many Continuation Sheets as required.
- 3. Substantiating Data for Stored Materials:
  - a. For each item on the Continuation Sheet listed as stored material, the Contractor shall submit the following:
    - (1) Supplier's invoice for the item listed as stored.
    - (2) A description of each item stored.
    - (3) The location and times at which the Architect or Owner can inspect the stored materials.
- 4. Waivers of Lien: The Contractor will include all waivers as required by the Specifications, Owner-Contractor Agreement or as may be required by the Owner.
- B. Preparation of Application for Final Payment
  - 1. Fill in Application Forms as specified for progress payments.
  - 2. Continuation Forms shall indicate 100% completion of all items.
  - 3. Supply all final waivers of lien.

# 3.2 Change Order Procedures

- A. General Requirements
  - 1. Promptly implement Change Order procedures.
    - a. Provide full written data required to evaluate changes.
    - Maintain detailed records of Work done on a "time and material"/"force account" basis.
    - c. Provide full documentation to Architect on request.
  - 2. Designate in writing the member of Contractor's organization:
    - a. Who is authorized to accept changes in the Work.
    - b. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the Work.
  - 3. Owner will designate in writing the person who is authorized to execute Change Orders.

## B. Preliminary Procedures

- 1. Owner or Architect may initiate changes by submitting a Proposal Request to Contractor. Request will include:
  - a. Detailed description of the Change, Products and location of the change in the Project.
  - b. Supplementary or revised Drawings and Specification.
  - c. The projected time span for making the change, and a specific statement as to whether overtime work is, or is not, authorized.
  - d. A specific period of time during which the requested price will be considered valid.
  - e. Such request is for information only, and is not an instruction to execute the changes, nor to stop Work in progress.
- 2. Contractor may initiate changes by submitting a written notice to Architect; containing:

- a. Description of the proposed changes.
- b. Statement of the reason for making the changes.
- c. Statement of the effect on the Contract Sum and the Contract Time.
- d. Statement of the effect on the work of separate Contractors.
- e. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

# C. Construction Change Authorization

- In lieu of Proposal Request, Architect may issue a Construction Change
   Authorization for Contractor to proceed with a change for subsequent inclusion in a
   Change Order.
- Authorization will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change, and will designate the method of determining any change in the Contract Sum and any change in Contract Time.
- 3. Owner and Architect will sign and date the Construction Change Authorization as authorization for the Contractor to proceed with the changes.
- 4. Contractor may sign and date the Construction Change Authorization to indicate agreement with the terms therein.

## D. Documentation of Proposals and Claims

- 1. Support each quotation for a lump-sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow Architect to evaluate the quotation.
- 2. On request, provide additional data to support time and cost computations:
  - a. Labor required.
  - b. Equipment required.
  - c. Products required.
    - (1) Recommended source of purchase and unit cost.
    - (2) Quantities required.
  - d. Taxes, insurance and bonds.
  - e. Credit for Work deleted from Contract, similarly documented.
  - f. Overhead and profit.
  - g. Justification for any change in Contract Time.
- 3. Support each claim for additional costs, and for Work done on a "time and material"/"force account basis", with documentation as required for a lump-sum proposal, plus additional information:
  - a. Name of the Owner's authorized agent who ordered the Work, and date of the order
  - b. Dates and times Work was performed, and by whom.
  - c. Time record, summary of hours worked, and hourly rates paid.
  - d. Receipts and invoices for:
    - (1) Equipment used, listing dates and times of use.
    - (2) Products used, listing quantities.
    - (3) Subcontracts.
  - Document requests for substitutions for Products as specified in Section 01 60

## E. Preparation of Change Orders

- 1. Architect will prepare each Change Order.
- 2. Form: Change Order AIA Document G 701 or similar.

- 3. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.
- 4. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.
- F. Lump-Sum/Fixed Price Change Order
  - 1. Content of Change Orders will be based on, either:
    - a. Architect's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor.
    - b. Contractor's Proposal for a change as recommended by the Architect.
    - c. Owner and Architect will sign and date the Change Order as authorization for the Contractor to proceed with the changes.
    - d. Contractor may sign and date the Change Order to indicate agreement with the terms therein.
- G. Unit Price Change Order
  - 1. Content of Change Orders will be based on, either:
    - a. Architect's definition of the scope of the required changes.
    - b. Contractor's Proposal for a change as recommended by the Architect.
    - c. Survey of completed Work.
  - 2. The amounts of the unit prices to be:
    - a. Those stated in the Agreement.
    - b. Those mutually agreed upon between Owner and Contractor.
  - 3. When quantities of each of the items affected by the Change Order can be determined prior to start of the Work:
    - a. Owner and Architect will sign and date the Change Order as authorization for Contractor to proceed with the changes.
    - b. Contractor may sign and date the Change Order to indicate agreement with the terms therein.
  - 4. When quantities of the items cannot be determined prior to start of the Work:
    - a. Architect or Owner will issue a Construction Change Authorization directing Contractor to proceed with the change on the basis of unit prices, and will cite the applicable unit prices.
    - b. At completion of the change, the Architect will determine the cost of such work based on the unit prices and quantities used.
      - (1) Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.
      - (2) Unit prices for excavation, backfill, concrete, etc., stated in dollars per cubic yard, shall be based on actual physical measurement of the area affected and will not be based on converting weight, truck loads, etc. into cubic yards.
    - c. Architect will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
    - d. Owner and Contractor will sign and date the Change Order to indicate their agreement with the terms therein.
- H. Time and Material/Force Account Change Order/Construction Change Authorization
  - 1. Architect and Owner will issue a Construction Change Authorization directing Contractor to proceed with the changes.
  - 2. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article 3.2D. "Documentation of Proposals and Claims" of this Section.

- 3. Architect will determine the allowable cost of such Work, as provided in General Conditions and Supplementary Conditions.
- 4. Architect will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
- Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

#### I. Correlation With Contractor's Submittals

- 1. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.
- 2. Periodically revise the Construction Schedule to reflect each change in Contract Time;
  - a. Revise sub-schedules to show changes for other items of Work affected by the changes.
- Upon completion of Work under a Change Order, enter pertinent changes in Record Documents.

# 3.3 Disposition of Forms by the Architect

### A. Payment Request

- 1. After receiving the Application, the Architect will review the submission, enter the amount certified for payment and sign the form.
- 2. Distribution:
  - a. One copy for the Architect's file.
  - b. Two copies to the Owner. One copy for Owner's records and one copy to be returned to the Contractor along with payment.

### B. Changes in the Work

- 1. After receiving from the Contractor the necessary information, the Architect will fill out the Change Order Form and sign it.
- 2. Two copies of the Change Order will be sent to the Contractor for his signature and both copies will be returned to the Architect.
- 3. The Architect and Contractor approved copies will be sent to the Owner for his signature. One copy will be sent by the Owner to the Contractor.
- 4. After receiving the copy which has been signed by the Architect and the Owner, the Contractor will incorporate the Change Order amount into the next payment application.

\* \* \* \* \* \* \* \* \* \* \* \*

### **SECTION 01 23 00 ALTERNATES**

Applicable provisions of the General and Supplementary Conditions and SCOPE

Division 1 governs Work under this Section.

INDEX 1.1 Description 2.1 Description of Alternatives

> 1.2 Submittals 3.1 Advance Coordination

1.3 Product Handling 3.2 Surface Conditions

### **PART 1 GENERAL**

## 1.1 Description

A. Work Included: To allow the Owner to compare total costs where alternate building material might be used, and to enable the Owner to make a decision prior to awarding the Contract. Alternates have been established as described in this Section of these Specifications.

B. Related Work Described Elsewhere

1. Basis of Awards Instruction to Bidders 2. Summary of Work Section 01 10 00 3. Coordination Section 01 30 00

- 4. The sections of the Specification as listed under the respective alternatives.
- 5. The method for stating the proposed alternative sum is described on the Bid Form.
- C. This Section describes the changes to be made under each alternative.
- D. The referenced Specification sections contain the pertinent requirements for materials and methods to achieve the Work described herein.
- E. Coordinate pertinent related work and modify surrounding work as required to complete the project under each alternative designated in the Owner-Contractor Agreement.
- 1.2 Submittals: All alternatives described in this Section of these Specification are required to be reflected in the Bid submitted on the Proposal Form for the Work; however, do not submit alternatives other than those described in this Section except as provided for under "Substitutions" in Section 01 60 00 of these Specifications.
- 1.3 Product Handling: If the Owner elects to proceed on the basis of one or more of the alternatives, make all modifications to the Work required in the furnishing and installation of the selected alternative or alternatives to the approval of the Architect and at no additional cost to the Owner other than as proposed on the Bid Form.

### **PART 2 PRODUCT**

## **2.1** Description of Alternatives

- A. General Contractor
  - 1. Alternate #1- Add to base bid Fuel Island.

February 6, 2024 01 23 00-1 Specification section 11 11 28 Vehicle Fuel Equipment and Canopy Footing Design and 60' x 64' Fuel Island area as noted on the site plan. This includes all work within the noted foot print. Base Bid would include the 8" stone base electrical feeds stubbed to the work area are part of the base bid.

- 2. Alternate #2 Add to base bid Salt Storage. The complete salt structure as detailed and concrete pad to the south and west.
- 3. Alternate #3 Add to base bid 5 Ton Hoist Crane. Specification Section 41 22 00 Hoists and Cranes
- 4. Alternate #4 Add to base bid Vehicle Lift. Specification Section 14 40 00 Lifts Hoists

Alternate #4 (a) ADD to the base bid amount to Vehicle Lift

Alternate #4 (b) ADD to the base bid amount to Vehicle Lift

Alternate #4 (c) ADD to the base bid amount to Vehicle Lift

Alternate #4 (d) ADD to the base bid amount to Vehicle Lift

Alternate #4 (e) ADD to the base bid amount to Vehicle Lift

### **PART 3 EXECUTION**

- 3.1 Advance Coordination: Immediately after award of Contract, and to the maximum extent practicable, thoroughly and clearly advise all necessary personnel and suppliers as to the nature and extent of alternatives selected by the Owner. Use means necessary to alert those personnel and suppliers involved as to all changes in the Work caused by the Owner's selection of alternatives.
- 3.2 Surface Conditions: Prior to installation of the alternative items, verify that all surfaces have been modified as necessary to accept the installation and that the item or items may be installed in complete accord with their manufacturer's current recommendations. In the event of discrepancy, immediately notify the Architect and proceed as he directs.

\* \* \* \* \* \* \* \* \* \* \* \*

### **SECTION 01 30 00 PROJECT COORDINATION**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

## **INDEX** 1.1 Description

- 2.1 Project Manager
- 3.1 General Duties of Project Managers
- 3.2 Coordination Between Contractors at the Project Site

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included
  - 1. General Contractor will coordinate the Work of the entire Project.
  - 2. The General Contractor shall:
    - a. Coordinate work of their own employees and subcontractors.
    - b. Expedite their work to assure compliance with schedules.
    - c. Coordinate their work with that of other prime contractors and work by Owner.
    - d. Comply with orders and instructions of the Owner.
- B. Related Work Specified Elsewhere: Division 1.

#### **PART 2 PERSONNEL**

# 2.1 Project Manager

- A. The General Contractor and each of the Mechanical and Electrical sub-contractors shall designate a qualified project manager for the duration of the construction work.
  - 1. Qualification:
    - a. A minimum of ten years of experience in field work required for this type and size of Project.
  - 2. Submit name to Architect.
  - 3. The Project Manager shall not be the same person as the Superintendent. The Project Manager shall work in concert with the Superintendent on this project.
- B. General Contractors: Per Section 00 72 00, Article 3.9 of the A201, a qualified project superintendent must be present on the job during performance of the work. The superintendent must be on site all day, min. 8 hours during the construction period and it is not acceptable to be a part time superintendent.

#### **PART 3 EXECUTION**

### 3.1 General Duties of Project Managers

- A. Construction Organization and Start-up
  - 1. Project Managers shall establish on-site lines of authority and communications:
    - a. Establish procedures for intra-project communication:
      - (1) Submittals
      - (2) Reports and records

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- (3) Recommendations
- (4) Coordination drawings
- (5) Schedules
- (6) Resolution of conflicts.
- b. Interpret Contract Documents:
  - (1) Consult with Architect to obtain interpretations.
  - (2) Assist in resolution of questions or conflicts which may arise.
  - (3) Transmit written interpretations to Prime Contractors, and to other concerned parties.
- c. Assist in obtaining permits and approvals:
  - (1) Building permits and special permits required for Work or for temporary facilities.
  - (2) Verify that contractors and subcontractors have obtained inspections for Work and for temporary facilities.

### **B.** Project Manager Duties

- Prepare Coordination Drawings as required to resolve conflicts and to assure coordination of the Work of, or affected by, mechanical and electrical trades, or by special equipment requirements.
  - a. Submit to Architect.
  - b. Reproduce and distribute copies to concerned parties after Architect review.
- 2. Inspection and Testing:
  - a. Inspect Work to assure performance in accord with requirements of Contract Documents.
  - b. Administer special testing and inspections of suspect Work.
  - c. Reject Work which does not comply with requirements of Contract Documents.
  - d. Coordinate Testing Laboratory Services:
    - (1) Verify that required laboratory personnel are present.
    - (2) Verify that tests are made in accord with specified standards.
    - (3) Review test reports for compliance with specified criteria.
    - (4) Recommend and administer any required retesting.
- 3. Monitor the use of temporary utilities:
  - a. Verify that adequate services are provided and maintained.
  - b. Coordinate installation, operation and maintenance, to verify compliance with project requirements and with Contract Documents.
  - c. Coordinate use of Owner's facilities.
- 4. Monitor Contractor's periodic cleaning:
  - a. Enforce compliance with Specification.
  - b. Resolve any conflicts.
- 5. Arrange for delivery of Owner-furnished products.
  - a. Inspect for condition at delivery.
  - b. Turn over to appropriate Contractor, obtain receipt.
- 6. Changes and Substitutions:
  - a. Recommend necessary or desirable changes to Owner and to Architect.
  - b. Review subcontractors' requests for changes and substitutions; submit recommendations to Owner and to Architect.
  - c. Assist Architect in negotiating Change Orders.
  - d. Promptly notify all subcontractors of pending changes or substitutions.

- 7. Provide cost control for Project:
  - a. Revise and refine the approved estimate of construction cost periodically:
    - (1) Record actual costs and estimates for uncompleted work.
    - (2) Incorporate approved changes as they occur.
    - (3) Develop cash flow reports and projections.
  - b. Maintain cost accounting records for authorized work performed under:
    - (1) Unit costs.
    - (2) Actual costs for labor and materials.
    - (3) Other basis requiring accounting records.
  - c. Implement procedures for review and processing of Contractor's applications for progress payments and for final payments;
    - (1) Review each application for payment, submit recommendations to Architect.
- 8. Maintain Reports and Records at Job Site, available to Architect and Owner.
  - a. Daily log of progress of Work.
  - b. Records:
    - (1) Contracts
    - (2) Purchase orders.
    - (3) Materials and equipment records.
    - (4) Applicable handbooks, codes and standards.
  - c. Obtain information from subcontractors and maintain file of record documents.
  - d. Assemble documentation for handling of claims and disputes.
- 9. Coordinate the work schedules of the subcontractors:
  - a. For temporary utilities.
  - b. Among the work of the trades specified in Division 23 and 26.
  - c. With the work of trades specified in Division 2 through 26.
- 10. Coordinate the schedules of subcontractors.
  - a. Verify timely deliveries of Products for installation by other trades.
  - b. Verify that labor and materials are adequate to maintain schedules.
- 11. Conduct conferences among subcontractors and other concerned parties as necessary to:
  - a. Maintain coordination and schedules.
  - b. Resolve matters in dispute.
- 12. Participate in Project Meetings:
  - a. Report progress of Work.
  - b. Recommend needed changes in schedules.
  - c. Transmit minutes of meetings to trades, as appropriate.
- 13. Temporary Utilities:
  - a. Coordinate installation, operation and maintenance, to verify compliance with Project requirements and with Contract Documents.
  - b. Verify adequacy of service at required locations.
- 14. Shop Drawings, Product Data Samples:
  - a. Prior to submittal, review for compliance with Contract Documents.
    - (1) Check field dimensions and clearance dimensions.
    - (2) Check relation to available space.
    - (3) Check anchor bolt settings.
    - (4) Review the effect of any changes on the work of other contracts or trades.
    - (5) Check compatibility with equipment and work of other trades.
    - (6) Check motor voltages and control characteristics.
    - (7) Coordinate controls and interlocks:
      - (a) Voltages
      - (b) Wiring of pneumatic electric switches or relays.

# (8) Coordinate wiring and control diagrams.

- 15. Job Site Visits:
  - a. Project Managers shall visit site monthly until work of their contract begins.
  - b. Visit site weekly after Contractor has begun.
- 16. Verify that subcontractors maintain accurate record documents.
- 17. Observe Work for compliance with requirements of Contract Documents.
  - a. Maintain list of observed deficiencies and discrepancies.
  - b. Promptly report deficiencies or discrepancies to Architect.
  - c. Record results including time and date of start-up.
- 18. Equipment Startup:
  - a. Check to assure that utilities and specified connections are complete and that equipment is in operable condition.
  - b. Observe test adjust and balance.
  - c. Record results including time and date of start-up.
- 19. Inspection and Acceptance of Equipment:
  - a. Prior to inspection, check that equipment is clean, repainted as required, tested and operational.
  - b. Assist inspector; prepare list of items to be completed or corrected.
  - c. Should acceptance and operation of equipment constitute the beginning of the specified warranty period, prepare and transmit written notice to Architect for the Owner.
- 20. Assemble Record Documents from subcontractors and transmit to Architect.
- C. Project Manager's Close-out Duties
  - 1. Mechanical and Electrical equipment start-up:
    - a. Coordinate check-out of utilities, operational systems and equipment.
    - b. Assist in initial start-up and testing.
    - c. Record dates of start of operation of systems and equipment.
    - d. Submit to Owner written notice of beginning of warranty period for equipment put into service.
  - 2. At completion of Work of each Contract, conduct an inspection to assure that:
    - a. Specified cleaning has been accomplished.
    - b. Temporary facilities have been removed from site.
  - 3. Substantial Completion:
    - a. Conduct an inspection to confirm or supplement Contractor's list of work to be completed or corrected.
    - b. Assist Architect in inspection.
    - c. Supervise correction and completion of work as established in Certificate of Substantial Completion.
  - 4. When Owner occupies a portion of Project prior to final completion, coordinate established responsibilities of Contractor and Owner.
  - 5. Final Completion:
    - a. When each Contractor determines the Work is finally complete, conduct an inspection to verify completion of Work.
    - b. Assist Architect in inspection.
  - 6. Administration of Contract Closeout:
    - a. Receive and review subcontractors' final submittals.
    - b. Transmit to Architect with recommendations for action.
- D. Additional Duties of General Contractor's Project Manager

- 1. Control the use of Site:
  - a. Supervise field engineering and site layout.
  - b. Allocate space for each Prime Contractor's use for field offices, sheds and work and storage areas.
  - c. Allocate field office and storage space, and work and storage areas, for use of each Prime Contractor.
  - d. Establish access, traffic and parking allocations and regulations.
  - e. Monitor use of site during construction.

#### 2. Construction Schedules:

- a. Coordinate schedules of the several Prime Contractors.
- b. Prepare a detailed schedule of basic operations for all Prime Contractors.
  - (1) Each Prime Contractor shall prepare sub-schedules to comply with critical phases.
- c. Monitor schedules as work progresses:
  - (1) Identify potential variances between scheduled and probable completion dates for each phase.
  - (2) Recommend to Owner adjustments in schedule to meet required completion dates.
  - (3) Adjust schedules of Contractors as required.
  - (4) Document changes in schedule, submit to Owner, Architect and to involved Contractors.
- d. Observe work of each Contractor to monitor compliance with schedule.
  - (1) Verify that labor and equipment are adequate for the Work and the schedule.
  - (2) Verify that product procurement schedules are adequate.
  - (3) Verify that product deliveries are adequate to maintain schedule.
  - (4) Report noncompliance to Owner with recommendation for changes.
- 3. Daily Reports: Establish a procedure for the General Contractor's job superintendent to write a daily report on the progress of the job. These reports will be sent to the Architect at the end of each week. The report will include date, weather conditions, temperatures, manpower for all prime Contractor's and subcontractor's work being done by all prime contractors, problems and delays, extra work done or materials purchased.

### 3.2 Coordination Between Contractors at the Project Site

- A. All Contractors and all subcontractors shall coordinate their work with adjacent work and shall cooperate with all other trades so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their work and for the storage of their material. In no case will any Contractor be permitted to exclude from the premises or Work, any other Contractor or their employees, or interfere with any Contractor in the execution or installation of their work.
- B. Each trade shall perform its work in proper sequence in relation to that of other contractors or trades and as approved by the Architect. Any cost caused by defective or ill-timed work shall be borne by the trade responsible therefore.
- C. Each Contractor shall arrange its Work and dispose of its materials so as not to interfere with the Work or storage of materials of other Contractors and each shall join their work to that of others in accord with the intent of the Drawings and Specifications.

- D. All mechanical and electrical contractors shall work in cooperation with the General Contractor and with each other, and fit their piping, ductwork, conduit, etc., into the structure as job conditions may demand. All final decisions as to the right-of-way and run of pipe, ducts etc., shall be made by the Architect or his/her representative at prearranged meetings with responsible representatives of the mechanical and electrical contractors.
- E. Each Contractor shall give due notice and proper information to other Contractors of any special provisions necessary for the placing or setting of their work coming in contact with work of other Contractors. Failing to do so in proper time, they will be held responsible and shall pay for any and all alterations and repairs necessitated by such neglect.
- F. It shall be the responsibility of all Contractors and all subcontractors to keep constant check on the progress of the Work so that the particular trade can ensure proper preparation for installation of that trade's work and not cause delay in the progress of the Work. It shall be the responsibility of each contractor to periodically make inspections of Work in progress and to notify the Architect when Work is complete in compliance with Specifications and Drawings.
- G. Contractors for Fire Protection, Plumbing, Heating and Ventilating and Electrical Work shall check and cross check the Drawings and Specifications of other trades to inform themselves of the work interrelated with their work.
- H. Any voluntary effort on the part of the Architect to expedite the notice to other Contractors shall not relieve any Contractor of their primary responsibility to give such notice.
- I. Contractors shall determine as far in advance as possible the exact size of openings and guarantee them to the General Contractor.
- J. All Contractors working on the site shall coordinate storage of materials on ground slabs and on above ground floor and roof members so as not to exceed the design live load shown on the Drawings. Material storage will not be allowed on any cantilevered members. Contractors will take immediate remedial action when so directed by the Architect.

\* \* \* \* \* \* \* \* \* \* \* \* \*

### **SECTION 01 31 19 PROJECT MEETINGS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and

Division 1 govern Work under this Section.

INDEX 1.1 Description 2.4 Completion Inspection Meeting

2.1 Pre-Construction Meetings 2.5 One Year Warranty Review Meetings

2.2 Progress Meetings 3.1 Representatives List

2.3 Roof Conference 3.2 Meetings

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Throughout the course of the Work, in order to provide coordination of the Project, the Architect will schedule meetings which will include but are not limited to:

- 1. Preconstruction Conference
- 2. Progress Meetings
- 3. Roof Conference
- 4. Completion Inspection Meeting
- B. Related Requirements Specified in Other Sections

Summary of Work	Section 01 10 00
2. Quality Control	Section 01 45 00
3. Construction Schedules	Section 01 30 00
4. Submittals, Shop Drawings and Samples	Section 01 33 00
5. Project Record Documents	Section 01 70 00
6. Operating and Maintenance Data	Section 01 70 00

- C. Related Requirements in Other Parts of the Project Manual
  - 1. Pre-Bid Conference: Instruction to Bidders
- D. Definitions: See General Conditions

#### **PART 2 PRODUCTS**

### 2.1 Preconstruction Meeting

- A. Schedule within fifteen (15) days after date of Notice to Proceed.
- B. Location: The Architect will designate a central site convenient for all parties.
- C. Attendance
  - 1. All persons named on the Representatives List described in Part 3 of this Section.
  - 2. Major subcontractors.
  - 3. Major suppliers.
  - 4. Others as appropriate.

## D. Suggested Agendum

- 1. Distribution and discussion of:
  - a. List of major subcontractors and suppliers
  - b. Projected construction schedules.
- 2. Critical work sequencing.
- 3. Major equipment deliveries and priorities.
- 4. Project coordination; designation or responsible personnel.
- 5. Procedures and processing of:
  - a. Field decisions
  - b. Proposal requests
  - c. Submittals
  - d. Change orders
  - e. Application for payment
- 6. Adequacy of distribution of Contract Documents.
- 7. Procedures for maintaining Record Documents.
- 8. Use of premises:
  - a. Office, work and storage areas.
  - b. Owner's requirements.
- 9. Construction facilities, controls and construction aids.
- 10. Temporary utilities.
- 11. Safety and first-aid procedures.
- 12. Security procedures.
- 13. Housekeeping procedures.

## 2.2 Progress Meetings

- A. Schedule regular periodic meetings, as required.
- B. Hold called meetings as required by progress of the Work.
- C. Location of the Meetings: The project field office.

#### D. Attendance

- 1. Architect's, Owner's and Contractor's representatives as shown on Representatives List in Part 3 of this Section.
- 2. Subcontractors as appropriate to the Agenda.
- 3. Suppliers as appropriate to the Agenda.
- 4. Others.

# E. Suggested Agendum

- 1. Review, approval of minutes of previous meeting.
- 2. Review of Work progress since previous meeting.
- 3. Field observations, problems, conflicts.
- 4. Problems which impede Construction Schedule
- 5. Review of off-site fabrication; delivery schedules.
- 6. Corrective measures and procedures to regain projected schedule.
- 7. Revisions to Construction Schedule.
- 8. Plan progress schedule, during succeeding work period.
- 9. Coordination of schedule.
- 10. Review submittal schedules; expedite as required.
- 11. Maintenance of quality standards.

- 12. Review proposed changes for:
  - a. Effect on Construction Schedule and on completion date.
  - b. Effect on other contracts of the Project.
- 13. Perform business.

#### 2.3 Roof Conference

- A. Scheduled prior to start of Roofing work.
- B. Location: At field office.
- C. Attendance
  - 1. Architect
  - 2. Owner's Representatives
  - 3. General Contractor's project manager and field superintendent.
  - 4. Roofing Manufacturer's representative.
  - 5. Roofing Contractor.
- D. Suggested Agendum
  - 1. Review all roofing materials to be used.
  - 2. Review acceptable condition of roof deck.
  - 3. Review installation of all roofing materials.
  - 4. Review maintenance procedures.
  - 5. Review warranty and bonds.

# 2.4 Completion Inspection Meeting

- A. Schedule after Punch List has been returned to Architect and before final payment.
- B. Location: A walk-though of the entire project.
- C. Attendance
  - 1. Architect
  - 2. Owner's Representatives
  - 3. Field Superintendent for each prime Contractor.
  - 4. Subcontractors as requested.
  - 5. Engineers
- D. Suggested Agendum
  - 1. Review of Punch List items not completed.
  - 2. Review of Project requirements for determination of final payment.
- 2.5 One Year Warranty Review Meeting: Approximately eleven (11) months after the date of substantial completion the Architect, Owner and Contractor will inspect the project and develop a list of items to be corrected under the provisions of the One-Year Warranty division of the General Conditions.

### **PART 3 EXECUTION**

3.1 Representative List: After Contracts are awarded, each Contractor will submit to the Architect the names of the Project Manager and Field Superintendent. The Architect will then compile a list of all the representatives of the Owner, Architect, Engineers and Contractors who are authorized to make decisions about the Project and distribute this list to all interested parties.

# 3.2 Meetings

- A. The General Contractor shall schedule and administer pre-construction meeting, periodic progress meetings and specially called meetings throughout the progress of the Work.
  - 1. Prepare agenda for meetings.
  - 2. Distribute written notice of each meeting four (4) days in advance of meeting date.
  - 3. Make physical arrangements for meetings.
  - 4. Preside at meetings.
  - 5. Record the minutes; include all significant proceedings and decision.
  - 6. Reproduce and distribute copies of minutes within three (3) days after each meeting.
    - a. To all participants in the meeting.
    - b. To all parties affected by decisions made at the meeting.
- B. Representatives of Contractors, Subcontractors and suppliers attending the meeting shall be qualified and authorized to act on behalf of the entity each represents.

\* \* \* \* \* \* \* \* \* \* \* \*

01 31 19-4 PROJECT MEETINGS

### **SECTION 01 33 00 SUBMITTALS**

SCOPE Applicable provisions of the General and Supplementary Conditions and

Division 1 govern Work under this Section.

INDEX 1.1 Description 2.2 Product Data

1.2 Submittals 2.3 Samples

2.1 Shop Drawings 3.1 Shop Drawings, Product Data and

Samples

#### **PART 1 GENERAL**

# 1.1 Description

#### A. Work Included

- 1. To ensure that the specified products are furnished and installed in accord with design intent, procedures have been established for advance submittal of design data and for its review by the Architect.
- 2. Construction Schedule
- 3. Progress Reports
- 4. Shop Drawings
- 5. Product Data
- 6. Samples
- 7. Lavout Data
- 8. Schedule of Values
- 9. Instruction Manuals

### B. Related Requirements Specified Elsewhere

- 1. General Conditions
  - a. Progress Schedule
  - b. Shop Drawings, Product Data and samples
  - c. Schedule of Values

2.	Instructions to Bidders	Section 00 21 13
3.	Project Meetings	Section 01 31 19
4.	Quality Control	Section 01 45 00
5.	Material and Equipment	Section 01 60 00
6.	Project Closeout	Section 01 70 00

### C. Definitions

- 1. Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor and which illustrate some portion of the Work.
- 2. Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship and to assist in the establishment of standards by which the work will be judged.

#### 1.2 Submittals

### A. Construction Schedule

1. Submit initial schedules within fifteen (15) days after date of Award of Contract.

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- a. Architect will review schedules and return review copy within ten (10) days after receipt.
- b. If required, resubmit within seven (7) days after return of review copy.
- 2. Submit periodically updated schedules accurately depicting progress on first day of each month.

### B. Shop Drawings, Product Data and Samples

- 1. Schedule submissions at least fourteen (14) days before dates reviewed submittals will be needed.
- Submit number of copies of Shop Drawings, Product Data and Samples which Contractor required for distribution plus two copies which will be retained by the Architect. An additional copy shall be submitted for mechanical engineers as required.
- 3. Accompany submittals with transmittal letter, in duplicate, containing:
  - a. Date
  - b. Project title and number
  - c. Contractor's name and address
  - d. The number of each Shop Drawing, Product Data and Sample submitted.
- 4. Submittals shall include:
  - a. Date and revision dates.
  - b. Project title and number.
  - c. The names of:
    - (1) Architect or Engineer
    - (2) Contractor
    - (3) Subcontractor
    - (4) Supplier
    - (5) Manufacturer
    - (6) Separate detailer when pertinent.
  - d. Identification of product or material.
  - e. Relation to adjacent structure or materials.
  - f. Field dimensions clearly identified as such.
  - g. Specification Section number.
  - h. Applicable standards, such as ASTM number.
  - i. Identification of deviations from Contract Documents clearly marked in a different color. Provide a summary of deviations on the front sheet of the submittal.
  - j. Contractor's stamp, initialed or signed, certifying to review of submittals, verification of field measurements and compliance with Contract Documents.
- 5. Resubmission Requirements:
  - a. Shop Drawings:
    - (1) Revise initial drawings as required and resubmit as specified for initial submittal.
    - (2) Indicate on drawings any changes which have been made other than those requested by Architect.
    - (3) Product Data and Samples: Submit new data and samples as required for initial submittal.
- 6. Distribution of submittals after review:
  - a. Distribute copies of Shop Drawings and Product Data which carry Architect's stamp to:
    - (1) Contractor's file
    - (2) Job-site file
    - (3) Record document file

- (4) Other prime contractors
- (5) Affected subcontractors
- (6) Suppliers
- (7) Fabricator
- (8) Erector
- b. Distribute samples as directed.
- 7. Note: Architect will not accept any drawing or data that has been transmitted by means of telephone or facsimile. Submittals may be transmitted via electronic mail or using a project management web application.
- 8. Provide sufficient space for both Contractor's and Architect's Review Stamp.

#### **PART 2 PRODUCTS**

## 2.1 Shop Drawings

- A. Original drawings, prepared by Contractor, subcontractor, supplier or distributor, which illustrate some portion of the Work; showing fabrication, layout, setting or erection details.
- B. Prepared by a qualified detailer.
- C. Identify details by reference to sheet, room schedule, detail numbers or other identification for coordinating with Contract Drawings.
- D. Reproductions for Submittals: Submittals made on paper should be provided with five copies in blue or black line on white background.
- E. Unless otherwise specifically directed by the Architect, make all Shop Drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.
- F. One set of corrected drawings used for fabrication will be made available on the Owner's request.

#### 2.2 Product Data

- A. Manufacturer's Standard Schematic Drawings:
  - 1. Modify drawings to delete information which is not applicable to project.
  - 2. Supplement standard information to provide additional information applicable to Project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
  - 1. Clearly mark each copy to identify pertinent materials, products or models.
  - 2. Show dimensions and clearances required.
  - 3. Shop performance characteristics and capacities.
  - 4. Show wiring diagrams and controls.

# 2.3 Samples

A. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.

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- B. Office Samples: Of sufficient size and quantity to clearly illustrate:
  - 1. Functional characteristics of product or material with integrally related parts and attachment devices.
  - 2. Colors: Submit accurate color charts and pattern charts to the Architect for review and selection as required. Indicate any cost differential between samples.
  - 3. After review, samples may be used in construction of Project.
- C. Field Samples and Mock-ups: Erect at Project site at location acceptable to the Architect.

### **PART 3 EXECUTION**

## 3.1 Shop Drawings, Product Data and Samples

- A. Contractor Responsibilities
  - Review Shop Drawings, Product Data and Samples prior to submission. The Contractor will be responsible to submit samples which are to be available during the period of construction.
  - 2. Verify
    - a. Field measurements
    - b. Field construction criteria
    - c. Catalog numbers and similar data.
  - 3. Secure all necessary approvals from public agencies and others and signify by stamp or other means that they have been secured.
  - 4. Coordinate each submittal with requirements of Work, Contract Documents, all trades, and public agencies involved.
  - 5. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.
  - 6. Begin no work which requires submittals until return of submittals with Architect's stamp and initials or signature indicating review. The Architect takes no responsibility for items delivered to the site and will reject if no Shop Drawings were submitted.
  - 7. Notify Architect, in writing, at time of submission, of deviations in submittals from requirements of Contract Documents.
  - 8. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals, unless Architect gives written acceptance of specific deviations. Corrections required in the field due to failure to submit the required documents for review shall be made at no cost to the Owner or Architect.
  - 9. Work started or materials released for production prior to receiving returned submittals indicating "Reviewed" or "Reviewed as Noted" shall be at the Contractor's sole risk.
  - 10. Begin no work related to submittals returned as "Rejected "or "Revise and Resubmit" unless specifically noted on the review by the Architect. Immediately work with the supplier to provide corrected or revised documents for resubmittal as noted on the returned submittal.
  - 11. After Architect reviews indicating either "Reviewed" or "Reviewed as Noted", distribute copies.
- B. Architect's Duties (General Conditions)
  - 1. Review submittals with reasonable promptness.
  - 2. Review for:

- a. Design concept of Project.
- b. Information given in Contract Documents.
- 3. Review of separate item does not constitute review of an assembly in which item functions.
- 4. Affix stamp and initials or signature certifying to review of submittal.
- 5. Return submittals to Contractor for distribution.
- 6. Review of Shop Drawings by Architect/Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory.
  - Review of such drawings will not relieve Contractor of responsibility for any error which may exist in the submittals as Contractor shall be responsible for dimensions and design of adequate connections, details and satisfactory construction of all work.
- 7. The Architect will only check those submittals which have been prepared by the Contractor or subcontractor that is actually supplying, fabricating or installing the product to be reviewed. Any evidence that the submittal was prepared by a prime contractor for a subcontractor without the subcontractor's knowledge will result in the submittal being returned marked Rejected/Resubmit.
- 8. The Architect's stamp, affixed to the Shop Drawing, means only what is says; that the submittal has been reviewed and is released for fabrication "as is" or "as noted," must be resubmitted or has been rejected. The stamp does not represent a Change Order Authorization. The Contractor will bear all increased costs for reviewed products that have not been previously approved by the Architect for use on this Project.

### C. Timing

- 1. General
  - a. Make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
  - b. In scheduling, allow at least ten (10) full working days for the Architect's review following receipt of the submittal.
  - c. Mechanical and Electrical submittals should be allowed additional lead time for Engineer's review.
  - d. Submittals pertaining to color selection are interdependent. No colors will be selected without all samples.
- 2. Delays: Costs of delays occasioned by tardiness of submittals maybe back charged as necessary and shall not be borne by the Owner. Such costs will include the purchase, installation and removal of temporary materials, equipment and fixtures, as required, in writing, by the Owner to allow the Project to be used or occupied until the permanent materials, equipment and fixtures can be installed. The Owner will not be forced to accept alternate materials, equipment, fixtures or colors because of the failure of the Contractor's to make timely submission of Shop Drawings and product data.
- D. Submittal Schedule: Submittals required by the various Sections of these Specifications include, but are not necessarily limited to:

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		Field Approval	Shop Drawings	Samples	Color Selections	Manuals	Instruction Methods	Product Data
	Work	<b>↓</b>		(0)	)	_	_=	
01 70 00	Contract Close-out Items		X					
03 30 00	Concrete Mix Designs Reinforcing Steel		X					X
03 41 00	Precast Concrete		X					
03 35 00	Polished Concrete		X					
04 20 00	Unit Masonry				X	X	X	X
05 12 00	Structural Steel		X					
05 21 00	Steel Joists and Truss Girders		X					
05 30 00	Metal Decking		X					
05 41 00	Cold-Formed Metal Framing	<u> </u>	X					X
05 50 00	Miscellaneous Metals		X					
06 10 00	Rough Carpentry		X		X			
06 17 53	Fabricated Wood Trusses		X		X			
06 40 00	Architectural Woodwork		X					
06 61 00	Solid Polymer Fabrications		X	X	X	X	X	X
07 11 00	Vapor Retarders		X			X	X	X
07 13 00	Self-Adhering Sheet Waterproofing		X			X	X	X
07 21 00	Insulation			X		X	X	X
07 27 26	Fluid-Applied membrane Air Barriers, Vapor Permeable	X	X	X	X			X
07 31 00	Shingles	X	X	X	X			X
07 53 00	Single Ply Elastomeric Sheet Roofing	X	X	X	X		X	X
07 60 00	Architectural Sheet Metal				X			
07 84 00	Firestopping				X			
07 92 00	Caulking				X			X
08 11 00	Metal Doors and Frames		X					
08 14 00	Wood Doors		X					
08 30 00	Special Doors		X	X	X		X	
08 41 13	Aluminum Doors and Frames		X		X			
08 71 00	Hardware		X					X
08 80 00	Glazing		X		X			

# Table Continued:

Section	Work	Field Approval	Shop Drawings	Samples	Color Selections	Manuals	Instruction Methods	Product Data
09 29 00	Gypsum Wallboard		X					X
09 31 00	Ceramic Tile	X		X	X		X	X
09 51 00	Acoustical Ceilings		X		X			X
09 65 00	Resilient Flooring			X	X			X
09 68 00	Carpet			X	X	X		X
09 91 00	Painting				X			X
10 14 19	Flat Cut Letters		X	X	X	X	X	X
10 21 13	Toilet Compartments		X		X			X
10 28 00	Toilet & Bath Accessories	X		X	X		X	X
10 51 00	Metal Locker	X		Х	X		X	X
10 75 00	Flagpoles	Х					X	X
10 80 00	Miscellaneous Specialties	X		X	X		X	X
12 21 00	Window Blinds and Shades		X	X	X	X		X
13 34 23	Metal Building Systems	X	X	X	X			X
21	Fire Protection	X	X			X	X	X
22	Plumbing	X				X	X	X
23	HVAC	Х				X	X	X
26	Electrical	X				X	X	X
31 20 00	Earthwork	Х		X				X

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# **SECTION 01 45 00 QUALITY CONTROL**

Applicable provisions of the General and Supplementary Conditions and Division 1 SCOPE govern Work under this Section.

INDEX 2.3 Documents

1.1 Description1.2 Quality Assurance1.3 Submittals1 4 Product Handling 3.1 Contractor's Inspections 3.2 Architect's Inspections 3.3 Testing Laboratories 3.4 Updated Documents

2.2 Inspections

#### **PART 1 GENERAL**

#### 1.1 Description

- Work Included: During the course of the Work, the Contractors will maintain a means of ensuring quality control of the Project. Such means of control shall include:
  - 1. On-site construction.
  - 2. Off-site operations.
  - 3. Testing laboratory.
  - 4. Reports
  - 5. Testing and inspection requirements.
  - 6. Updated documents.
- Related Work Specified Elsewhere: Requirements for quality controls, certification and tests may be described in various Sections of these Specifications and the General Conditions.
- C. Work Not Included
  - 1. Selection of testing laboratories employed by Owner.
  - 2. Payment of testing laboratories for initial testing.
- D. Work by Owner
  - 1. Owner will employ and pay for the services of an Independent Testing Laboratory to perform specified testing.
    - a. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.
    - b. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

### 1.2 Quality Assurance

- A. Qualifications of Inspectors: Quality control personnel shall be familiar with all aspects of the Work and experienced in controlling the finished quality of the Work.
- B. Qualifications of Testing Laboratories
  - 1. Meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.
  - 2. Meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."
  - 3. Authorized to operate in the State in which the Project is located.

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- 4. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during the most recent tour of inspection with memorandum of remedies of any deficiencies reported by the inspection.
- 5. Testing Equipment:
  - a. Calibrated at reasonable intervals by devices of accuracy traceable to either:
    - (1) National Bureau of Standards.
    - (2) Accepted values of natural physical constants.
- C. Codes and Standards: Testing, when required, will be in accord with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.
- **1.3 Submittals**: Test reports, inspection reports and other documents will be submitted to all interested parties.
- **1.4 Product Handling:** Promptly process and distribute all required copies of reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

#### **PART 2 PRODUCTS**

## 2.1 Testing

- A. Code Compliance Testing: Inspections and tests, required by codes or ordinances, or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
- B. Contractor's Convenience Testing: Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
- C. Testing laboratory inspection, sampling and testing is requested by the Owner for:

1.	Portland cement concrete paving	Section 03 30 00
2.	Concrete reinforcement	Section 03 30 00
3.	Cast-in-place concrete	Section 03 30 00
4.	Structural metal framing	Section 05 12 00
5.	Metal fabrications	Section 05 50 00
6.	Soil compaction control	Section 31 20 00

## D. Payment for Testing

- 1. Initial services:
  - a. The Owner will pay for all initial testing services requested by the Owner.
  - b. When initial tests indicate non-compliance with the Contract Documents, the costs of initial tests associated with that non-compliance will be deducted by the Owner from the Contract Sum.
- Retesting: When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing laboratory and the costs thereof will be deducted by the Owner from the Contract Sum.

# 2.2 Inspections

- A. On-Site: The Contractor will provide the necessary personnel to maintain continuous inspection of the Work to ensure compliance with all the requirements of the Contract Documents, all applicable Codes and Manufacturer's recommendations.
- B. Off-Site Construction: The Contractor will provide the necessary inspections to ensure the adequacy of all items manufactured off site and delivered to the job ready for installation.
- **2.3 Documents:** The Contractor will prepare all documents necessary to comply with the requirements of this Section and deliver same to all interested parties.

#### **PART 3 EXECUTION**

3.1 Contractor's Inspections: The Contractor will continuously monitor the quality of the Work. Any work found to be inadequate will be corrected immediately. Any work found inadequate but requiring the consultation of the Architect will be reported to the Architect and then corrected immediately after clarification. Proper inspection procedures by the Contractor will eliminate the need for a Punch List at the completion of the Project.

## 3.2 Architect's Inspections

- A. The Architect will perform a periodic inspection of the Project as required by his/her agreement with the Owner. The Contractor will immediately carry out the Architect's instructions based on these inspections. The Architect will not assume the role of a full time inspector because of the inadequacies of the inspection procedures of the Contractor.
- B. As part of the Architect's inspections, the Contractor will provide the necessary tools and instruments to allow for the on-site verification of all dimensions, grades and elevations.

### 3.3 Testing Laboratories (Owner or Contractor Employed)

- A. Laboratory Duties
  - 1. Cooperate with Architect and Contractor; provide qualified personnel after due notice.
  - 2. Perform specified inspections, sampling and testing of materials and methods of construction: Comply with specified standards. Ensure certain compliance of materials with requirements of Contract Documents.
  - 3. Promptly notify Architect and Contractor of observed irregularities or deficiencies of Work or products.
  - 4. Promptly submit written report of each test and inspection; one copy each to Architect, Owner, Contractor and one copy to Record Document File.
  - 5. Perform additional tests as required by Architect or the Owner.
- B. Limitations of Authority of Testing Laboratory
  - 1. Laboratory is not authorized to:
    - a. Release, revoke, alter or enlarge on requirements of Contract Documents.
    - b. Approve or accept any portion of the Work.
    - c. Perform any duties of the Contractor.

# C. Contractor's Responsibilities

- 1. Cooperate with laboratory personnel, provide access to Work and to Manufacturer's operations.
- 2. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- 3. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes which require control by the testing laboratory.
- 4. Furnish copies of Products test reports as required.
- 5. Furnish incidental labor and facilities:
  - a. To provide access to Work to be tested.
  - b. To obtain and handle samples at the Project site or at the source of the product to be tested.
  - c. To facilitate inspections and tests.
  - d. For storage and curing of test samples.
- 6. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
  - a. When tests or inspections cannot be performed after such notice, reimburse
     Owner for laboratory personnel and travel expenses incurred due to Contractor's
     negligence.

### D. Schedules for Testing

- 1. Establishing schedule:
  - a. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to ensure each of its findings.
- Adherence to schedule: When the testing laboratory is ready to test according to the
  determined schedule but is prevented from testing or taking specimens due to
  incompleteness of the Work, all extra costs for testing attributable to the delay may be
  back-charged to the Contractor and shall not be borne by the Owner.
- E. Taking Specimens: All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.
- F. Notification: Testing agency shall notify all interested parties before testing begins.

### 3.4 Updated Documents

- A. Latest Contract Documents: The Contractor will be responsible for prompt distribution to all parties of the latest revised Contract Documents as supplied by the Architect.
- B. Record Documents: The Contractor will supply the Architect with record documents for those items which differ from the Contract Documents. This will be done immediately and not be left to the end of the Construction.

### SECTION 01 50 00 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX 1.1 Description 2.6 Access Roads and Parking

1.2 Requirements of Regulatory Areas

Agencies 2.7 Traffic Regulations

2.1 Utilities 2.8 Project Identification and Signs

2.2 Construction Aids
2.9 Field Offices and Sheds

2.3 Barriers 2.10 Owner Occupancy

2.4 Security 3.1 Removal

2.5 Temporary Controls

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Temporary facilities and controls required for this Work include, but are not necessarily limited to:
  - 1. Temporary utilities such as gas, water, electricity, heat, ventilation and light.
  - 2. Field offices and sheds.
  - 3. Sanitary facilities.
  - 4. Enclosures such as tarpaulins, barricades and canopies.
  - 5. Signs.
  - 6. Barriers.
  - 7. Access roads and parking.
  - 8. Construction elevators and hoists.
  - 9. Security.
  - 10. Special controls such as noise, dust and water.
  - 11. Winter protection.
  - 12. Fire protection.
  - 13. Traffic.

#### B. Related Work Specified Elsewhere

- 1. Compliance with safety regulations: Comply with all requirements of pertinent regulations as described in the General Conditions of the Contract.
- Subcontractor equipment: Except that equipment furnished by subcontractors shall comply with all requirements of pertinent safety regulations, the ladders, hoists, planks and similar items normally furnished by individual trades in execution of their own portions of the Work are not part of this Section of these Specifications.
- 3. Utility hook-up: Installation and hook-up of the various utility lines are described in the pertinent other Sections of these Specifications.

4. Sitework
5. Mechanical Materials
6. Electrical Materials and Lighting
9. Section 31 20 00
10. Division 23
10. Division 26

**1.2** Requirements of Regulatory Agencies: Comply with Federal, State and Local codes and regulations.

### **PART 2 PRODUCTS**

### 2.1 Utilities

- A. Temporary Heating, Cooling and Ventilating
  - 1. Conditions Required:
    - a. Provide and operate equipment required to control temperature and humidity, as necessary to facilitate progress of Work.
    - b. Provide ventilating and cooling required to maintain adequate conditions.
      - (1) To control humidity, and to prevent condensation which would have an adverse effect on products and finishes or which would affect application of materials.
      - (2) To cure installed materials.
    - c. Ventilation Required:
      - (1) General: To prevent hazardous accumulations of dust, fumes, mists, vapor or gases in areas occupied during construction.
        - (a) Provide local exhaust ventilation to prevent harmful dispersal of hazardous substances into atmosphere of occupied areas.
        - (b) Dispose of exhaust materials in a manner which will not result in harmful exposure to persons.
        - (c) Ventilate storage spaces containing hazardous or volatile materials.
  - 2. Use of Permanent System:
    - a. Prior to use of permanent system, obtain written permission of Owner, which will define:
      - (1) Conditions of use.
      - (2) Provisions relating to guarantees on equipment.
  - 3. Costs of Installation and Operation:
    - a. The General Contractor will pay fees and charges for applications, permits and inspections.
    - b. The General Contractor will pay costs of installation, fuel, operation, maintenance and removal of equipment and restoration of permanent facilities used.
  - 4. Materials:
    - a. Comply with applicable Sections of Division 23, Mechanical.
    - b. Materials may be new or used, but must be adequate for the purposes intended, and must not violate requirements of applicable codes and standards.
  - 5. Equipment:
    - a. Provide required facilities, including piping, wiring and controls, as appropriate.
    - b. Portable heaters: Standard units, in compliance with applicable codes and regulations.
  - 6. Installation:
    - a. Comply with applicable Sections of Division 23, Mechanical.
    - b. Modify and extend system as Work progress requires.
    - c. Locate units to provide uniform distribution of heat and air movement.
  - 7. Operation of Permanent Equipment (HVAC Sub-Contractor):
    - a. Place operational zones of permanent HVAC system in use sequentially as respective areas of Project become adequately enclosed for efficient operation.
    - b. Prior to operation, verify that inspection has been made by proper authorities and installation has been approved for operation.
    - c. Install temporary filters for air handling units and for permanent ducts.
    - d. Protect permanent radiation units such as convectors or finned pipe.

- e. Provide operation and maintenance of systems.
- 8. Removal:
  - Completely remove temporary materials and equipment when use is no longer required.
  - Restore existing equipment used for temporary services to original or better condition.
  - c. Restore permanent equipment used for temporary services to specified condition.
  - d. Remove temporary filters and install new.
- B. Temporary Electricity (See applicable sections of Division 26 Electrical)
  - 1. Service Requirements:
    - The Electrical Contractor will provide temporary power during the course of construction for all Contractors. This will be done through a separate temporary service.
    - b. Power centers for miscellaneous tools and equipment used in the Work:
      - (1) Weatherproof distribution box with minimum of four 20 ampere, 120 volt grounded outlets or more as needed.
      - (2) Locate so that power is available at any point of use with not more than 100 foot power cords.
      - (3) Minimum: One on each floor of building.
      - (4) Circuit breaker protection for each outlet.
    - Power to maintain continuous operation of Owner's facilities during changeover of electrical services.
    - d. Capacity of Service:
      - Provide electrical service for construction used by trades during construction period; minimum 120/240 volts, single phase, 60 hertz. See Electrical Specifications.
      - (2) Notify power company when unusually heavy loads, such as for welding and other equipment with special power requirements, will be connected.
      - (3) Any trade requiring service of capacity or characteristics other those specified above shall provide and pay for the additional service.
    - e. Power Source: Local power provider
    - f. Preliminary Power Source:
      - Prior to availability of service, provide portable power plants of a capacity adequate for construction needs.
  - 2. Use of Permanent System:
    - Prior to use of permanent system for construction purposes, obtain written permission of Owner.
    - b. Maintain permanent system as specified for temporary facilities.
  - 3. Costs of Installation and Operation:
    - a. General Contractor:
      - (1) Pay costs of electrical power used.
    - b. Electrical Contractor:
      - To obtain permits and applications. The General Contractor to pay for permits, installation fees and related charges.
      - (2) Pay costs of installation, maintenance and removal of temporary services, and restoration of any permanent facilities used.
    - c. Subcontractors: Should any subcontractor do any electric welding on the job, they shall inform the Electrical Contractor and work out a satisfactory agreement for payment to the General Contractor for his power.

# 4. Materials and Equipment:

- a. General:
  - (1) Comply with applicable sections Division 26 Electrical.
  - (2) Products may be new or used, but must be adequate in capacity for required usage, and must not violate requirements of applicable codes and standards.
  - (3) Each trade will provide its own extension cords.

# 5. Installation:

- a. Comply with applicable requirements specified in Sections of Division 26, Electrical.
- b. Maintain system to provide continuous service.
- c. Modify and extend service as Work progress requires.
- d. Make connections for temporary heating, cooling and ventilating equipment:
  - (1) Wire all safety devices specified for final operation of equipment.
  - (2) Verify proper operation of safety devices.

#### 6. Removal:

- a. Completely remove temporary materials and equipment:
  - (1) When construction needs can be met by use of permanent installation.
  - (2) At completion of Project.
- b. Restore existing facilities used for temporary services to original or better condition.
- c. Restore permanent facilities used for temporary services to specified condition.

### C. Temporary Lighting

- 1. The Electrical Contractor will provide temporary artificial lighting in enclosed areas and for all areas when natural light does not meet minimum requirements for:
  - a. Construction work.
    - (1) For work areas: uniform illumination of 20-foot candles minimum or as required for execution of work.
  - b. Security.
    - (1) For work areas: temporary security lighting at building entrances 1-foot candle minimum within 10 feet of entrance.
    - (2) For staging and storage areas: temporary security lighting at staging and storage areas 1-foot candle average.
  - c. Temporary offices, storage, shop and other construction buildings.
- 2. Use of Permanent System: Prior to use of permanent lighting system, obtain written permission of Owner. Use of permanent system shall not shorten guarantee period.
- Materials:
  - a. Comply with applicable requirements specified in Sections of Division 26, Electrical.
  - b. Maintain lighting and provide routine repairs.
  - c. Immediately prior to final inspection, clean fixtures and replace defective lamps and any other defective parts.

# D. Temporary Gas and Water

- 1. Construction Water and Gas:
  - a. Provide adequate supply of water and gas suitable for construction usage.
  - b. Capacity of Service:
    - (1) Size water and gas service to provide adequate volume for all anticipated construction uses and to maintain minimum specified pressure when taps are in use.

- c. Water Source: City of Huber Heights
- d. Gas Source: Local Gas Provider
- e. Water and Gas Source:
  - Install specified permanent system sufficiently complete to serve for temporary supply.
  - (2) Obtain inspections and certifications from authorities prior to use.
- f. Maintain strict supervision of use of temporary system:
  - (1) Protect against freezing; repair leaks.
- 2. Use of Permanent System:
  - a. Prior to use of permanent system for construction purposes, obtain written permission of Owner.
  - b. Prior to use of system for drinking water:
    - (1) Disinfect piping.
    - (2) Obtain inspection and approval of governing authority.
  - Extend system as necessary to comply with temporary water and gas requirements.
- 3. Costs of Installation and Operation:
  - a. The General Contractor will pay fees and charges for applications and permits.
  - Pay costs of installation, maintenance and removal of temporary services, and restoration of existing and permanent facilities used.
  - c. The General Contractor will pay costs for water and gas used.
  - Obtain and pay costs for temporary easements required across proprieties other than that of the Owner.
- Materials:
  - a. General:
    - (1) Comply with applicable sections of Division 23 Mechanical
    - (2) Materials may be new or used, but must be adequate for purpose required, must be sanitary, and must not violate requirements of applicable codes.
- 5. Installation:
  - Comply with applicable requirements specified in Sections of Division 23, Mechanical.
  - Maintain system to provide continuous service.
  - Modify and extend service as Work progress requires.
  - When necessary to maintain pressure, provide temporary pumps, tanks and compressors.
- 6. Removal:
  - a. Completely remove temporary materials and equipment.
    - (1) When construction can be met by use of permanent installation.
    - (2) At completion of Project.
  - b. Clean and repair damage caused by installation or use of temporary facilities.
  - Restore existing facilities, used for temporary services, to original or better condition.
  - d. Restore permanent facilities, used for temporary services, to specified condition.
- E. Temporary Sanitary Facilities
  - 1. Use of Permanent Facilities:
    - a. When portions of permanent sanitary sewerage and water systems have been installed, tested and inspected, install temporary plumbing fixtures for use of construction personnel.
      - (1) Remove and relocate fixtures as Work progress requires.

- b. Permanent sanitary facilities may be used by construction personnel after completion of installation, testing and inspection.
  - (1) Obtain written permission of Owner prior to usage, establishing conditions of use.
- 2. Cost of Installation and Operation:
  - a. The General Contractor will obtain and pay for permits as required by governing authorities.
  - b. The General Contractor will pay costs of temporary sanitary facilities, including costs of installation, maintenance and removal.
  - c. The General Contractor will pay service charges for use of portable units.
- Materials:
  - a. General:
    - (1) Comply with applicable sections of Division 23 Mechanical.
    - (2) Materials may be new or used, but must be adequate for purpose intended, and must not create unsanitary conditions nor violate code requirements.
  - b. Toilet Facilities:
    - (1) Portable toilets or temporary flush toilets at Contractor's option.
- 4. Installation:
  - a. Comply with applicable provisions of Sections of Division 23, Mechanical.
  - b. Modify and extend service as Work progress requires.
  - c. Place portable toilets in conformance with applicable laws, codes and regulations.
  - d. Temporary flush toilets: Provide water and sewer connections, and install toilets as soon as water supply and sewerage connections are available.
- 5. Maintenance: Maintain facilities in a clean, operable sanitary condition.
- 6. Removal:
  - a. Remove portable units when no longer required.
  - b. Remove temporary flush toilets when the space is ready for finishing and adequate facilities are provided elsewhere.
  - c. Completely remove temporary materials and equipment at completion of Project.
  - d. Clean and repair areas used for temporary purposes; replace damaged fixtures, surfaces and accessories.
- F. Temporary Fire Protection: The General Contractor shall provide and maintain, in working order, during the entire construction period, a minimum of three (3) fire extinguishers on each floor level including basement of the building, one in temporary office and such other fire protective equipment and devices as it deems necessary and suitable for any possible class of type of fires. They shall be non-freeze type such as A-B-C rated dry chemical extinguishers of not less than 10 pound capacity each. In addition each Contractor who maintains an enclosed shed on the premises shall install and maintain, in an accessible location one or more similar non-freezing type of fire extinguisher in each shed. Provisions of Local, State or Federal requirements, whichever are more restrictive, shall apply.

#### 2.2 Construction Aids

A. General: Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

#### **B.** Construction Aids

- 1. Provide construction aids and equipment required by personnel to facilitate the execution of the Work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.
- 2. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
- C. Construction Elevators and Hoists: The Contractors shall furnish, install and maintain all necessary material hoists, skips, tools, equipment, scaffolding, etc., in approved locations and in sufficient quantities to properly expedite the Work and protect the public. The Contractors will be responsible for the operation of its equipment and allow all contractors to use it as the progress of the Work requires. This equipment shall be installed according to State and local requirements and shall be removed by the Contractors at the completion of the Work. The permanent elevator may not be used.

# D. Temporary Enclosures

- Provide temporary weather-tight enclosures of exterior walls for successive areas of the building as Work progresses as necessary to provide acceptable working conditions; provide weather protection for interior materials; allow for effective temporary heating; and, to prevent entry of unauthorized persons.
  - a. Provide temporary exterior doors with self-closing hardware and padlocks.
  - b. Other enclosures shall be removable as necessary for work and for handling of materials.
  - c. Exterior partitions or enclosures shall be covered with 3-inch insulation on interior face.
- Provide temporary enclosures to separate work areas from the areas of existing building occupied by Owner; to prevent penetration of dust or moisture into occupied area; to prevent damage to existing equipment; and, to protect Owner's employees and operations.
  - Temporary partition and ceiling enclosures: Framing and sheet materials which comply with structural and fire rating requirements of applicable codes and standards.
    - (1) Close joints between sheet materials, and seal edges and intersections with existing surfaces, to prevent penetrations of dust of moisture.

#### E. Installation

 Preparation: Consult with Architect, review site conditions and factors which affect construction procedures and construction aids, including adjacent properties and public facilities which may be affected by execution of the Work.

## 2. General:

- a. Preparation: Consult with Architect, review site conditions and factors which affect construction procedures and construction aids, including adjacent properties and public facilities which may be affected by execution of the Work.
- b. Relocate construction aids as required by progress of construction, by storage or Work requirements, and to accommodate legitimate requirements of Owner and other Contractors employed at the site.

#### F. Removal

- 1. Completely remove temporary materials, equipment and services:
  - a. When construction needs can be met by use of permanent construction.
  - b. At completion of the Project.

- 2. Clean and repair damage caused by installation or by use of temporary facilities.
  - a. Remove foundations and underground installations for construction aids.
  - b. Grade the areas of the site affected by temporary installations to required elevations and slopes, and clean this area.
- 3. Restore existing facilities used for temporary purposes to specified, or to original condition.
- 4. Restore permanent facilities used for temporary purposes to specified condition.

### 2.3 Barriers

- A. Materials, General: Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.
- B. Silt Fencing: Materials: as required by detail shown on Site Plan.
- C. Installation
  - 1. General:
    - a. Install facilities of neat and reasonable uniform appearance, structurally adequate for the required purposes.
    - b. Maintain barriers during entire construction period.
    - c. Relocate barriers as required by progress of construction.
  - 2. Silt Fences:
    - a. Prior to the start of Work at the Project Site, install as located on Site Plan.
- D. Removal
  - 1. Completely remove barricades; silt fence, when construction has progressed to the point that they are no longer needed, and when approved by Architect.
  - 2. Clean and repair damages caused by installation, fill and grade the areas of the Site to required elevations and slopes, and clean the area.

## 2.4 Security

- A. Responsibility: During the course of construction, up until the time the Owner accepts the Work as completed, the General Contractor only assumes care and custody of the Work and will be responsible for the Work.
- B. Maintenance of Security
  - 1. Initiate security program promptly after job mobilization, when enclosure fence and gates are installed.
- C. Personnel
  - 1. Identification:
  - 2. Exclude from Site personnel not properly identified.
- D. Entrance Control
  - 1. Provide control of all persons and vehicles entering and leaving Project Site.
    - a. Allow no visitors except with issuance of temporary identification.
  - 2. Owner will control deliveries and vehicles related to his/her own operations.
- E. Safety Barrier: The Contractor is responsible to secure the site.

# **2.5** Temporary Controls

A. Dust Control: All Contractors will provide positive methods and apply dust control materials to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

# B. Water Control

- The General Contractor will provide methods to control surface water to prevent damage to the Project, the Site, or adjoining properties. See silt fence location and construction on Site Plan.
  - Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff.
- 2. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface and water.
- Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the Site or to adjoining areas as required by applicable codes and ordinances.

### C. Debris Control

- 1. Maintain all areas under Contractor's control free of extraneous debris.
- 2. Initiate and maintain a specific program to prevent accumulation of debris at construction Site, storage and parking areas, or along access roads and haul routes;
  - a. Provide containers for deposit of debris as specified in Section 01 77 16, Cleaning.
  - b. Prohibit overloading of trucks to prevent spillages on access and haul routes.
    - (1) Provide periodic inspection of traffic areas to enforce requirements.
- 4. Schedule periodic collection and disposal of debris as specified in Section 01 77 16, Cleaning;
  - a. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation.

#### D. Pollution Control

- 1. All Contractors will provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.
- 2. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
  - a. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
- 3. Take special measure to prevent harmful substances from entering public waters;
  - a. Prevent disposal of wastes, effluents, chemicals or other such substances adjacent to streams, or in sanitary or storm sewers.
- 4. Provide systems for control of atmospheric pollutants.
  - a. Prevent toxic concentration of chemicals.
  - b. Prevent harmful dispersal of pollutants into the atmosphere.
- E. Erosion Control: Per Local and State requirements see Section 31 20 00
- F. Soil Control: After the soil is excavated, General Contractor will isolate any excavated areas that tend to become tacky due to vehicular traffic.

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# 2.6 Access Roads and Parking Areas

#### A. Site Access Roads

- 1. The General Contractor will provide site access for all construction equipment vehicles.
- 2. Construct new temporary access roads over designated easements from public thoroughfare to entire construction site area.

# B. On-Site Roads and Parking Areas

- Locate roads, drives, walks and parking facilities to provide uninterrupted access to construction offices, mobilization, work, storage areas, and other areas required for execution of the Contract.
- 2. Provide access for emergency vehicles.
  - a. Maintain driveways a minimum of fifteen (15) feet wide between and around combustible materials in storage and mobilization areas.
- 3. Maintain traffic areas free as possible of excavated materials, construction equipment, products, snow, ice and debris.
- 4. Keep fire hydrants and water control valves free from obstruction and accessible for use.

# C. Base and Topping Materials

- 1. For temporary construction which will be removed when no longer needed for construction purposes: To Contractor's option.
- 2. For earthwork and topping which will become a permanent part of the work: respective sections of Specifications.

#### D. Preparation

- 1. Clear areas required for access roads and parking areas.
- 2. Fill, compact and grade areas as necessary to provide suitable support for vehicular traffic anticipated loadings. Provide for heaviest vehicle that will use site e.g. concrete trucks, mobile cranes, precast concrete trucks, etc.
- 3. Provide for surface drainage of facilities and surrounding areas;
  - a. Provide and operate temporary pumps.

#### E. Construction

- Construction methods for temporary facilities to be removed when no longer needed:
   To Contractor's option to provide the required results.
- 2. For work which will become a part of permanent work, comply with respective sections of Specification for preparation and construction.
- 3. Any gravel topping used for temporary roadway shall be at least six (6) inches below finished elevation of permanent drives. Topping shall be at least one (1) foot below finished landscape areas or removed to that point below finished grading.

## F. Maintenance

- 1. Maintain roads, walks and parking areas in sound, clean condition.
  - a. Repair or replace any portions damaged during progress of construction work.

#### G. Removal

1. Completely remove temporary materials and construction when construction needs can be met by use of permanent installation;

- a. Remove and dispose of compacted materials to depths required by various conditions to be met in completed Work.
- 2. See Section 31 20 00, Access for all contractors.

# **2.7** Traffic Regulations

# A. Traffic Signals and Signs

- The General Contractor will provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under Contractor's control, or affected by Contractor's operations.
- 2. Provide traffic control and directional signs, mounted on barricades or standard posts:
  - a. At each change of direction of a roadway and at each crossroads.
  - b. At detours.
  - c. At parking areas.

#### B. Haul Routes

- 1. Consult with governing authorities to establish public thoroughfares which will be used as haul routes and site access.
- 2. Confine construction traffic to designated haul routes.
- 3. Keep haul routes free of mud and debris to meet local ordinances.

# 2.8 Project Identification and Signs

# A. Project Identification Sign

1. The General Contractor will provide one (1) 4' X 8' FT identification sign as approved by Owner prior to installation.

# B. Quality Assurance

- 1. Sign Painter: Professional experience in the type of work required.
- 2. Finishes, Painting: Adequate to resist weathering and fading for the scheduled construction period.
- C. Allow no other signs or advertising of any type on the Project Site except as specifically approved by the Architect.

# D. Sign Materials

- 1. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to the Work and suitable for specified finish.
- 2. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints;
  - a. Thickness: As required by standards to span across framing members, to provide even, smooth surface without waves or buckles.
- 3. Rough Hardware: Galvanized.
- 4. Paint: Exterior quality, as specified in Section 09 90 00.
  - a. Use bulletin colors for graphics.
  - b. Colors for structure, framing, sign surfaces and graphics: As selected by Architect.

# E. Execution

1. Project Identification Sign:

- a. Paint all exposed surfaces of supports, framing and surface material; one coat of primer and one coat of exterior paint.
- b. Paint graphics in the styles, sizes and colors as selected.
- 2. Information Signs:
  - a. Paint all exposed surfaces: one coat of primer and one coat of exterior paint.
  - b. Paint graphics in the styles, sizes and colors as selected.
  - c. Install at a height for optimum visibility, on ground-mounted poles or attached to temporary structural surfaces.

## F. Maintenance

- 1. Maintain signs and supports in a neat, clean condition: repair damages to structure, framing or sign.
- 2. Relocate informational signs as required by progress of the Work.
- G. Removal: Remove signs, framing, supports and foundations at the completion of Project.

# 2.9 Field Office and Sheds

- A. Coordination: Prior to installation of offices and sheds, consult with Architect on location, access and related facilities.
- B. Requirements for Facilities
  - 1. Construction:
    - a. Structurally sound, weathertight, with floors raised above ground.
    - b. Temperature transmission resistance: Compatible with occupancy and storage requirements.
    - c. At Contractor's option, portable or mobile buildings may be used.
      - (1) Mobile homes, when used, shall be modified for office use.
      - (2) Do not use mobile homes for living quarters.
- C. Materials, Equipment, Furnishings: May be new or used, but must be serviceable, adequate for the required purpose, and must not violate applicable codes or regulations.
- D. Preparation: Fill and grade sites for temporary structures to provide surface drainage.

#### E. Installation

- 1. Construct temporary field offices and storage sheds on proper foundations, provide connections for utility services.
  - a. Secure portable or mobile buildings when used.
  - b. Provide steps and landings at entrance doors.
- 2. Mount thermometer at convenient outside location, not in direct sunlight.
- F. Maintenance and Cleaning: Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment and services.
- G. Removal
  - 1. Remove temporary field offices, contents and services at time they are no longer needed.
  - 2. Remove storage sheds when they are no longer needed.

- 3. Remove foundations and debris; grade the site to required elevations and clean the areas.
- 2.10 Owner Occupancy: As portions of the building are completed, the space should be made so the Owner can set up its equipment, if so requested. In those areas occupied, the General Contractor will take the necessary precautions to protect Owner's equipment against damage and dust.

#### **PART 3 EXECUTION**

**3.1 Removal:** 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.

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## **SECTION 01 60 00 MATERIALS AND EQUIPMENT**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX 1.1 Description 2.3 Storage and Protection

> 1.2 Submittals2.1 Materials and Equipment2.2 Transportation and Handling 1.2 Submittals 2.4 Substitution and Product Options

3.1 Storage of Materials

3.2 Protection

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: The Work under this Section will ensure the proper handling and protection of materials and establish methods for product approval and shall include but is not limited to:
  - 1. Transportation and handling
  - 2. Storage and protection
  - 3. Installation requirements
  - 4. Identifying markings
  - 5. Product approval standards
  - 6. Substitutions and product options

# B. Related Work Specified Elsewhere

1.	Substitutions during bidding	Instructions to Bidders
2.	Coordination	Section 01 30 00
3.	Schedule of Values	Section 01 30 00
4.	Shop Drawings, Project Data, Samples	Section 01 33 00
5.	Quality Control	Section 01 45 00

#### C. Definitions

 "Or Equal" Clause: Whenever the Contract Documents designate any article, material or equipment by describing a propriety product or by using the name of a Manufacturer or vendor, the term "or equal" shall apply. The article, material or equipment so named shall be understood to define a type, function, minimum standard of design, efficiency and quality desired, and is not intended to eliminate competition. The Contractor may, by complying with the requirements of Article E of the Instructions to Bidders, use authorized substitutions in the Bid. Determination of "or equal" products is the responsibility of the Architect. The burden is on the Manufacturer, who has not been specified by name, to convince the Architect that the product is equal.

## 1.2 Submittals

### A. Product Approval

- 1. Within fifteen (15) days after date of Contract, submit to Architect five (5) copies of complete list of all products which are proposed for installation.
- 2. Tabulate list by each Specification Section.
- 3. For products specified under reference standards, include with listing of each product.

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- a. Name and address of Manufacturer
- b. Trade name.
- c. Model or catalog designation.
- d. Manufacturer's data.
  - (1) Performance and test data.
  - (2) Reference standards.

#### B. Substitutions

- Architect will consider substitutions quoted with Base Bid, and requests submitted with Bid.
- 2. Within 15 days after date of Contract, Architect will consider formal requests from Contractor for substitution of products in place of those specified.

# **PART 2 PRODUCTS**

# **2.1** Materials and Equipment

#### A. General

- 1. Materials and equipment incorporated into the Work
  - a. Conform to applicable Specifications and Standards.
  - b. Comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.
  - c. Manufactured and Fabricated Products:
    - (1) Design, fabricate and assemble in accord with the best engineering and shop practices.
    - (2) Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
    - (3) Two or more items of the same kind shall be identical, by the same Manufacturer.
    - (4) Products shall be suitable for service conditions.
    - (5) Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
  - d. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

### B. Manufacturer's Instructions

- When Contract Documents require that installation of Work shall comply with Manufacturer's printed instructions, obtain and distribute copies of such instructions, obtain and distribute copies of such instructions to parties involved in the installation and until completion;
  - a. Maintain one set of complete instructions at the Project site during installation and until completion.
- 2. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements;
  - a. Should Project conditions or specified requirements conflict with Manufacturer's instructions, consult with Architect for further instructions.
- Perform work in accord with Manufacturer's instructions. Do no omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

C. Identifying Markings: Nameplates and markings required by codes or regulations or as required for proper operation of equipment shall be affixed for ready access but shall not be placed on exposed surfaces unless required otherwise.

# 2.2 Transportation and Handling

## A. Delivery

- 1. Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation.
- 2. Coordinate deliveries to avoid conflict with Work and conditions at site:
  - a. Work of other Contractors or Owner.
  - b. Limitations of storage space.
  - c. Availability of equipment and personnel for handling products.
  - d. Owner's use of premises.
- 3. Deliver products in undamaged condition in original containers or packaging with identifying labels intact and legible.
- 4. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
- 5. Immediately on delivery, inspect shipment to ensure:
  - a. Product complies with requirements of Contract Documents and reviewed submittals.
  - b. Quantities are correct.
  - c. Containers and packages are intact, labels are legible.
  - d. Products are properly protected and undamaged.

### B. Product Handling

- Provide equipment and personnel necessary to handle products, including those provided by Owner by methods to prevent soiling or damage to products or packaging.
- 2. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- 3. Handle products by methods to prevent bending or overstressing.
- 4. Lift heavy components only at designated lifting points.

#### 2.3 Storage and Protection

## A. Storage

- 1. Store products immediately on delivery, and protect until installed in the Work;
  - a. Store in accord with Manufacturer's instructions, with seals and labels intact and legible.
- 2. Store products subject to damage by elements in substantial weathertight enclosures.
- 3. Exterior Storage:
  - a. Provide substantial platforms, blocking or skids to support fabricated products above ground, prevent soiling or staining;
    - (1) Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
  - b. Store loose granular materials on solid surfaces such as paved areas, or provide plywood or sheet materials to prevent mixing with foreign matter.
    - (1) Provide surface drainage to prevent flow or ponding of rain water.
    - (2) Prevent mixing of refuse or chemically injurious materials with liquids.

4. Arrange storage in manner to provide easy access for inspection.

## B. Maintenance of Storage

- 1. Maintain periodic system of inspection of stored products on scheduled basis to ensure that:
  - a. State of storage facilities is adequate to provide required conditions.
  - b. Required environmental conditions are maintained on continuing basis.
  - c. Surfaces of products exposed to elements are not adversely affected;
    - (1) Any weathering of products, coating and finishes is acceptable under requirements of Contract Documents.
- 2. Mechanical and electrical equipment which requires servicing during long term storage shall have complete Manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.
  - a. Comply with Manufacturer's instructions on scheduled basis.
  - b. Space heaters which are part of electrical equipment shall be connected and operated continuously until equipment is placed in service.

#### C. Protection After Installation

- 1. Provide protection of installed products to prevent damage form subsequent operations. Remove when no longer needed, prior to completion of Work.
- 2. Control traffic to prevent damage to equipment and surfaces.
- 3. Provide coverings to protect finished surfaces from damage.
  - a. Cover projections, wall corners and jambs, sills and soffits of openings in areas used for traffic and for passage of products in subsequent work.
  - b. Protect finished doors and stairs from dirt and damage:
    - (1) In areas subject to foot traffic, secure heavy paper, sheet goods or other materials in place.
    - (2) For movement of heavy products, lay planking or similar materials in place.
    - (3) For storage of products, lay tight wood sheathing in place.
    - (4) Cover walls and floor of elevator cars, and surfaces of elevator car doors used by construction personnel.
- 4. Waterproofed and roofing surfaces:
  - a. Prohibit use of surfaces for traffic of any kind, and for storage of any products.
  - b. When some activity must take place in order to carry out the Contract, obtain recommendations of installer for protection of surface.
    - (1) Install recommended protection, remove on completion of that activity.
    - (2) Restrict use of adjacent unprotected areas.
- 5. Lawns and Landscaping: Prohibit traffic of any kind across planted lawn and landscaped areas.

## 2.4 Substitution and Product Options

- A. Product Approval Standard
  - 1. Definitions:
    - a. The term "product" shall include material, equipment, assembly methods, Manufacturer, brand, trade name, or other description.
    - b. References to "approved equal" or similar terms mean that approval of the Architect is required.

- 2. Contractor's Options:
  - a. For products specified only by reference standards, select any product meeting standards, by any Manufacturer.
    - (1) Proof of Compliance: Whenever the Contract Documents require that a product be in accord with Federal Specifications, ASTM designation, ANSI Specifications or other association standards, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies therewith. Where requested or specified, submit supporting test data to substantiate compliance.
  - b. For products specified by naming several products or Manufacturers, select any product and Manufacturer named.
  - c. For products specified by naming one or more products but indicating the option of selecting equivalent products by stating "or equal" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.
  - d. For products specified by naming only one product and Manufacturer, there is no option, and no substitution will be allowed.
- B. Availability of Specified Items: Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work. In the event specified item or items will not be available, notify the Architect prior to receipt of Bids. Costs or delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall not be borne by the Owner.

### C. Substitutions

- 1. For a period of 30 days after Contract Date, Architect will consider written requests from Contractor for substitutions of Products.
- 2. Submit five copies of request for substitution. Include in request:
  - a. Complete data substantiating compliance of proposed substitution with Contract Documents.
  - b. For products:
    - (1) Product identification, including Manufacturer's name and address.
    - (2) Manufacturer's literature:
      - (a) Product description.
      - (b) Performance and test data.
      - (c) Reference standards.
    - (3) Samples
    - (4) Name and address of similar projects on which product was used, and date of installation.
  - c. For construction methods:
    - (1) Detailed description of proposed method.
    - (2) Drawings illustrating methods.
  - d. Itemized comparison of proposed substitution with product or method specified.
  - e. Data relating to changes in construction schedule.
  - f. Relation to separate contracts.
  - g. Accurate cost data on proposed substitution in comparison with product or method specified.
- 2. In making request for substitution, Contractor represents:
  - a. They have personally investigated proposed product or method, and determined that it is equal or superior in all respects to that specified.

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- b. They will provide the same warranty for substitution as for product or method specified.
- c. They will coordinate installation of accepted substitution into Work, making such changes as may be required for Work to be complete in all respects.
- d. They waive all claims for additional costs related to substitution which consequently becomes apparent.
- e. Cost data is complete and includes all related costs under the Contract, but excludes:
  - (1) Costs under separate Contracts.
  - (2) Architects or Engineer's redesign.
- 3. Substitutions will not be considered if:
  - a. The substitutions will result in any increased cost for the Owner over the cost of the item as it was originally specified.
  - b. They are indicated or implied on Shop Drawings or project data submittals without a formal request submitted to the Architect.
  - c. Acceptance will require substantial revision of Contract Documents.

#### PART 3 EXECUTION

## 3.1 Storage of Materials

### A. General

- All Contractors shall confine their equipment, apparatus, storage of materials and operations to limits indicated and shall not bring materials onto the site until needed for the progress of the Work.
- 2. Storage of materials within the building shall at no time exceed the design carrying capacity of the structural system.
- 3. The General Contractor shall slot space to other Contractors and subcontractors for storage of their materials, erection of their sheds.
- 4. The Owner assumes no responsibility for materials stored in building or on the Site.

  The Contractors assumes full responsibility for damage due to the storing of material.

#### 3.2 Protection

#### A. General

- Precaution shall be exercised at all times for the protection of persons, including employees, and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery equipment and all hazards shall be guarded or eliminated.
- 2. Notify Owners of corporate or private property if their property interferes with the Work so the arrangements for proper protection can be made.
- 3. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into the building excavation. Provide temporary protection around openings through floors and roofs, including elevator openings, stairwells and edge of slabs.

#### B. Finish Construction

 Each Contractor shall assume the responsibility for the protection of all finished construction under this Contract and shall repair and restore any and all damage of finished Work to its original state.

- 2. Where responsibility can be fixed, the cost shall be charged to the party responsible. If responsibility cannot be fixed, the cost shall be pro-rated among all Contractors in proportion to their activities at the building at the time the damage was done.
- 3. No wheeling of any loads over finished floors, either with or without plank protection will be permitted in anything except rubber tired wheelbarrows, buggies, trucks or dollies. This applies to all finished floors and to all concrete floors exposed as well as those covered with composition tile or other applied surfacing, and shall apply to all Contractors and subcontractors.
- 4. Where structural concrete is also the finished surface, care must be taken to avoid marking or damaging those surfaces.

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## **SECTION 01 70 00 CONTRACT CLOSEOUT**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX** 1.1 Description 3.6 Punch Lists

1.2 Quality Assurance 3.7 Substantial Completion

1.3 Submittals2.1 Project Close Out3.8 Final Inspection3.9 Reinspection Fees

3.1 Damage Repair 3.10 Contractor's Closeout Submittals to

3.2 Tests and Adjustments Architect

3.3 Project Record Documents
3.4 Operating and Maintenance Data
3.12 Final Adjustment for Accounts
3.2 Final Application for Payment

3.5 Warranties and Bonds

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Such work as will be necessary to turn the Project over to the Owner in a clean and usable condition. The Work shall include but is not limited to:
  - 1. Damage repair
  - 2. Test and adjustments
  - 3. Punch lists
  - 4. Warranties
  - 5. Final waiver of lien
  - 6. Operation and maintenance instructions
  - 7. Project record documents

## B. Related Work Specified Elsewhere

1.	Summary of Work	Section 01 10 00
2.	Coordination	Section 01 30 00
3.	Shop Drawings, Product Data and Samples	Section 01 33 00
4.	Operation and Maintenance Data	Section 01 33 00
5.	Cleaning	Section 01 77 16

- 6. Closeout Submittals Required of Trades: The respective Sections of Specification
- 7. Various Sections of these Specifications describe procedures, for individual items, to make finished Construction ready for acceptance by Owner.
- C. Work by Owner:

# 1.2 Quality Assurance

- A. The Contractor will promptly make any necessary corrections to the Work as directed by the Architect so as to expedite final payments.
- B. Preparation of operating and maintenance data shall be done by personnel:
  - 1. Trained and experienced in maintenance and operation of the described products.
  - 2. Completely familiar with requirements of this Section.
  - 3. Skilled as a technical writer to the extent required to communicate essential data.

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- 4. Skilled as a draftsperson competent to prepare required Drawings.
- Submittals: The Contractors will submit all warranties, manuals, Drawings, waivers and test reports as required by the various Sections of this Specification to the Owner at the close of the Project.

## **PART 2 PRODUCTS**

**2.1 Project Closeout:** The Contractors will provide the manpower to promptly close out the Project so that Owner may occupy the building on the date of completion.

#### **PART 3 EXECUTION**

- **3.1 Damage Repair:** The Contractors will make final resolution of the repairing of damaged Work.
- 3.2 Tests and Adjustments: Each Contractor will perform all tests and make all final adjustments under the actual working condition of each piece of equipment. Comply with Manufacturer's recommendations and turn over a complete and workable installation to the Owner.

## 3.3 Project Record Documents

- A. Maintenance of Documents
  - 1. Maintain at jobsite, one copy of:
    - a. Contract Drawings.
    - b. Specifications
    - c. Addenda
    - d. Reviewed Shop Drawings
    - e. Change Orders
    - f. Other modifications to Contract
    - a. Field test records.
  - 2. Store documents in field office, apart from documents used for construction.
  - 3. Maintain documents in a clean, dry and legible condition.
  - 4. Do not use record documents for construction purposes.
  - 5. Make documents available at all times for inspection by the Architect and Owner.

### B. Recording

- 1. Label each document "PROJECT RECORD".
- 2. Keep record documents current.
- 3. Do not permanently conceal any Work until required information has been recorded.
- 4. Contract Drawings: Legibly mark to record actual construction.
  - a. Depths of various elements of foundation in relation to Floor Level.
  - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
  - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  - d. Field changes of dimension and detail.
  - e. Changes made by Change Order or Field order.
  - f. Details not on original Contract Drawings.
- 5. Specifications and Addenda: Legibly mark up each Section to record:

- a. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
- b. Changes made by Change Order or Field Order.
- c. Other matters not originally specified.
- 6. Shop Drawings: Maintain as Record Documents; legibly annotate following Drawings to record changes made after review.

#### C. Submittals

- 1. At completion of Project, deliver Record Documents to Architect.
- 2. Accompany submittal with transmittal letter, in duplicate, containing:
  - a. Data.
  - b. Project title and number.
  - c. Contractor's name and address.
  - d. Title and number of each record document.
  - e. Certification that each document is submitted is complete and accurate.
  - f. Signature of Contractor, or his authorized representative.

# 3.4 Operating and Maintenance Data

#### A. General

- 1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
  - a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent Sections of Specifications.
- 2. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.
- This portion of these Specifications will be strictly enforced. Final Payment will not be made until all data has been submitted to the Architect. Any money or time spent by the Architect to obtain information from manufacturer shall be deducted from Contractor's final payments.

#### B. Form of Submittal

- 1. Prepare data in the form of an instructional manual for use by Owner's personnel.
- 2. Format:
  - a. Size: 8-1/2 inch by 11 inch.
  - b. Text: Manufacturer's printed data, or neatly typewritten.
  - c. Drawings:
    - (1) Provide reinforced punched binder tab, bind in with text.
    - (2) Fold larger Drawings to the size of the text pages.
  - d. Provide fly-leaf for each separate product, or each piece of operating equipment.
    - (1) Provide typed description of product and major component parts of equipment.
    - (2) Provide indexed tabs.
  - e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
    - (1) Title of Project
    - (2) Identity of general subject matter covered in the Manual.
  - f. In addition to paper copies of O&M data, provide 3 electronic copies with all information in .pdf format. Each division with the .pdf file shall be bookmarked if multiple sections are included in one file.

3. Binders: Commercial quality three-ring binders with durable and cleanable plastic covers.

#### C. Content of Manual

- 1. Neatly typewritten table of contents for each volume, arranged in a systematic order.
  - a. Contractor, name of responsible principal, address and telephone number.
  - b. A list of each product required to be included, indexed to the content of the volume.
  - c. List, with each product, the name, address and telephone number of:
    - (1) Subcontractor or installer.
    - (2) Maintenance contractor, as appropriate.
    - (3) Identify the area of responsibility of each.
    - (4) Local source of supply for parts and replacement.
  - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

#### 2. Product Data:

- a. Include only those sheets which are pertinent to the specific product.
- b. Annotate each sheet to:
  - (1) Clearly identify the specific product or part installed.
  - (2) Clearly identify the data applicable to the installation.
  - (3) Delete references to inapplicable information.

## 3. Drawings:

- a. Supplement product data with Drawings as necessary to clearly illustrate:
  - (1) Relations of component parts of equipment and systems.
  - (2) Control and flow diagrams.
- b. Coordinate Drawings with information in Project Record Documents to assure correct illustration of completed installation.
- c. Do not use Project Record Documents as maintenance Drawings.
- 4. Written text, as required, to supplement product data for the particular installation:
  - a. Organize in a consistent format under separate headings for different procedures.
  - b. Provide a logical sequence of instructions for each procedure.
- 5. Copy of each warranty, bond and service contract issued;
  - a. Provide information sheet for Owner's personnel, give:
    - (1) Proper procedures in the event of failure.
    - (2) Instances which might affect the validity of warranties or bonds.

#### D. Manual for Materials and Finishes

- 1. Submit two copies of complete manual in final form.
- 2. Content, for architectural products, applied materials and finishes.
  - a. Manufacturer's data, giving full information on products.
    - (1) Catalog number, size, composition.
    - (2) Color and texture designations.
    - (3) Information required for re-ordering special-manufactured products.
  - b. Instructions for care and maintenance.
    - (1) Manufacturer's recommendation for types of cleaning agents and methods.
    - (2) Cautions against cleaning agents and methods which are detrimental to the product.
    - (3) Recommended schedule for cleaning and maintenance.
- 3. Content, for moisture-protection and weather-exposed products:
  - a. Manufacturer's data, giving full information on products.

- (1) Applicable standards.
- (2) Chemical composition.
- (3) Details of installation.
- b. Instructions for inspection, maintenance and repair.
- 4. Additional requirements for maintenance data: The respective Sections of Specifications.
- E. Manual for Equipment and Systems
  - 1. Submit three copies of complete manual in final form.
  - 2. Content, for each unit of equipment and system, as appropriate:
    - a. Description of unit and component parts.
      - (1) Function, normal operating characteristics, and limiting conditions.
      - (2) Performance curves, engineering data and tests.
      - (3) Complete nomenclature and commercial number of all replaceable parts.
    - b. Operating procedures:
      - (1) Start-up, break in, routine and normal instructions.
      - (2) Regulation, control, stopping, shut-down and emergency instructions.
      - (3) Summer and winter operating instructions.
    - c. Maintenance procedures:
      - (1) Routine operations.
      - (2) Guide to "trouble-shooting".
      - (3) Disassembly, repair and reassembly.
    - d. Servicing and lubrication schedule.
      - (1) List of lubricants required.
    - e. Manufacturer's printed operating and maintenance instructions.
    - f. Description of sequence of operation by control Manufacturer.
    - g. Original Manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      - (1) Predicted life of parts subject to wear.
      - (2) Items recommended to be stocked as spare parts.
    - h. As-installed control diagrams by controls Manufacturer.
    - i. Each Contractor's coordination Drawings;
      - (1) As-installed color coded piping diagrams.
    - j. Charts of valve tag numbers, with the location and function of each valve.
    - k. List of original Manufacturer's spare parts, Manufacturer's current prices, and recommended quantities to be maintained in storage.
    - I. Other data as required under pertinent Sections of Specifications.
  - 3. Content, for each electric and electronic system, as appropriate:
    - a. Description of systems and component parts.
      - (1) Function, normal operating characteristics, and limiting conditions.
      - (2) Performance curves, engineering data and tests.
      - (3) Complete nomenclature and commercial number of replaceable parts.
    - b. Circuit directories of panelboards.
      - (1) Electrical service.
      - (2) Controls.
      - (3) Communications.
    - c. As-installed color coded wiring diagrams.
    - d. Operating procedures:
      - (1) Routine and normal operating instructions.
      - (2) Sequences required.
      - (3) Special operating instructions.

- e. Maintenance procedures:
  - (1) Routine operations.
  - (2) Guide to "trouble-shooting".
  - (3) Disassembly, repair and reassembly.
  - (4) Adjustment and checking.
- f. Manufacturer's printed operating and maintenance instructions.
- g. List of original Manufacturer's spare parts, Manufacturer's current prices, and recommended quantities to be maintained in storage.
- h. Other data as required under pertinent Sections of Specifications.
- 4. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- 5. Additional requirements for operating and maintenance data: The respective Section of Specifications.
- 6. Provide complete information for products specified in:
- F. Submittal Schedule: Submit specified number of copies or approved data in final form ten (10) days after final inspection or acceptance.
- G. Instruction of Owner's Personnel
  - Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems.
  - 2. Operating and maintenance manual shall constitute the basis of instruction;
    - a. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

# 3.5 Warranties and Bonds

## A. General

- 1. Compile specified warranties and bonds.
- 2. Compile specified service and maintenance contracts.
- 3. Co-execute submittals when so specified.
- 4. Review submittals to verify compliance with Contract Documents.
- 5. Submit to Architect for review and transmittal to Owner.

### B. Submittal Requirements

- 1. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
- 2. Number of original signed copies required: Two each.
- 3. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
  - a. Product or work item.
  - b. Firm, with name of principal, address and telephone number.
  - c. Scope
  - d. Date of beginning of warranty, bond or service and maintenance contract.
  - e. Duration or warranty, bond or service maintenance contract.
  - f. Provide information for Owner's personnel:
    - (1) Proper procedure in case of failure.
    - (2) Instance which might affect the validity of warranty or bond.
  - g. Contractor, name of responsible principal, address and telephone number.

#### C. Form of Submittals

- 1. Prepare in duplicate packets.
- 2. Format:
  - a. Size 8-1/2 inches by 11 inches, punch sheets for 3-ring binder;
    - (1) Fold larger sheets to fit into binders.
  - b. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
    - (1) Title of Project.
    - (2) Name of Contractor.
  - c. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.
  - d. CD/Flash drive three (3) of all documents.

#### D. Time of Submittals

- 1. For equipment or component parts of equipment put into service during progress of construction:
  - a. Submit documents within ten (10) days after inspection and acceptance.
- 2. Otherwise, make submittals within ten (10) days after Date of Substantial Completion prior to final request for payment.
- 3. For items of Work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.
- E. Submittals Required: Submit warranties, bonds, and service and maintenance contracts as specified in the respective Sections of Specifications.

## 3.6 Punch Lists

- A. Prior to substantial completion, the Architect will inspect the project and publish all items of the Work found unacceptable in the form of a Punch List. The Work described should be done immediately and the Punch List returned to the Architect with each item initialed and dated. The Contractors should not use the Punch List as a final inspection service because of their own lack of quality control.
- B. Contractor will, within seven (7) days of issuance of Punch List by Architect, provide, in writing, to the Architect a Schedule of Completion for the Punch List items.

# 3.7 Substantial Completion

- A. When Contractor considers the Work is substantially complete, they shall submit to Architect:
  - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
  - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, Architect will make an inspection to determine the status of completion.
- C. Should Architect determine that the Work is not substantially complete:
  - 1. Architect will promptly notify the Contractor, in writing, giving the reasons therefore.
  - 2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
  - 3. Architect will reinspect the Work.

# 3.8 Final Inspection

- A. When Contractor considers the Work is complete, he shall submit written certification that:
  - Contract Documents have been reviewed.
  - 2. Work has been inspected for compliance with Contract Documents.
  - 3. Work has been completed in accord with Contract Documents.
  - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
  - 5. Work is completed and ready for final inspection.
- B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Architect consider that the Work is incomplete or defective:
  - 1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
  - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.
  - 3. Architect will reinspect the Work.
- D. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

# 3.9 Reinspection Fees

- A. Should Architect perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
  - 1. Owner will compensate Architect for such additional services.
  - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.
- 3.10 Contractor's Closeout Submittals to Architect: Documents required prior to Final Payment: Prior to final payment, and before the issuance of final certificate for payment the following items must be filed with the Architect:
  - A. Evidence of compliance with requirements of governing authorities:
    - 1. Certificates of Inspection
      - a. Elevators
      - b. Mechanical
      - c. Electrical
  - B. Project Record Documents: to requirements of Section 01 70 00.
  - C. Operating and Maintenance Data, Instructions to Owner's Personnel: to requirements of Section 01 70 00.
  - D. Warranties and Bonds: to requirements of Section 01 70 00.
  - E. Keys and Keying Schedule: to requirements of Section 08 71 00, Finish Hardware.

F. Spare Parts and Maintenance Materials: Attic stock is required by the various Sections of these Specifications include, but are not necessarily limited to the table below. Provide evidence that the following have been accepted by the Owner:

Section	Product	Quantity
07 31 00	Shingles	One percent (1%) of total shingles laid.
09 31 00	Ceramic Tile	One quarter (¼) carton of each tile and color.
09 51 00	Acoustical Ceilings	Two percent (2%) of each type of acoustical material supplied.
09 65 00	Resilient Flooring	One carton per 1,000 square feet of each color and style. One carton minimum.
09 68 00	Carpet	One carton of each style and color of carpet.
09 91 00	Paint	1 gallon of each color.

- G. Final Waiver of Lien: To indicate that all debts and claims against this Project have been paid in full or otherwise satisfied, and to give final evidence of release of all liens against the Project and its Owner, the Contractors shall submit a certification to that effect.
- H. Provide the Architect with a written statement that the Owner's maintenance personnel have received operation and maintenance manuals and have received complete instructions on the operation of all equipment under every possible condition.
- I. Certificate of Insurance for Products and Completed Operations.

## 3.11 Final Adjustment of Accounts

- A. Submit a final statement of accounting to the Architect.
- B. Statement shall reflect all adjustments to the Contract Sum:
  - 1. The original Contract Sum.
  - 2. Additions and deductions resulting from:
    - a. Previous Change Orders.
    - b. Unit Prices.
    - c. Deductions for uncorrected work.
    - d. Deductions for reinspection payments.
    - e. Other adjustments.
  - 2. Total Contract Sum, as adjusted.
  - 3. Previous payments.
  - 4. Sum remaining due.
- C. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

#### 3.12 Final Application for Payment

A. Contractor shall submit the final Application for Payment in accord with procedures and requirements stated in the Conditions of the Contract.

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## **SECTION 01 73 29 CUTTING AND PATCHING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX 1.1 Description 3.1 Inspection

1.2 Submittals 3.2 Preparation Prior to Cutting

1.3 Payment for Costs 3.3 Performance

2.1 Materials

#### **PART 1 GENERAL**

# 1.1 Description

- A. Related Requirements Specified Elsewhere
  - 1. General Conditions
    - a. Cutting and patching of Work
    - b. Tests
    - c. Uncovering and correction of Work

Summary of Work
 Coordination
 Excavating and Backfilling
 General Provisions, Mechanical Section
 General Provisions, Electrical Section
 Division 26

- B. Execute Cutting (including excavating), Fitting or Patching of Work, required to:
  - 1. Make several parts fit properly.
  - 2. Uncover Work to provide for installation of ill-timed work.
  - 3. Remove and replace defective Work.
  - 4. Remove and replace work not conforming to requirements of Contract Documents.
  - 5. Remove samples of installed Work as specified for testing.
  - 6. Install specified Work in existing construction.
  - 7. To receive the Work of other contractors as shown or reasonably implied by the Drawings or Specifications
- C. In addition to Contract requirements, upon written instructions of Architect:
  - 1. Uncover work to provide for Architect's observation of covered work.
  - 2. Remove samples of installed materials for testing.
  - 3. Remove work to provide for alteration of existing work.
- D. Do not endanger any Work by cutting or altering work or any part of it.
- E. Do not cut or alter Work of another Contractor without written consent of Architect.

# 1.2 Submittals

- A. Prior to cutting which affects structural safety of Project, or Work of another Contractor, submit written notice to Architect, requesting consent to proceed with cutting, including:
  - 1. Identification of project.
  - 2. Description of affected Work.
  - 3. Necessity for cutting.

- 4. Effect on other Work, on structural integrity of Project.
- 5. Description of proposed work designate:
  - a. Scope of cutting and patching.
  - b. Contractor and trades to execute work.
  - c. Products proposed to be used.
  - d. Extent of refinishing.
- 6. Alternatives to cutting and patching.
- 7. Designation of party responsible for cost of cutting and patching.
- B. Prior to cutting and patching done on instruction of Architect, submit cost estimate.
- C. Should conditions of work, or schedule, indicate change of materials or methods, submit written recommendation to Architect, including:
  - 1. Conditions indicating change.
  - 2. Recommendations for alternative materials or methods.
  - 3. Submittals as required for Substitutions.
- D. Submit written notice to Architect, designating time Work will be uncovered, to provide for observation.

# 1.3 Payment for Costs

- A. Costs caused by ill-timed or defective Work or Work not conforming to Contract Documents, including cost for additional services of Architect: Party responsible for ill-timed, rejected or nonconforming work.
- B. Work done on instructions of Architect, other than defective or nonconforming work:

  Owner.
- C. Work caused by the damage of a Contractor's installation or equipment by another Contractor: Contractor responsible for causing the damage.

#### **PART 2 PRODUCTS**

**2.1 Materials:** For replacement of Work removed, comply with Specifications for type Work to be done.

#### **PART 3 EXECUTION**

## 3.1 Inspection

- A. Inspect existing conditions of Work, including elements subject to movement or damage during:
  - 1. Cutting and patching
  - 2. Excavating and backfilling.
- B. After uncovering Work, inspect conditions affecting installation of new products.

# 3.2 Preparation Prior to Cutting

- A. Provide shoring, bracing and support as required to maintain structural integrity of Project.
- B. Provide protection for other portions of Project.

#### 3.3 Performance

- A. Each prime Contractor will arrange for all cutting and patching, for their portion of the Work. Hire only skilled workmen qualified in the type of work required.
- B. Each Prime Contractor will be expected to cut, bore, drill, etc. through all materials as required including concrete, steel and wood.
- C. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, finishes.
- D. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation or repairs and new work.
- E. Execute excavating and backfilling by methods which will prevent damage to other work, and will prevent settlement.
- F. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.
- G. Refinish entire surfaces as necessary to provide an even finish.
  - 1. Continuous Surfaces: to nearest intersections.
  - 2. Assembly: entire refinishing.
- H. The painting Contractor will be responsible for repairing <u>all</u> damage to their work under this Specification.

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## **SECTION 01 77 16 PROGRESS CLEANING AND FINAL CLEANING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

**INDEX** 1.1 Description 2.3 Containers

1.2 Quality Assurance2.1 Cleaning Materials & Equipment3.1 Progress Cleaning3.2 Final Cleaning

2.2 Compatibility 3.3 Cleaning During Owner's Occupancy

#### **PART 1 GENERAL**

# 1.1 Description

# A. Work Included

- 1. Throughout the construction period, maintain the building, the site and adjacent private and public property in a standard of cleanliness as described in this Section.
- 2. It shall be the duty of each Prime Contractor to keep the premises free of accumulations of surplus materials and rubbish caused by his operations and the operations of this subcontractors unless otherwise stated.

# B. Related Work Specified Elsewhere

- 1. General Conditions
  - a. Cleaning up
  - b. Owner's right to clean-up

2.	Summary of Work	Section 01 10 00
3.	Coordination	Section 01 30 00
4.	Temporary Controls	Section 01 50 00
5.	Project Closeout	Section 01 70 00
6.	Cutting and Patching	Section 01 73 29

7. In addition to standards described in this Section, comply with all requirements for cleaning up as described in various other Sections of these Specifications.

## 1.2 Quality Assurance

- A. Inspection: Conduct daily inspections, 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 governmental agencies having jurisdiction.

# **PART 2 PRODUCTS**

- **2.1** Cleaning Materials and Equipment: Provide all required personnel, equipment and materials needed to maintain the specified standards of cleanliness.
- **2.2 Compatibility:** 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.

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**2.3 Containers:** Each Contractor for the General Work will provide metal containers for storage of rubbish which will be used by all persons working for that contractor.

#### **PART 3 EXECUTION**

# 3.1 Progress Cleaning

#### A. General

- 1. Retain all stored items in an orderly arrangement allowing maximum, 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 and legally dispose of at public or private dumping areas off Owner's propriety.
- 4. The General Contractor will assign adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
- 5. No burning of rubbish or debris will be allowed at site. No rubbish shall be thrown through openings or from heights without proper protection.
- 6. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- 7. The General Contractor will vacuum-clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as needed basis until building is ready for substantial completion or occupancy.
- 8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- 9. The General Contractor shall perform a broom cleaning of all appropriate surfaces, each Friday afternoon.

## B. Safety Requirements

- 1. Hazards Control
  - a. Store volatile wastes in covered metal containers, and remove from premises daily.
  - b. Prevent accumulation of wastes which create hazardous conditions.
  - c. Provide adequate ventilation during use of volatile or noxious substances.
  - d. Keep work areas, passageways, ramps, stairs, free of debris and scrap.
  - e. Form and scrap lumber shall have nails withdrawn or bent over and lumber shall be stacked or removed.
  - f. Remove spills of oil, grease or other liquids immediately or sprinkle with sand.
- 2. Conduct cleaning and disposal operation to comply with local ordinances and antipollution laws.
  - a. Do not bury rubbish and waste materials on project site.
  - b. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
  - c. Do not dispose of wastes into streams or waterways.

#### C. Site

1. Daily, and more often if necessary, inspect the site 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, inspect all arrangements of materials stored on the site, restack, tidy or otherwise service all arrangements to meet the requirements of Paragraph 3.1-A-1 above.
- 3. Maintain the site in a neat and orderly conditions at all times to the approval of the Architect.

#### D. Structures

- Weekly, and more often if necessary, each prime contractor will inspect the structures and pick up all their scrap, debris and waste material. Remove all such items to the place designated for their storage.
- 2. Weekly, and more often if necessary, the General Contractor will 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 reasonable diligence using a hand-held 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 finished floor materials, the General Contractor will clean the finished floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials have been installed. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free form all foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.
- 5. Daily cleanup, within all Owner occupied areas in which work has occurred, will be the responsibility of the Contractor doing the work.
- E. Graffiti: As directed by the Architect, the General Contractor will promptly remove all evidence of graffiti within the limits of the site.
- F. Disputes Over Responsibility for Cleaning: If, during the course of construction, disputes should arise over which parties are responsible for cleaning all or a portion of the work, the Architect will require each prime contractor, working at the site, to supply one employee for a clean-up crew, which will be under the direction of the General Contractor.

#### 3.2 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 commercial quality building maintenance equipment and materials. Employ experienced workers, or professional cleaners, as approved by the Owner, for final cleaning.
- B. General: Prior to completion of the Work, all Contractors will remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in Article 3.1 above.
- C. Site: Unless otherwise specifically directed by the Architect, the General Contractor will hose down all paved areas on the site and all public sidewalks directly adjacent to the site.

February 6, 2024 01 77 16-3 Completely remove all resultant debris. Rake clean other surfaces of grounds. Remove snow and ice from access to building.

#### D. Structures

- 1. Exterior: The General Contractor will 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, by the responsible Contractor, at no additional cost to the Owner.
- 2. Interior: The General Contractor will visually inspect all interior surfaces and remove 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 equipment. Stubborn stains will be removed by the responsible Contractor at the direction of the Architect.
- Window Washing: General Contractor shall wash all glass immediately prior to occupancy of this project. Work shall include the removal of labels, paint splattering, putty or compound, etc. Surfaces shall include both sides of all glass in windows, borrowed lights, partitions, doors. Include mirrors.
- 4. Polished surfaces: To all surfaces requiring the routine application of buffed polish, apply the specified polish as recommended by the manufacturer of the material being polished.
- 5. Carpet: The General Contractor will vacuum all carpeted areas.
- 6. Mechanical Systems (HVAC Contractor)
  - a. Clean ducts, blowers and coils, if air conditioning units were operated without filters during construction.
  - b. Replace air conditioning filters if units were operated during construction.
- 7. Electrical Fixtures (Electrical Contractor)
  - a. Lenses and louvers should be free of dirt and dust.

## E. Timing

- 1. Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean project.
- The General Contractor will notify all prime contactors of the dates for the final cleaning of the building. After those dates, but prior to issuance of the prefinal inspection Punch List, any soiling of cleaned areas will be cleaned by the responsible Contractor or cleaned by the General Contractor and charged to the responsible Contractor.
- After issuance of the prefinal inspection Punch List, recleaning will be done by the responsible Contractor or cleaned by the General Contractor or Owner and charged to the responsible Contractor.
- 4. Maintain cleaning until Project, or portion thereof, is occupied by Owner.
- 3.3 Cleaning During Owner's Occupancy: 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 determined by the Architect in accord with the General Conditions of Contract.

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## **SECTION 03 30 00 CAST-IN-PLACE CONCRETE**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 1.3 Submittals

> 1.2 Quality Assurance 2.1 Supplemental Requirements

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Cast-in-place concrete required for this work (including forms and reinforcing) is indicated on the drawings and includes but is not necessarily limited to:
  - 1. Footings foundations
  - 2. Exterior flat work
  - 3. Interior floor slabs and concrete topping on metal deck
  - 4. Curbs
  - 5. Landings & steps at metal pan stairs
- B. Related Work Specified Elsewhere

1. Testing laboratory Section 01 45 00 2. Structural Steel Framing Section 05 12 00 3. Sitework Section 31 20 00

C. Work Installed but Furnished by Others: Anchor bolts, templates and built-in items for precast work, Section 03 41 00 and steel work, Section 05 12 00.

### 1.2 Quality Assurance

- A. Workers: Use only workers experienced in the placing and finishing of concrete and erecting of reinforcing.
- B. Codes and Standards: Concrete work shall conform to all requirements of ACI 301-16, Specifications for Structural Concrete, except as modified by the Supplemental Requirements below:
  - 1. A copy of ACI-301-16, Specifications for Structural Concrete for Buildings is on file at the office of the Architect. The Contractor in submitting a proposal verifies that they have complete knowledge of ACI 301-16. A copy of ACI 301 shall be bound into the copy of the building Specifications and kept on the site during construction. All concrete work will also conform to ACI 318-14 Building Code Requirements for Structural Concrete.
- 1.3 Submittals: At award of Contract and before any concrete is delivered to the job site submit to the Architect in accordance with these Specifications: Reinforcing steel drawings and Mix designs.

# **PART 2 PRODUCTS**

**2.1** Supplemental Requirements: Numbers listed below correspond to numbering designations used in ACI 301-16, Specifications for Structural Concrete for Buildings.

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- (1.6) Testing: Take test cylinders as directed by Architects for testing by Owner.
- (2.2.1.4) Joint at perpendicular filler to meet Article 2.2.1.4
- (2.2.4) Added section for drain tile; provided and installed:

Drain Tile: 4" Perforated Corrugated Drain Tile

- 1. ADS single wall corrugated HDPE pipe or equal.
- 2. Drainage filter sock.
- 3. Complete foundation at areas with finished below grade.
- (3.1) Reinforcement: Fiber reinforcing for the topping slab shall be a blend of polypropylene/polyethylene high performance macro-synthetic fibers. Propex Novomesh 950 or equal, dosage of 5 pounds per cubic yard of concrete. Fiber mesh reinforcement is not permitted in concrete to be polished.
- (3.2) Reinforcing steel:
  - 3.2.1.1 Deformed bars grade: ASTM A615 Grade 60, new billet steel.
  - 3.2.1.5 Wire grade: ASTM A1064.
- (3.3.2.5) Welded Wire Fabric: Welded wire fabric shall be as specified on the drawings. Fabric to be supplied in sheets; rolled goods are not permitted. Fabric to be supported on chairs to position the wires at the specified height. "Hooking" during concrete placement is not permitted.
- (4.2.1.4) Admixtures: Air entraining admixtures compliant with ASTM C260 in accord with ACI 301 will be acceptable. Chemical admixtures compliant with ASTM C 494 or ASTM C 1017 in accord with ACI 301 will be acceptable / Chemical (non-chloride) admixtures compliant with ASTM C 494 or ASTM C 1017 in accord with ACI 301 will be acceptable.
- (4.2.2) Concrete Strength: All concrete 4000 psi at 28 days.
- (4.2.2.2) Maximum slumps as follows: Slump shall be 4" per ACI 301 with a tolerance of +/- 1" per ACI 117. As stated in ACI 301, plasticizing admixtures will increase the allowable slump. Expected slump shall be documented on the mix design.
- (4.2.2.4) Concrete for footings and interior slab-on-grade shall be classified as Exposure Class F0. Concrete for exterior walls above grade shall be classified as Exposure Class F1. Concrete for foundation walls and exterior slabs shall be classified as Exposure Class F2.
- (5.3.1) Placing: Notify Architect 24 hours in advance of starting time of each pour. Allow time for inspection of forms, reinforcement, screeds, etc., and to explain procedures for slump and cylinder tests.
- (5.3.1) Concrete contractor to verify actual topping thickness to account for camber in steel joists/ Precast Deck.

(5.3.3.3)	As-cast finishes: 5.3.3.3.b Smooth form finish required.
(5.3.3.4.a)	Smooth rubbed finish on exposed sections of retaining walls, exposed foundations and curbs. Remove form marks prior to application. Commercial coating as approved by Architect.
(5.3.4.2)	Tolerances: Concrete to be true to plane, plumb and level with true curves. Deviations from dimensions, pitches, contours may not exceed 1/4" when by adding to scratch coat this may be corrected. Deviations which require a reduction in total two inch thickness of tile and setting bed, as shown on the Drawings will not be allowed.
(5.3.4.2.d)	Stiff broom finish on stair treads and areas to receive ceramic tile.
(5.3.5)	Control Joints: saw cut or trowel as shown on plan or max size 14'-0" x 14'-0"; curbing at 10'-0" o.c.
(5.3.6)	Concrete Densifier and Hardener: At all slabs to remain exposed and noted as "Densifier" on Room Finish Schedule, Ashford Formula by Cure Crete Seal Hard by L&M Construction Chemicals TK-Floor Hardener and Densifier 5329 by TK Products
	Concrete Surface Sealer: At all slabs to remain exposed and noted as "Sealer" on Room Finish Schedule, Lapidolith by Sonneborn Aquapel by L&M Construction Chemicals.
	Apply per manufacturer's specifications for new concrete immediately after finishing.
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## SECTION 03 35 43 POLISHED CONCRETE SURFACES (DYE)

SCOPE Applicable provisions of the General and Supplementary Conditions, Division 1 govern Work under this Section.

<b>INDEX</b>	1.1	Description	2.4	Finishes
	1.2	References	3.1	Examination
	1.3	Submittals	3.2	Preparation
	1.4	Quality Assurance	3.3	Floor Finishing
	1.5	Pre-Installation Meeting	3.4	Floor Surface Treatment
	1.6	Delivery, Storage & Handling	3.5	Field Quality Control
	1.7	Warranty	3.6	Adjusting
	2.1	Manufacturers	3.7	Cleaning
	22	Manufacturers & Products	3.8	

## **PART 1 GENERAL**

2.3 Equipment

### 1.1 Description

- A. Work Includes: All equipment and labor, tools and training for the polished concrete floor finish where shown on the plans including:
  - Dyed Ground Polished Concrete Finishing System at designated areas.
  - 2. Minimum of six (6) Passes, Last grit level to be #1500.

### B. Related Sections:

1. Cast-in-place concrete Section 03 30 00 Joint Sealants Section 07 92 13

### 1.2 References

- A. Valid and current certificate of training for system installer
- B. ACI 301 Specifications for Structural Concrete for Buildings; American Concrete Institute
- C. ACI 302.1R Guide for Concrete Floor and Slab Construction; American Concrete Institute
- D. NFSI Test Method 101-A National Floor Safety Institute Standard for evaluating high traction flooring materials, coatings and finishes. www.nfsi.org.
- E. ASTM C 779, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces

### 1.3 Submittals

- A. General: Submit in accordance with these Sections
- B. Product Data:
  - Submit manufacturer's descriptive literature, product specifications and Safety Data Sheets (SDS) for each product.
  - 2. Submit a letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase two level of certification when tested by method 101-A.
  - Preparation and concrete grinding procedures.
  - Number of applications of the Hardener, Sealer, Densifier liquid.
  - 5. Joint filing, crack repair and/or surface repair products and protocols.

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6. Maintenance Data: provide data on maintenance renewal of applied coatings.

### C. Shop Drawings:

- 1. Indicate typical layout including dimensions and floor grinding schedule.
- 2. Plan view of the floor and joints clearly marked for the work and the sealer.

# 1.4 Quality Assurance

- A. Manufacturer's Qualification: Company specializing in products and procedures specified in this Section.
- B. Installer Qualifications: Acceptable to Manufacturer with documented current manufacturer's certificate and performance on projects of a similar nature.

### C. Mock up

- 1. Construct mock-up area under conditions similar to those which will exist during actual placement, at least 50 square feet, with coatings applied.
- 2. Locate where directed.
- 3. Mock-up may remain as part of the Work if satisfactory and protected from damage.

### D. Protection:

- 1. Protect from all petroleum stains during construction
- 2. Diaper all hydraulic powered equipment.
- 3. Do not park vehicles on inside slab.
- 4. No pipe cutting machines will be used on inside floor slab.
- 5. Do not place reinforcing steel on interior slab, to avoid rust stains.
- 6. Do not use acids or acidic detergents on slab.
- 7. Inform all trades that the slab is to be protected at all times. General Contractor is to coordinate the work of other trades to assure floor protection.

## 1.5 Pre-installation Meeting

- A. Conduct a pre-installation meeting in accordance with Section 01 31 19.
- B. Convene a pre-installation meeting seven days prior to commencing work of this section. Assure purchase of specified materials for fielding sample work or mock- ups.

## 1.6 Delivery, Storage and Handling

- A. Provide product in manufacturer provided containers.
- B. Keep product at an ambient temperature acceptable to the manufacturer.
- C. Protect packaging and product and from damage and loss.

### 1.7 Warranty

A. Warrant installed units to be free from defects in material and workmanship for ten years.

### **PART 2 PRODUCTS**

### 2.1 Manufacturers

- A. Acceptable Manufacturers
  - Laticrete International, Inc., One Laticrete Park North, Bethany, CT, 06524-3423, (800) 243-4788, www.laticrete.com
  - Sika Scofield Systems, 4155 Scofield Road, Douglasville, GA, 30134, (800) 800-9900, www.scofield.com
  - CureCrete, 1203 Spring Creek Place, Springville, UT, 84663 (801)489-3307, www.curecrete.com
- B. Substitutions: As permitted.

### 2.2 Manufacturers and Products

- A. Acceptable Products and Manufacturers
  - Laticrete International, Inc. FGS PermaShine System
  - Sika Scofield Systems Interior Polished Concrete System
  - Advanced Floor Products Retro Plate System
- B. Laticrete International, Inc. FGS PermaShine System consisting of the following:
  - FGS Hardener Plus, Alkaline siliconate, liquid type, hardener, sealer, and densifier.
  - Joint Tite 750, polyurea polymer, semi-rigid joint.
  - Petrotex, Oil repellent sealer.
  - PermaGuard SPS Stain Protectant System.
  - FGS VIVID DYES Colors as Scheduled.
  - FGS Concrete Cleaner/Conditioner, liquid type.
- C. Scofield Systems Interior Polished Concrete System consisting of the following:
  - Scofield Formula One Lithium Densifier
  - Scofield Formula One Liquid Dye Concentrate Colors as Scheduled.
  - Scofield Formula One Guard-S Concentrate
  - Scofield Formula One K
  - Scofield Formula One SG
  - Scofield Formula One Finish Coat
- D. CureCrete Distribution, Inc. Retro Plate System
  - Advanced Floor Products, Retro-Plate 99 penetrating liquid floor densifying agent.
  - 2. Advanced Floor Products, Retro-Pel oil repellent.
  - Advanced Floor Products, Retro Guard penetrating stain repellent.
  - ChemSystems, Inc, Helix Color Systems Dye for use with the Retro Plate Concrete Dye System. Colors as Scheduled.
  - CureCrete, CreteClean Plus concrete cleaner.
- E. Colors: Allow for 2 colors will be used on the project
- F. Substitutions: As permitted

# 2.3 Equipment

- A. As approved by the system manufacturer.
- B. Mechanical plural component pumps for joint and crack filler material.
- <u>2.4</u> Finishes The degree of polish and finish level, as well as the number of passes to be determined by condition of the floor and by the Approved Applicator and the owner's representative on field mock up. Levels of possible finish to be determined:
  - A. 1500 grit finish Medium Gloss
  - B. Two applications of hardener liquid as applied by certified installers.



C. Restroom and Wet Areas: KEY #467-HS Urethane Topcoat sealer.

### PART 3 EXECUTION

### 3.1 Examination

- A. Examine conditions in accordance with manufacturer's requirements. Do not begin work until unsatisfactory conditions have been corrected.
- B. Verify that concrete surfaces are acceptable to receive the work of this section.
- D. Concrete shall have been cured 14 to 28 days prior to beginning any part of the polished concrete system. Verify with manufacturer, unless exposed aggregate look is to be achieved, then grinding can commence earlier than 14 days.

### 3.2 Preparation

- Examine the surface to determine soundness of the concrete for polishing.
- B. Remove all surface contamination to permit effective polishing
- C. Patch any cracks that have developed outside of control joints.
- D. Caulk all Joints

## 3.3 Floor Finishing

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1R.

B. Steel trowel surfaces that are scheduled to be ground and polished. Combination blades are not acceptable, and floor finish shall meet minimum flatness F<sub>f</sub> number of 40.

### 3.4 Floor Surface Treatment

- A. Install in accordance with manufacturer's printed instructions and approved drawings.
- B. Install with waterless polishing and airborne concrete dust-free conditions
- C. Install hardener/sealer to treated floor surfaces in accordance with manufacturer's instructions.

## 3.5 Field Quality Control

- A. General: Comply with requirements of Section 01 45 00.
- B. Inspection by manufacturer's representative for proper installation

### 3.6 Adjusting

- A. Polishing to higher gloss as the work requires
- B. Filling of joints to ensure smooth traffic passage over joints

### 3.7 Cleaning

- A. Prior to Owner occupancy, scrub with manufacturer recommended pads and cleaner / conditioner liquid.
- B. Provide Owner instruction session on proper cleaning techniques and products.

### 3.8 Dyed or Stained and Ground Polished Concrete

- A. All the above information applies to this application.
- B. Special attention needs to be made for transition from dye/stained and polished concrete to other finishes. A straight-line transition shall occur at these areas. Verify the exact location for the demarcation line.
- C. Procedure for dyed or stained polished concrete
  - 1. Apply joint filler and miscellaneous floor patching
  - 2. Grind and polish concrete to desired gloss level (see section 2.04).
  - 3. Apply diluted dye concentrate for polished concrete.
  - 4. Allow dye to dry. Reapply as necessary for desired result.
  - 5. Remove residue with buffer.
  - 6. Apply two coats of hardener/sealer in accordance with manufacturer's written instructions.

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# SECTION 03 41 00 STRUCTURAL PRECAST PRESTRESSED CONCRETE (PLANT CAST)

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.4 Fabrication and Manufacture

1.2 Quality Assurance1.3 Submittals2.5 Concrete Testing3.1 Surface Conditions

1.4 Product Delivery, Storage & Handling
1.5 Job Conditions
2.1 Materials
3.2 Preparation
3.3 Erection
3.4 Cleaning

2.2 Mixes 3.5 Bidding Procedures

2.3 Acceptable Manufacturers

### **PART 1 GENERAL**

### 1.1 Description

#### A. Work Included

- 1. These Specifications cover precast and precast pre-stressed structural concrete construction, including product design not shown on Contract Drawings, manufacture, transportation, erection, and other related items, such as: anchorage, bearing pads, storage and protection of precast concrete. Include cast-in-place concrete to develop connections and cast-in anchorage and alignment items required to accomplish completion of pre-tensioned portions of the structure as shown and specified including bearing plates.
- 2. Members will include:
  - a. Hollow core precast, pre-stressed, floor and roof decking.
  - b. Exposed aggregate insulated wall panels. (Load bearing or non-load bearing)
- B. Work furnished but not installed: Cast in accessories installed by concrete contractor.
- C. Related Work Specified Elsewhere

1.	Concrete formwork	Section 03 30 00
2.	Cast-in place concrete	Section 03 30 00
3.	Structural concrete topping	Section 03 30 00
4.	Masonry bearing walls	Section 04 20 00
5.	Structural metal framing	Section 05 12 00
6.	Miscellaneous steel	Section 05 50 00
7.	Insulation	Section 07 21 00
8.	Flashing and sheet metal	Section 07 60 00
9.	Sealants and caulking	Section 07 92 13
10.	. Painting	Section 09 91 00
11. Site preparation		Division 22,23, & 26
12. Holes for mechanical equipment		Division 23
13.	. Small holes in members	See Drawings

D. Testing Agency Furnished by Owner.

# 1.2 Quality Assurance

- A. Erector Qualifications
  - 1. Precast pre-stressed Section Manufacturer's erection crew.
  - Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing and erecting the type of concrete described herein and who shall direct all work performed under this Section.
- B. Qualifications of Welders and Tackers: AWS D 1. Qualified within the past year.
- C. Design Responsibility: Each precast concrete member shall be designed by a registered professional engineer employed by the Manufacturer and licensed in the State of OH. The structure will be designed for the loads shown on the Drawings and the design will meet the requirements of ACI 318. Design units for fire ratings as shown on drawings.
- D. Product Design Criteria
  - 1. Loadings for design
    - a. Initial handling and erection stresses.
    - b. All dead and live loads as specified on the Contract Drawings.
    - c. All other loads specified for member where they are applicable.
  - Design calculations of products not completed on the Contract Drawings shall be performed by a registered engineer experienced in precast pre-stressed concrete design, employed by the Manufacturer and licensed in the State of Ohio. Submit calculations to Architect for review.
  - Design shall be in accord with applicable codes, ACI 318, or AASHTO Standard Specifications for Highway Bridges. Design units for fire rating as shown on structural plan.
  - 4. Permissible design deviations.
    - a. Design deviations will be permitted only after the Architect's written approval of the Manufacturer's proposed design supported by complete design calculations and Drawings.
    - b. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the Owner.
- E. Requirements of Regulatory Agencies: In addition to complying with all pertinent codes and regulations, comply with:
  - 1. ACI Standards 301, 315, 318, and 525.
  - 2. Applicable Building Code.
  - 3. ASTM E 119 for fire rated construction.
  - 4. PCI MNL-116, MNL-117 and MNL-127.
  - 5. AWS D 1.1 Structural Welding Code Steel.
  - 6. AWS D 1.4 Structural Welding Code Reinforcing Steel.
  - 7. ASTM Specifications as referred to in Part 2 Products, of this Specification.
  - 8. Where provisions of pertinent codes and standards conflict with this Specifications, the more stringent provisions shall govern

# F. Allowable Tolerances

- 1. Width or thickness
  - a. Under 7 inches: + 1/8 inch.
  - b. 7 inches to 16 inches: ± 3/16 inch.
  - c. 16 inches to 36 inches: ± 1/4 inch.
  - d. Over 36 inches: ± 3/8 inch.
- 2. Length:
  - a. Under 20 feet: ± 3/8 inch.
  - b. 20 feet to 30 feet: ± 3/8 inch.
  - c. 30 feet to 40 feet: ± 1/2 inch.
  - d. 40 feet to 50 feet: + 5/8 inch.
  - e. Over 50 feet: ± 3/4 inch.
- 3. Camber or sweep:
  - a. ± (3/8 inch plus span length/960).
  - b. Variation in camber between adjacent and abutting members: 1/2 of total variation.
- 4. Ends out of square:
  - a. Dimensions 12 inches or less: 1/32 of dimension of width or depth.
  - b. Dimension over 12 inches: 3/16 inch plus 1/64 of dimension of width or depth over 12 inches.
- 5. Structural panel units not out of square more than 1/8 inch In 6 feet over 1/4 inch total.
- 6. Inserts, bolts, and pipe sleeves: Maximum ± 3/8 inch deviation from drawing location.
- 7. Per MNL-116.

### G. Reference Standards

- 1. American Welding Society (AWS)
  - a. D 1, Code for Welding in Building Construction
  - b. D 1.1, Structural Welding Code Steel
  - c. D 1.4, Structural Welding Code Reinforced Steel, Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- 2. American Concrete Institute (ACI)
  - a. 301, Specifications for Structural Concrete for Buildings.
  - b. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures
  - c. 318 Building Code Requirements for Reinforced Concrete
  - d. 525, Minimum Requirements for Thin-Section Precast Concrete Construction
- 3. American Society for Testing and Materials (ASTM)
  - a. A 36. Structural Steel
  - b. A 153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - c. A 416, Uncoated Seven-Wire Stress-Relieved Strand for Pre-stressed Concrete
  - d. A 615, Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - e. A 1064, Welded Steel Wire Fabric for Concrete Reinforcement
  - f. C 33, Concrete Aggregates
  - g. C 150, Portland Cement
  - h. C 260, Air-Entraining Admixtures for Concrete
  - i. C 494, Chemical Admixture for Concrete
- 4. Pre-stressed Concrete Institute (PCI)
  - a. MNL-116, Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.
  - b. MNL-117, Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

- c. MNL-127, Recommended Practice for Erection of Precast Concrete
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

### A. Shop Drawings

- 1. Erection drawings.
  - a. Plans and/or elevations locating and defining all material furnished by Manufacturer.
  - b. Sections and details showing connection, cast-in-items and their relation to the structure.
  - c. Description of all loose, cast-in and field hardware.
  - d. Field installed anchor location drawings.
  - e. Bearing elevations of all field built support structures.
  - f. Show location of precast pre-stressed sections with same identification marks used in fabrication.
  - g. Manufacturer's instructions for handling, transporting and erecting.
- 2. Production drawings
  - a. Elevation view of each member.
  - b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, connections accessories, joints and openings.
  - c. Lifting and erection inserts.
  - d. Dimensions and finishes.
  - e. Pre-stress for strand and concrete strengths.
  - f. Estimated cambers.
  - g. Method of transportation.
  - h. Chamfer and radius of corners.
  - i. Welds.
  - j. Tensioning and de-tensioning sequence and schedule.
- B. Manufacturer's Literature: Manufacturer's recommended installation instructions.
- C. Test Reports: Reports of test on concrete as requested by the Architect.
- D. Certificates: Manufacturer's certificates of material compliance with Specifications.
- E. Mock-up: The Manufacturer will prepare a small mock-up of the finish face panel work called for, for the review of the Architect.
- F. The designer will submit to the Architect one set of design calculations for review.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery and Handling of Materials
  - 1. Transport and handle precast concrete units with equipment to protect from dirt and damage.
  - 2. Do not place units in a position which will cause overstress, wrap or twist.

- 3. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, or both, as shown on the Contract and Shop Drawings, and with approved lifting devices. All lifting devices shall have a minimum safety factor of 4.
- 4. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.

## C. Storage of Materials

- 1. Store units off the ground.
- 2. Place stored units so that identification marks are discernible.
- 3. Separate stacked members by battens across full width of each bearing point.
- 4. Stack so that lifting devices are accessible and undamaged.
- 5. Do not use upper member of stacked tier as storage area for shorter members or heavy equipment.
- 6. Store only in areas set aside by the Project Manager.
- 7. Units will not be stored on top of any slab or other structural member already employed in the project.
- 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.

### 1.5 Job Conditions

A. Site Conditions and Scheduling: Immediately after the award of the Contract, this Contractor will verify with the Project Manager the requirements for site access for erection and the scheduling for erection. The Project Manager will be responsible for providing the Contractor access to the site so that all erection equipment can be used.

### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Portland Cement
  - 1. ASTM C150, Standard Gray Portland cement.
  - 2. Use same brand, type and source of supply throughout.

#### B. Aggregates

- Provide fine and coarse aggregates. They shall be clean, hard, strong, durable and inert, free of staining or deleterious material. Water absorption 0 2% minimum. No iron oxide content in course aggregate.
- 2. Normal weight aggregate shall conform to ASTM C 33, for fine to course gradation.
- 3. Finish side aggregate to match sample in Architect's office. Design Mix Below
  - a. Precast Panel Color "01" (Aggregate Panel)

Cement: White Sand: 51 Aggrecon Stone: 3/8" Kreamer

Finish: Water Wash / Acid Wash

b. Precast Panel – Color "02" (Smooth Panel)

Cement: White Sand: 51 Aggrecon

Finish: Smooth / Light Sandblast

c. Precast Panel - Color "04" (Smooth Panel)

Cement: White Sand: 51 Aggrecon

Finish: Smooth / Light Sandblast

Panel Thickness: 14" Thick Panel (3/4/7)

Reveals: Paint per (09 91 00).

- C. Water: Potable or free from foreign materials in amounts harmful to concrete.
- D. Reinforcing Steel
  - 1. Deformed billet steel: ASTM A615, Grade 40 or 60.
  - 2. Wire fabric: Welded steel, ASTM A1064.

#### E. Tendons

1. Pretensioning: Uncoated, stress-relieved strand, ASTM A416, grade 270.

# F. Anchors and Inserts

- 1. Material: Structural steel: ASTM A36. Strap steel plate design as detailed on Architectural sections.
- 2. Finish: Hot-dipped galvanized: ASTM A153.

### G. Grout

- 1. Cement grout: One part Portland cement, 2-1/2 parts sand, sufficient water for placement and hydration.
- 2. Nonshrink grout: Premixed, packaged ferrous aggregate shrink-resistant grout.

### H. Bearing Pads

- 1. Tempered hardboard, 1/8 inch thick, smooth on both sides.
- 2. Chloroprene (Neoprene): Conform to Division II, Section 25 of AASHTO Standard Specifications for Highway Bridges.
- I. Welded Headed Studs: Conform to Section 4, Part VI, of AWS D 1.1.
- J. Wall Panel Insulation: Panel to have the insulation value as specified in Section 07 21 00 of these specifications.
- K. Sealant: Panel joints to be sealed as specified in Section 07 92 00 of these specifications.
- L. Water Repellent: Tnemec Chemprobe Prime-A-Pell 200 or equal. Complete exterior wall surfaces by this contractor. Apply per manufacturer's recommended instruction.

### 2.2 Mixes

A. Mixing Procedures: Same as for cast-in-place concrete, Section 03 30 00.

- B. Concrete Properties
  - 1. Air-entrainment: Minimum 3%; maximum 6%.
  - 2. 28 day compressive strength: Minimum of 5,000 psi.
  - 3. Release strength: Minimum of 3500 psi.
  - 4. Do not use calcium chloride or other salts.
- 2.3 Acceptable Manufacturers: A company specializing in providing precast and precast pre-stressed concrete products and services normally associated with the industry for at least five years. When requested by the Architect, written evidence shall be submitted to show experience, qualifications and adequacy of plant capability and facilities for performance of Contract.

## 2.4 Fabrication and Manufacture

- A. Units will be manufactured using the suppliers' standard methods. Manufacturing procedures shall be in general compliance with PCI MNL-116.
- B. Place concrete in continuous operation to prevent formation of seams.
- C. Finishes
  - Smooth finish underside: resulting from casting against approved forms using good industry practice in cleaning of forms, design of concrete mix, placing and curing. Small surface holes caused by air bubbles, normal color variations, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or other defects will be permitted.
  - 2. Standard top: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentation, minor chips and spalls will be permitted. No major imperfections, honey comb, or defects will be permitted.
  - 3. Exposed vertical ends: Strands shall be recessed and the ends of the member will receive sacked finish.
- D. Fasteners: The Manufacturer shall cast in structural inserts, bolts and plates as detailed in the Contract Drawings.
- E. Holes: Holes for mechanical openings larger than 10 inches by 10 inches shall be cast in by the Manufacturer in accord with approved Shop Drawings. All other holes shall be field cut or cored by the trades after the Precast Contractor has approved the layout of the holes in the field. This Contractor will be responsible to give the Mechanical Contractor guidance in hole location in the field so as to avoid any structural problems.
- F. Patching: Patching will be acceptable providing the structural adequacy of the product and the appearance is not impaired.
- **2.5** Concrete Testing: Make one compression test for each day's production of concrete.

#### **PART 3 EXECUTION**

## 3.1 Surface Conditions

A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that structure and anchorage inserts are within required tolerances.
- 3. Check that bearing surfaces are smooth and level for installation of precast members.
- 4. Determine field conditions by actual measurements.
- 5. Verify that the Work of this Section may be performed in strict accord with all pertinent codes and regulations, the original design, and the Manufacturers' recommendations for the items being installed.
- 6. Discrepancies
  - a. In the event of discrepancy, immediately notify the Architect.
  - b. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

- A. Co-ordination: Supply the Concrete Contractor with all anchor bolts, setting plates, bearing pads or other built-in items required for this Work.
- B. The Concrete Contractor shall be responsible for:
  - 1. Providing true, level bearing surfaces on all field-placed bearing walls and other field-placed supporting members.
  - 2. Placement and accurate alignment of anchor bolts, plates or dowels in column footings, grade beams and other field-placed supporting members.
  - 3. Site Access: Providing suitable access to the building and firm level bearing for the hauling and erection equipment to operate under their own power.

## 3.3 Erection

A. Responsibility: The entire method and sequence of erection shall be the responsibility of the Contractor. Strictly adhere to all provisions and recommendations in MNL-127.

#### B. Installation:

- Installation of precast pre-stressed concrete shall be performed by the Manufacturer or a competent erector. Members shall be lifted by means of suitable lifting devices at points provided by the Manufacturer. Temporary shoring and bracing, if necessary, shall comply with Manufacturer's recommendations.
- 2. Install precast concrete work in accord with approved Shop Drawings and details. Exposed concrete units shall not be erected until approved by the Architect for appearance. Units will not be delivered to the site any sooner than they are needed. The Architect will not accept any column that is out of plumb more than the required tolerances. Remove lifting devices flush with concrete surfaces.
- 3. Set units dry, without mortar, attaining specified joint dimension with lead or plastic spacers.
- 4. Fasten precast units in place by bolting or welding.
- 5. Tighten bolted connections with equal torque.
- 6. Provide temporary erection anchorage for welded anchorage system.
- 7. Clean field welds and protect with coat of rust inhibiting paint.

## C. Alignment

- Members shall be properly aligned and leveled as required by the approved Shop Drawings. Variations between adjacent members shall be reasonably leveled out by jacking, loading, or any other feasible method as recommended by the Manufacturer and acceptable to the Architect.
- 2. Noncumulative erection tolerances
  - a. Joint dimension: Nominal 3/8 inch; to vary not more than + 3/16" or 1/4".
  - b. Edge alignment and offset: Not to exceed 1/4 inch.
- Adjust differential camber between units to within tolerance before final connection is made.
- 4. Level differential elevation of horizontal joints with grout to slope not steeper than 1:12.
- D. Field Welding: Field welding is to be done by qualified welders using equipment and materials compatible to the base metal.
- E. Grouting: After the frame is approved, grout all connections and bearing points requiring same. Advise other trades as to time required before frame may be loaded to the design loads.
- F. Attachments: Subject to approval of the Architect, precast pre-stressed products may be drilled or "shot" provided no contact is made with the pre-stressing steel. Should spalling occur, it shall be repaired by the trade doing the drilling or the shooting.
- G. Patching
  - 1. Patch damaged units to match adjacent area.
  - 2. Add patch to concrete with bonding agent.
  - Cut off lifting device and grout Plastic Covers or Inserts will not be accepted in lieu Grout.
  - 4. Spot paint damaged metal finishes.
- H. Inspection and Acceptance: Final inspection and acceptance of erected precast prestressed concrete shall be made by Architect to verify conformance with Plans and Specifications.

### 3.4 Cleaning

- A. After installation, clean soiled portions of precast concrete surfaces with detergent and water, using fiber brush and sponge, and rinse thoroughly with clean water. Contractor is responsible to protect adjacent work prior to and during cleaning.
- B. Clean soiled portions of precast concrete panels with acid-free commercial cleaners.
- C. Use acid to clean particularly stubborn stains only after more conservative methods have been tried unsuccessfully.
- D. Use extreme care to prevent damage to precast concrete surfaces and to adjacent materials.
- E. Rinse thoroughly with clean water immediately after using cleaner.
- F. Leave deck ready for topping.
- G. Remove all equipment from site.

## 3.5 Bidding Procedures

- A. The Drawings show a layout of the precast plank and panels that is preferred by the Architect. Any changes in member size and location, location of joints, changes in the aesthetic appearance of the members, etc. must be approved by the Architect prior to bidding. The precast contractor will submit drawings to indicate these changes and will receive written approval from the Architect before bidding the job.
- B. The precast contractor will make known to the Architect, prior to bidding, any and all changes in the structural systems supporting precast members, which may be required to allow for installation of the contractors precast systems. The precast contractor will review the supporting structure, designed by the Architect, and the loads shown on the Drawings to verify that they apply to the proposed precast system.

\* \* \* \* \* \* \* \* \* \* \*

# **SECTION 04 20 00 UNIT MASONRY**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 3.1 Surface Conditions

1.2 Quality Assurance1.3 Submittals3.2 Co-Ordination3.3 Installation

1.4 Product Delivery, Storage & Handling 3.4 Field Quality Control

1.5 Job Conditions 3.5 Cleaning Up

2.1 Materials

### **PART 1 GENERAL**

## 1.1 Description

- A. Work Included: Unit Masonry required for the work is indicated on the Drawings and includes, but is not limited to:
  - 1. Load bearing and non-load bearing interior concrete block.
  - 2. Exterior Face Brick.
  - 3. Architectural Faced Block trim units.
  - 4. Furnish and install wall reinforcement and anchorages.
  - 5. Install items furnished by other Sections of the Work.
  - 6. Furnish and install masonry accessories.
  - 7. Install reinforcement in bond beams and fill with concrete.
  - 8. Install reinforcement in bond beam lintels less than 3'-8" and fill with mortar.
  - 9. Fill cells of block at pilasters and for grouted wall construction.
  - 10. Grout under base and bearing plates on masonry walls.
  - 11. Slush full all jambs of hollow metal frames.

### B. Related Work Specified Elsewhere

1.	Cleaning	Section 01 77 16
2.	Concrete	Section 03 30 00
3.	Precast concrete	Section 03 41 00
4.	Structural steel	Section 05 12 00
5.	Light Gauge Steel Roof Trusses	Section 05 44 00
6.	Rough carpentry	Section 06 10 00
7.	Fabricated Wood Trusses	Section 06 17 53
8.	Damproofing	Section 07 11 00
9.	Self-Adhering Sheet Waterproofing, Low Temperature	Section 07 13 00
10.	Fluid-Applied Membrane Air Barriers, Vapor Permeable	Section 07 27 26
11.	Flashing and Sheet Metal	Section 07 60 00
12.	Caulking	Section 07 92 13
13.	Metal Doors and Frames	Section 08 11 00
14.	Ceramic Tile	Section 09 31 00
15.	Painting	Section 09 91 00

### C. Work Installed but Supplied by Others

1. Loose lintels Section 05 12 00

- 2. Bolts
- 3. Anchors

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- 4. Inserts
- 5. Expansion Joints
- D. Work by Owner: Hiring of testing agency for on-site testing.

### 1.2 Quality Assurance

- A. Qualifications of Workmen
  - 1. For the actual cutting and placing of concrete masonry units, use only skilled journeyman masons who are thoroughly familiar with the design requirements.
  - 2. In acceptance or rejection of installed concrete masonry units, no allowance will be made for lack of skill on the part of workmen.
  - Provide one skilled journeyman mason who shall be present at all times during execution of the work of this Section and who shall personally direct the execution of this portion of the Work.
- B. Tolerances: Walls to be erected in accord with standard industry practices and written guidelines of ACI Standard for concrete masonry and BIA Standards for brick masonry.
- C. Requirements of Regulatory Agencies: Work of this Section shall comply with all applicable building codes and as supplemented in subsequent articles contained herein.
- D. Reference Standards: In addition to complying with all pertinent codes and standards, comply with the following standards of masonry installation described in:
  - 1. Masonry construction and materials shall conform to all requirements of TMS 402/602 "Building Code Requirements and Specification for Masonry Structures"
  - 2. Modular System: Sizes of masonry units and brick: Modular sizes, whether so indicated or not, so that materials specified in this Section will be as per Modular Planning Standards.
  - 3. American Concrete Institute (ACI)
    - a. ACI 530/ASCE 5, Building Code Requirements for Masonry Structures
  - 4. American Society of Testing and Materials (ASTM):
    - a. A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    - b. A615, Deformed Billet-Steel Bars for Concrete Reinforcement
    - c. A951, Steel Wire for Masonry Joint Reinforcement
    - d. A1064, Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed
    - e. C90, Load Bearing Concrete Masonry Units.
    - f. C129, Hollow non-load Bearing Concrete Masonry Units.
    - g. C270, Mortar for Unit Masonry.
    - h. C387, Packaged Dry, Combined Materials for Mortar and Concrete.
  - 5. Federal Specifications (FS):
    - a. QQ-W-461, Carbon Steel Wire.
- **1.3 Submittals**: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Samples and Mockup:
    - 1. Submit masonry unit color samples to the Architect for selection and approval.
    - 2. Jobsite Mockup: Construct a full size mockup on the construction site to replicate the exact colors and sizes selected.

Mockup shall be 4'-0" x 4'-0" minimum or larger if necessary to portray the final product. Coordinate mockup location with the General Contractor.

B. Product Cut Sheets: Submit copies of proposed mortar, grout, and accessories.

# 1.4 Product Delivery, Storage and Handling

#### A. Protection:

- 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- 2. Stack masonry for facing work on platforms; cover or store in an approved manner that will protect them from contact with soil, weather exposure. Exercise care in handling masonry units to avoid chipping, breakage. Locate storage piles, stacks or bins to avoid being disturbed, or barricade to protect materials from damage.
- 3. Stack units immediately upon delivery to job, under cover, or otherwise protect from weather conditions.
- 4. Protect anchors, ties and reinforcement from elements.
- B. Mortar Materials
  - Deliver and store manufactured products in original unopened containers.
  - 2. Keep water free of harmful materials.
- 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.

### 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Cold Weather Protection
    - a. Preparation:
      - (1) Remove ice or snow formed on masonry bed by carefully applying heat until top surface is dry to touch.
      - (2) Remove frozen or damaged masonry.
      - (3) Use dry masonry units.
      - (4) Do not use frozen units.
    - b. Mortar
      - (1) Heat mixing water when air temperature is below 40 degrees F. and heat aggregates when air temperature is below 32 degrees F., to assure mortar temperatures between 40 degrees F. and 120 degrees F. until used.
      - (2) Do not heat water or sand above 120 degrees F.
    - c. Protection Requirements While Masonry Units are Being Laid:
      - (1) Air temperature 25 degrees F. to 20 degrees F.:
        - (a) Use salamanders or other heat sources on both sides of walls under construction.
      - (2) Air temperature 20 degrees F. and below.
        - (a) Provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F.
        - (b) Minimum temperature of units when laid: 20 degrees F.
    - d. Protection Requirements for Completed Masonry and Masonry not Being Worked on:
      - (1) Mean daily air temperature 48 degrees F. to 32 degrees F.: Protect masonry from rain or snow for 24 hours by covering with non-staining weather-resistive membrane.

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- (2) Mean daily air temperature 32 degrees F. to 25 F degrees: Completely cover masonry with non-staining weather-resistive membrane for 24 hours.
- (3) Mean daily air temperature 25 degrees F. to 20 degrees F.: Completely cover masonry with insulating blankets or equal protection for 24 hours.
- (4) Mean daily air temperature 20 degrees F. and below: Maintain masonry temperature above 32 degrees F. for 24 hours by enclosure and supplementary heat, electric heating blankets, infra-red lamps, or other acceptable methods.
- (5) Cover top of walls with non-staining waterproof coverings at end of each day or shutdown.
- (6) Cover partially completed walls with non-staining waterproof membrane when work is not in progress.
- (7) Provide minimum 2 foot overhand of protective covering on each side of wall securely anchored.
- (8) Do not apply uniform floor or roof loading for at least 12 hours after completing masonry columns or walls.
- (9) Do not apply concentrated loads for at least three days after completing masonry columns or walls.
- 2. Hot Weather Protection: Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99 degrees F. in the shade with relative humidity less than 50 percent.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Mortar
  - 1. ASTM C387, color as selected by Architect.
  - 2. Color as selected.
  - 3. Mixes:
    - a. Mix mortar materials to product mortar cubes having the following compressive strength when tested in accord with compressive strength test, ASTM C270.

MORTAR	COMPRESSIVE	WATER	MAXIMUM
TYPE	STRENGTH (PSI)	RETENTION	AIR CONTENT
M	2500	75	18
S	1800	75	18

- B. Concrete Masonry Units
  - 1. Load Bearing Units:
    - a. ASTM C 90, Type II, Grade N
    - b. Nominal face dimensions: 8 inches by 16 inches.
  - 2. Hollow Non-load bearing Units:
    - a. ASTM C 129, Type II
    - b. Nominal face dimensions: 8 inches by 16 inches.
  - 3. Provide light weight aggregate units.
  - 4. Bond: running
- C. Face Brick

- 1. Manufacturer: Summit Brick or Approved Equal
- 2. Finish: Grain
- 3. Size: Modular (2 1/4" x 3 5/8" x 7 5/8")
- 4. Color Classification: Red with Brown Flash
- Color: "Market Street". Color subject to modification upon sample review. Color selection from standard finishes.
- 6. Bond: Running

#### D. Veneer Stone

- Fond du Lac Tailored Blend or equal 1.
  - Nominal size range:
    - Length: [6 to 42 inches] [152 to 1066 mm]
    - 2) Height:
      - 20 percent: 2 1/4 inches [57 mm] a)
      - b) 40 percent: 5 inches [127 mm]
      - c) 30 percent: 7 3/4 inches [196 mm]
      - 10 percent: 10 ½ inches [266 mm]
    - 3) Width: [3 to 5 inches] [76 to 127 mm]
  - Color range: gray, light gray, buff, and white b.
  - Color consistency: somewhat consistent C.
  - d. Ends: square
  - Properties for limestone complying with ASTM C568:
    - Maximum absorption rate tested in accordance with ASTM C97: 3
    - Minimum density tested in accordance with ASTM C97: 2.560 kg per cubic meter.
    - Minimum compressive strength tested in accordance with ASTM C170: 55 Mpa.
    - Minimum flexural strength tested in accordance with ASTM C 880: 8.27 Mpa.

#### E. Burnished CMU

- Basis of Design: Premier Ultra Burnished Masonry Units as manufactured by County Materials Corporation or equal.
- 2. Description: Integrally pigmented loadbearing hollow units with a net area compressive strength of greater than or equal to 2000 psi.
- 3. Compliance: ASTM C 90.
- 4. Coloring: Integral, through-body coloring; synthetic or natural iron oxide pigments.
- 5. Water Repellent: Integral Water Repellent.
- 6. Finish: Ground Face.
- 7. Size and Shape: 8F Full Veneer (Both sides at locations per plans). If the area is not noted on the plans assumption is to be finished both sides. Furred walls do not receive burnished finish, refer to the plans for all walls locations.
- 8. Special Shapes, Finished Ends, Scores, Chamfers: As required.
- 9. Corner: 8FEBN: 7-5/8 x 7-5/8 x 15-5/8 inches, 3-5/8 inch thickness.
- 10. Bullnose End: 8FEBN: 7-5/8 x 7-5/8 x 15-5/8 inches.
- 11. Bond Beam: 8UF: 7-5/8 x 7-5/8 x 15-5/8 inches.
- 12. Style: Hollow.
- 13. Color: As selected from manufacturer's full color range.
- 14. Color: Accent Walls as noted on the drawings. (2 color options to be provided).
- 15. Color: To be selected by Architect.

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- 16. Scoring: None.
- 17. Sealer: Sealer: Clear-drying, water-based, silicone emulsion with 6 percent solids as measured by ASTM D 5095.
  - a. Sealer: Selected and confirmed during construction, as applicable after test area is prepared.
  - b. Type per manufacturer specified.
- 18. Cleaners
  - a. Cleaners: Non muriatic acid cleaner.
  - b. Type per manufacturer specified.
- F. Setting material for base and bearing plates: Mortar shall be same as used in all construction.
- G. Anchors and Ties:
  - 1. Welded Wire: Standard
    - a. Type: Ladder
    - b. Longitudinal wire:
      - (1) Style: Single
      - (2) Treatment: Cold-Drawn Steel Wire
      - (3) Wire: ASTM A1064
      - (4) Size: 9 gauge
    - c. Transverse wires:
      - (1) Wire ASTM A1064
      - (2) Size: 9 gauge
      - (3) Spacing: 16" o.c.
    - d. Finish: Hot Dip Galvanized, ASTM A153.
    - e. Installation to conform to Chapter 21 of the International Building Code
  - 2. Corrugated Metal:
    - a. Type: Plain end.
    - b. Material: Galvanized Steel
    - c. Size:
      - (1) Thickness: 22 Gauge.
      - (2) Length: System required to pass thru 3" insulation and 3" into stone/brick.
      - (3) Width: 3/4 inch
    - d. Finish: Hot Dip Galvanized, ASTM A153, Class B-2.
- H. Reinforcement: Billet Steel Deformed Bars: ASTM A615, Grade 60
- I. Weep Hole Material: Plastic or rubber tube. 24" o.c. at masonry terminations at concrete or steel.
- J. Flashing: Butyl rubber membrane locate where detailed on Drawings and per standard masonry practice to relieve water penetration brick veneer and base flashing to be a stainless steel plate with drip.
- K. Cleaning Agents: As recommended by block supplier.
- L. Two (2) coats of Sure Klean Blok-Guard by Prosoco, Inc. required on all exterior masonry walls.

- M. Grout: All grout shall be transit-mixed in accord with ASTM C94 and shall consist of one part Portland cement, 2-1/2 parts sand, two parts pea gravel, and adequate water to produce a concrete of approximately ten inches slump, and shall have an ultimate compressive strength of at least 2000 psi in 28 days.
- N. Control Joint Resilient Keys: Control joint resilient keys: Factory-fabricated solid section of natural or synthetic rubber, combination thereof, plastic, or other rubber-like material. Durometer hardness shall be not less than 70 when tested in conformance with ASTM Specification D2240. The key shall be of the shape indicated and of dimensions to completely fill and fit neatly, but without forcing, into masonry-unit jamb-sash grooves and to provide control-joint width of 3/8 inch with tolerance of 1/6 inch. Shear section shall be 5/8 inch minimum thickness.
- O. ReCon retaining wall units. By ReCon Wall Systems, Inc or equal(Complete engineered system)
  - 1. The block unit shall consist of concrete with the average 28-day compressive strength of no less than 4000 psi.
  - 2. Concrete shall have air entrainment by volume (as measured in the plastic state in accordance with ASTM C172) of:
    - a. 5.5 8.5 percent, or
    - b. In conformity with ASTM C94, latest revision.
  - 3. Exterior dimensions of the face shall be 48-inches by 16-inches for full and corner unit, and 24-inches by 16-inches for half unit.
  - 4. Depth of unit should be as per Construction Drawings and is available in depths from 24-inches up to 84-inches (dimensions in inches: 24, 39, 45, 60, 66, 72, 78, 84).
  - 5. ReCon Units used shall maintain tolerances of:
    - a. Height: +/- 3/16-inch
    - b. Width: +/- 1/2-inch unless field cut for fitting purposes.
    - c. Depth: No less than the unit design depth (i.e. 24-inch, 39-inch, etc.) with the textured face portion of the block is considered as 4-inches
  - 6. Special shape units should be obtained and used where indicated on the final engineered construction drawings. Reference ReCon Drawing #101 for overview of standard unit types.
  - 7. ReCon Unit Face Texture
    - Shall be Weathered Edge"
- P. Modular Wall Units Wall units shall be Allan Block Retaining Wall units as produced by Reading Rock, Inc.
  - 1. Wall units shall have minimum 28-day compressive strength of 3000 psi (20.7 MPa) in accordance with ASTM C1372. The concrete units shall have adequate freeze-thaw protection with an average absorption rate in accordance with ASTM C1372 or an average absorption rate of 7.5 lb./ft3 (120 kg/m³) for northern climates and 10 lb./ft³ (160 kg/m³) for southern climates.

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- 2. Exterior dimensions shall be uniform and consistent. Maximum dimensional deviations on the height of any two units shall be 0.125 in. (3 mm).
- 3. Wall units shall provide a minimum of 110 lbs total weight per square foot of wall face area (555 kg/m²). Hollow cores to be filled with wall rock and compacted by using plate compactor on top of wall units (see section 3.4). Unit weight of wall rock in cores may be less than 100% depending on compacted base.
- 4. Exterior face shall be textured. Color as specified by owner.
- 5. Freeze Thaw Durability: Like all concrete products, dry-cast concrete SRW units are susceptible to freeze-thaw degradation with exposure to de-icing salts and cold temperature. This is a concern in northern tier states that use deicing salts. Based on good performance experience by several agencies, ASTM C1372, Standard Specification for Segmental Retaining Wall Units should be used as a model, except that the compressive strength for the units should be increased to a minimum of 4,000 5,800 psi (28 40 MPa) unless local requirements dictate higher levels. Also, maximum water absorption should be reduced and requirements for freeze-thaw testing increased.
  - a. Require a current passing ASTM C1262 or equivalent governing standard or public authority, test report from material supplier in northern or cold weather climates.
  - b. See the Best Practices for SRW Design document for detailed information on freeze thaw durability testing criteria and regional temperature and exposure severity figures and tables to define the appropriate zone and requirements for the project.
- A. Wall Rock Material must be well-graded compactable aggregate, 0.25 in. to 1.5 in., (6 mm - 38 mm) with no more than 10% passing the #200 sieve. (ASTM D422)
- B. Material behind and within the blocks may be the same material.

#### **PART 3 EXECUTION**

### 3.1 Surface Conditions

### A. Inspection

- Prior to all Work of this Section the mason contractor shall inspect related installed work of other trades, notify the Project Manager who shall verify that such work is complete to the point where portions of the masonry installation may properly commence.
- 2. Verify that unit masonry may be completed in accord with the referenced standards and the contract documents.

#### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Project Manager and the Architect for clarification.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been completely resolved.

**3.2 Co-ordination**: Carefully coordinate with all other trades to insure proper and adequate interface of the work of other trades with the work of this Section.

### 3.3 Installation

#### A. General

- Protection: Protect masonry surfaces not being worked during construction work.
   At such time as rain or snow is imminent, work is discontinued; protect work with water proof membrane, well secured. Overlap covering two feet each side of wall.
- 2. Temperature: Do not erect masonry when ambient temperature has dropped below 45 degrees F., unless it is rising; at no time when it has dropped below 40 degrees F., except by written permission. When masonry work is authorized during temperatures below 40 degrees F., make provisions for heating and drying materials. Protect completed work as per recommended practices for cold weather masonry construction by the International Masonry Industry All-weather Council.
- 3. At completion of each day's work, all masonry should be cleaned with brushes and as required to keep work neat and clean at all times; covered and protected from weather.
- 4. Do not permit mortar to touch aluminum surfaces to be exposed.
- 5. Do not use chopped or broken units; if any such units are discovered in the finished wall, the Architect will require their immediate removal and replacement with new units at no additional cost to the Owner.
- 6. Lay masonry plumb, true to line, with level, accurately spaced courses. Keep bond plumb throughout. Lay corners, reveals, plumb, true. Exposed block to be running bond. Set in ties, wire reinforcing, etc.
- 7. Building-In: Unless otherwise required, fill solidly with mortar, spaces around metal door frames, and other built-in items. Built-in work required to be built-in with masonry, including anchors, wall plugs, and accessories, as erection progresses.
- 8. Cutting, patching: For cutting, patching of masonry required to accommodate work of others use masonry mechanics. Use masonry saws to cut and fit masonry units.
- 9. Adjust masonry unit to final position while mortar is soft and plastic.
- 10. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar and relay with fresh mortar.
- 11. Adjust shelf angles to keep masonry level and at proper elevation.
- 12. 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 Division 7.
- 13. 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.
- 14. If necessary to stop off a horizontal run of masonry, rack back one-half block length in each course.
- 15. Do not use toothing to join new masonry to set or partially set masonry when continuing a horizontal run.
- 16. Anchors, ties, and reinforcement: Remove all dirt, ice, loose rust and scale prior to installation.
- 17. Placement of loads (i.e. floors and upper walls) on completed sections of masonry construction shall not proceed until 7 days have elapsed from the completion of that particular construction. Placement of such loads may be made in advance of this time period provided that prism tests show that the construction has achieved sufficient strength and also subject to the approval of the Architect.

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## 18. Installing Control Joints:

- a. Provide expansion and control joints as shown on Drawings. Sealants and backing will be by Sealant Contractor.
- b. Control joints shall extend through bond beams unless otherwise indicated.
- 19. Setting Base and Bearing Plates: For those base and bearing plates set by masons, place grout under plates to thoroughly fill all the space under the plates. Plates to be set level.
- 20. Stainless steel base flashing at all sills, windows, door heads, and wall penetrations: 28 gauge metal Type 304 / 2D finish per ASTM A240 and ASTM B633 profile per details and industry standards.

### B. Mixing Mortar

### 1. General

- a. Use a mechanical mixer of one sack minimum capacity.
- b. Mix mortar at least three minutes after all materials have been added.
- c. Mix only as much mortar as can be used in one hour after water has been first mixed into batch
- 2. Retempering: Retemper mortar only within 2-1/2 hours of mixing. Discard unused mortar that has begun to set or that is more that 2-1/2 hours old.

#### C. Built-in Items

- Build in, around, items required, as indicated. Set loose lintels, small beam plates, bearing strips, in locations required, as indicated. Loose lintels, small beam plates, bearing strips furnished under "Structural Steel" Section. Set anchors, anchor bolts for parapet, fascia, cap, door frames, flashing, etc.
- 2. Avoid cutting and patching.
- 3. Solidly grout spaces around built-in items.

#### D. Blockwork

### 1. General

- a. Lay only dry units. Wetting the units shall not be permitted except when hot and dry weather exists causing the units to be warm to the touch, and then the surface only may be wetted with a light fog spray.
- b. Bond: Running bond with vertical joints located at center of masonry units in alternate course below.

#### 2. Reinforcement

- a. Install all reinforcement as indicated on the Drawings.
- b. Fully embed reinforcement in grout, not in mortar or mortar joints.
- c. Furnish and install all required metal accessories to insure accurate alignment of steel during grout filling operations.

## 3. 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 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.

### 4. 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) Point joints tight in unparged masonry below ground.
- (6) Tool joints in exposed or to-be-painted surfaces when thumb-print hard with round jointer.
- (7) Remove mortar protruding into cells of cavities to be reinforced or filled.
- (8) Fill horizontal joints with mortar between top of masonry partitions and underside of concrete slabs or beams

### 5. Grouting

- a. Timing: Do not grout until masonry has cured at least 24 hours.
- b. Consolidation: Consolidate all grout at time of pouring by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.

## 6. Pointing and Cleaning

- a. At final completion of unit masonry work fill holes in joints and tool.
- b. Do not fill weep holes.
- c. Cut out and repoint defective joints.
- d. Dry brush masonry surface after mortar has set, at end of each day's work and after final pointing.
- e. Leave work and surrounding surfaces clean and free of mortar spots and drippings.

# 3.4 Field Quality Control

#### A. Prism Testing

- These requirements generally meet NCMA or BIA. The required 28 day strength, f<sub>m</sub> is shown on the Drawings for each class of masonry construction. The actual strength of the masonry construction shall be determined by the prism method.
- 2. One prism test consisting of three specimens for each class of masonry shall be made in advance of construction to confirm f<sub>m</sub>. Prisms made at the job site shall be carefully handled so as to preclude damage during both handling operations and transportation to testing lab per ASTM C1388.
  - a. Of the three specimens used in the advance test, two shall be tested at 28 days and one shall be tested at 7 days.
  - b. As part of the advance test procedure, six 2 inch by 2 inch by 2 inch mortar cubes shall be fabricated and tested with the three prism specimens. Two tests shall be at 7 days and four at 28 days.
  - c. As a part of the advance test procedure, tests on three masonry units shall be made at the same time as the 28 day prism test.
- 3. After prism testing and during the construction process, additional prism tests will be required. Prism tests are as defined above and one test shall be made for each 5,000 square feet of wall constructed.
- 4. Subject to written approval of the Architect, test of units and mortar cubes may be made in lieu of prism test. Cubes shall be as described above. Three unit tests will be required at the testing of each set of mortar cubes. For bidding purposes. assume that prism tests will be required during the construction phase.

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B. Mortar Tests: The Architect may at his sole discretion order test on mortar at any time during the construction to insure compliance with the Property requirements of Part 2 even though laboratory test data has been submitted. Mason Contractor shall cooperate with the testing laboratory during the taking of samples.

# 3.5 Cleaning Up

A. Inspection and Adjustment: Upon completion of the Work of this Section, make a thorough inspection of all installed masonry and verify that all units have been installed in accord with the provisions of this Section. Make all necessary adjustments.

### B. Cleaning

- Clean, point and wash down brick and concrete block surfaces. Clean as units are being set and again upon completion. Use all cleaning agents in strict conformance with the Manufacturer's instructions. Make ready for application of the specified finishes.
- 2. Remove surplus mortar and leave surface of all masonry clean and finished. Remove large particles of mortar with putty knife or chisel before cleaning walls. Remove sharp burrs on exposed block mortar joints with rubbing stone.
- 3. Remove shoring, supports, centering, scaffolding, mason's wedges, false work and protection. Remove mortar spattering from sills, walls and finished work of other trades and contractors. Take special care during cleaning operations not to damage glass, window frames, shrubbery or other similar completed adjacent construction.

04 20 00-12 UNIT MASONRY

#### **SECTION 05 12 00 STRUCTURAL STEEL FRAMING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Fabrication

1.2 Quality Assurance 3.1 Surface Conditions

1.3 Submittals 3.2 Preparation

1.4 Product Handling 3.3 Erection

2.1 Materials

### **PART 1 GENERAL**

### 1.1 Description

## A. Work Included

Columns
 Beams
 Lintels
 Stairs

# B. Related Work Specified Elsewhere

1.	Precast Concrete	Section 03 41 00
2.	Masonry	Section 04 20 00
3.	Steel Joists	Section 05 21 00
4.	Metal Decking	Section 05 30 00
5.	Metal Fabrications	Section 05 50 00
6.	Finish painting	Section 09 91 00

### C. Work Furnished but Not Installed

- 1. Anchor bolts, loose bearing plates which will be installed under Section 03 30 00.
- 2. Loose lintels which will be installed under Section 04 20 00.
- D. Work Furnished by the Owner: Testing agency will be provided by the Owner.

### 1.2 Quality Assurance

#### A. Qualifications

- 1. Steel fabricator:
  - a. Fabricator shall have not less than 5 years experience in the fabrication of structural steel.
  - b. Submit a written description of fabrication ability including facilities, personnel and list of similar completed projects.
- 2. Steel Erection:
  - a. Erector shall have not less than 5 years experience in the erection of structural steel.
- 3. Welding: All welding shall be performed by operators who have been recently qualified as prescribed in "Qualification Procedure" of the American Welding Society.
- 4. Design connections not detailed on the Drawings under direct supervision of a professional structural engineer experienced in design of this work and licensed in the State of Ohio.

- B. Requirements of Regulatory Agencies: In addition to complying with all pertinent codes and regulations, comply with:
  - 1. "Specification for Structural Steel Buildings" of the American Institute of Steel Construction.
  - 2. "Structural Welding Code" of the American Welding Society.
  - 3. "Specifications for Structural Joints Using High Strength Bolts", approved by the Research Council on Structural Connections.
  - 4. "Standards and Best Practice for Surface Preparation of Steel Substrates" of the Society for Protective Coatings (SSPC).
  - 5. Applicable Building Code.
  - 6. In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.

### C. Source Quality Control

- 1. Material Compliance: Manufacturer will supply on request of Architect, certificates showing mechanical, physical and strength properties of all materials supplied.
- 2. Inspection of shop assembled high strength bolted construction.
- Inspection of field assembled high strength bolted construction shall be in accord with Section 9, RCSC Specification for Structural Joints Using High-Strength Bolts.
- 4. Inspection of shop welds shall be in accordance with Section 6 of AWS Structural Welding Code and as follows:
  - a. Visual inspection of shop welds in accordance with Article 6.9.
  - b. Stud welding inspection of shop welded studs in accordance with Article 6.9.
- 5. Testing Agency shall perform the following:
  - a. Inspection of shop fabricated structural steel members and assemblies for conformance with the requirements specified.
- **1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Shop Drawings: Show all shop and erection details including cambers, cuts, copes, connections, holes, threaded fasteners, rivets and welds. All welds, both shop and field, shall be indicated by AWS "Welding Symbols" A 2.0.
  - B. The following shall be available upon request:
    - 1. Erection Procedure: Submit descriptive data to illustrate the structural steel erection procedure, including the sequence of erection and temporary staying and bracing.
    - 2. Welding Procedure: Submit written description as required to illustrate each welding procedure to be performed in the specified work.
    - 3. Field welding equipment: Submit descriptive data for field welding equipment, including type, voltage and amperage.
    - 4. Manufacturer's Literature: Submit description of each type of welding stud and arc shield.

# 1.4 Product Delivery, Storage and Handling

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

- B. Delivery of Materials to be Installed Under Other Sections:
  - 1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
- C. Storage of Materials
  - 1. Structural steel members stored at the project site shall be above ground on platforms, skids or other supports.
  - 2. Steel shall be protected from corrosion.
  - 3. Other materials shall be stored in a weather tight and dry place, until ready for use in the work.
  - 4. Packaged materials shall be stored in their original unbroken package or container.
- 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.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Steel Shapes, Bars and Plates
  - 1. Wide flange shapes ASTM A992 (50 ksi)
  - 2. All other shapes ASTM A36
- B. Structural Steel Tubing: F<sub>v</sub> 46 ksi cold-formed round, ASTM A500, Grade B.
- C. Headed Stud Type, Shear Connectors:
  - 1. Cold finished carbon steel, ASTM A108, forged steel, uncoated.
  - 2. Dimensions of shear connectors shall conform to Figure M-1 of AWS Building Code.
- D. Anchor Bolts: conform to ASTM F1554, Grade 36.
- E. High-Strength Threaded Fasteners: ASTM A325.
  - 1. Use high strength bolts for all bolted connections unless noted.
  - 2. Bolt Holes: 1/16" larger than bolt diameter.
  - 3. All bolts to have threads excluded from shear plane.
- F. Filler Metals for Welding: Shielded metal-arc welding: AWS A5.1.
- G. Accessories: Include bridging, headers, end and side wall anchors, ceiling extensions, etc. to provide a complete installation.
- H. Shop Paint Primer: Standard primer: SSPC Paint 13.
- I. Sliding Bearing Plates: Teflon coated.
- J. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 4,000 psi at 28 days.

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K. Other Materials: All other materials not specifically described but required for a complete and proper installation of structural steel shall be new, free from rust, first quality of their respective kinds, and subject to the approval of the Architect.

### 2.2 Fabrication

A. Fabricate Structural Steel in accord with the Shop Drawings and reference standards with the modifications and additional requirements specified in this Section.

#### B. Connections:

- 1. Shop Connections: Welded or bolted.
- 2. Field Connections:
  - a. Provide bolted connections as follows:
    - (1) High strength threaded fasteners shall be used for bolted connections, except where standard threaded fasteners are permitted.
    - (2) High strength bolted construction assembly: tightening shall be done in accord with Section 5 of RCSC Specifications for Structural Joints.
    - (3) Fabricator is responsible for design and strength of connections unless otherwise noted on the Drawings.

### C. Holes:

- 1. Punch holes as required for connection of other work per templates and directions of such trades.
- 2. Steel requiring accurate alignment shall be provided with slotted holes and shims for trueing up steel, as required for alignment.

### D. Welded Construction

- 1. Welding process shall be limited to one or a combination of the following: Manual shielded-arc
- 2. Welded assemblies shall be stress relieved by heat treatment.
- 3. Use equipment which will supply proper current in order that operator may produce satisfactory welds. Welding machine: 200 to 400 amperes, 25-40 volts capacity.
- 4. Field welding: by direct current. Remove paint within two inches of weld.
- E. Column bases shall be milled and attached to columns.

## F. Bearing plates:

- 1. Bearing plates shall be provided under beams, girders and trusses resting on footings, piers and walls.
- 2. Bearing plates shall be either attached or loose.

### G. Shear Connectors:

- 1. Welded to beam or girders in composite construction; spaced as indicated.
- 2. Headed stud type shear connectors shall be automatically end welded in accord with Articles 4.3.1 and 4.3.2 of AWS Structural Welding Code.
- H. Shop Painting: Shop paint all steel work, field welded, and high strength bolted.

## **PART 3 EXECUTION**

### 3.1 Surface Conditions

A. Inspection

- 1. 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.
- 2. Verify that all structural steel may be fabricated and erected in strict accord with the original design, the approved Shop Drawings, and the referenced standards.

### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 Preparation

A. Field Measurements: Take field measurements to verify or supplement dimensions. Be responsible for accurate fit of all work.

### 3.3 Erection

- A. Column Bases and Bearing Plates:
  - 1. Attached column bases and bearing plates for beams and similar structural members shall be aligned with wedges or shims.
  - 2. Loose column bases and bearing plates which are too heavy to be placed without a derrick or crane shall be set and wedged or shimmed.

#### B. Erection Tolerances:

1. Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1 to 500.

### C. Field Assembly

- 1. Structural steel frames shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerances.
- 2. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
- 3. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.
- 4. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
- 5. Splices shall be permitted only where indicated.
- 6. Use drift pins only for bringing members into position, not to enlarge or distort holes.
- 7. Erection bolts used in welded construction shall be tightened and left in place.
- 8. Give special attention to steel handling during construction to avoid overloading green floor slabs, adhere to Architect's instructions when criticisms are made in this regard.
- 9. Provide temporary bracing as necessary, and leave in place as long as may be required.

### D. Gas Cutting

- 1. Field correcting of fabrication by gas cutting shall not be permitted on any major member in the structural framing without prior approval of the Architect.
- 2. Cut out and reinforce, as indicated and/or required, holes through webs of members for mechanical work. Verify exact locations with heating and ventilating contractor.

E. After erection, prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete and surface of crane rail.

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#### **SECTION 05 21 00 STEEL JOISTS AND TRUSS GIRDERS**

SCOPE Applicable provisions of the General and Supplementary Conditions, Supplementary Conditions for City of Oshkosh, City Specifications and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials 1.2 Quality Assurance 2.2 Fabrication

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage & Handling 3.2 Erection and Handling

#### **PART 1 GENERAL**

### 1.1 Description

- A. Work Included: Structural steel joists required for this Work is indicated on the Drawings and includes, but is not necessarily limited to:
  - 1. Floor Joists
  - 2. Roof Joists
  - 3. Joist Girders
  - 4. Bridging, anchors, and attached bearing plates and angles.
  - 5. Loose bearing plates and anchor bolts for site placement.

## B. Related Work Specified Elsewhere

1.	Precast Concrete	Section 03 41 00
2.	Masonry	Section 04 20 00
3.	Structural Steel	Section 05 12 00
4.	Metal Decking	Section 05 30 00
5.	Finished Painting	Section 09 91 00

C. Work Furnished but Installed by Others

1.	Anchorages cast in place	Section 03 30 00
2.	Anchorages embedded in masonry	Section 04 20 00

### 1.2 Quality Assurance

#### A. Qualifications

- 1. Joist Fabricator: Fabricator shall have not less than 5 years experience in the fabrication of structural steel joists.
- 2. Steel Erection: Erector shall have not less than 5 years experience in the erection of structural steel.
- 3. Welding: All welding shall be performed by operators who hold a valid certification for the type of weld performed according to the American Welding Society.

### B. Design Criteria

1. Design to conform to specific S.J.I. Specification for the type of joist indicated and to all applicable AISC Specifications.

- 2. Design to be based upon loads indicated on Drawings.
  - a. The member sizes shown on the Drawings are based upon the design procedure outlined in the recommended code of standard practice for steel joist and joist girder published by the Steel Joist Institute. Standard catalog joists sizes shown have been selected using the deflection limits set forth in this section. Joist supplier to provide joists designed for the allowable loads listed in the "Standard ASD Load Table", published by S.J.I. Deflection limits shall be 1/360 span for live load and 1/240 span for total load at both roof and floor joists unless noted otherwise on the drawings.
  - b. Joists and girders listed on the drawings as "SP" shall be considered "SPECIAL" designs. Joist supplier shall prepare calculations to determine actual member sizes to be used based on the service loads shown. Depth of member should not exceed those shown on the Drawings.
  - c. Joists adjacent and parallel to exterior walls shall be designed with zero camber. Joists parallel to exterior walls one space in shall be designed with one half standard camber.
- 3. Joist Contractor will note differential snow loading conditions as shown on the structural drawings and allow for same. Joists will be noted as to proper direction of joist ends to accommodate load variances for differential snow loadings shown.
- 4. In addition to all other loads, provide concentrated live loads per the Ohio Building Code Table 1607.1 #26 Roofs: See notes on the drawings.
  - a. All roof surfaces subject to maintenance workers = 300#
  - Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages = 2,000#

# C. Source Quality Control

- 1. Material Compliance: Manufacturer will supply on request of Architect, certificates showing mechanical, physical and strength properties of all materials supplied.
- 2. Inspection of welds shall be in accord with Section 9 of AWS Building Code.
- 3. Inspection of Shop Painting
  - a. Surface preparation prior to painting shall be visually evaluated for degree of cleaning by comparison with SSPC pictorial standards.
  - b. Measurement of dry film thickness of each coat of shop-applied paint shall be in accord with ASTM D1005.
- D. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with:
  - Reference standards: The term "Standard Specifications" as used shall refer to "Standard Specifications, Load Tables and Weight Tables for K, LH, DLH Series Steel Joists and Joist Girders, as adopted by the Steel Joist Institute and American Institute of Steel Construction.
  - 2. "Structural Welding Code" of the American Welding Society.
  - 3. "Standards and Best Practice for Surface Preparation of Steel Substrates" of the Society for Protective Coatings (SSPC).
  - 4. All joist to meet state of applicable building codes and be approved by local building authority.

### E. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. A325, High Strength Bolts for Structural Steel Joints.

- b. D1005, Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
- 2. American Welding Society (AWS)
  - a. D1.1, Structural Welding Code.
- 3. Steel Joists Institute (SJI)
  - a. Technical Digest #9, Handling and Erection of Steel Joists and Joist Girders.
- 4. Structural Steel Painting Council (SSPC)
  - a. SSPC PAINT15, Grey.
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with the provisions of these Specifications; the following:

## A. Shop Drawings

- 1. Steel Joists: Furnish detailed drawings and lists showing the mark, number, type, location and spacing of all joists. Show bridging type, mark, method of attachment to the joists, camber and anchorage at the ends. Show type of paint and all accessories and details as may be required for proper installation of joists.
- 2. Erection Procedure: Submit descriptive data to illustrate the structural steel erection procedure, including the sequence of erection and temporary staying and bracing.
- 3. Field welding equipment: Submit descriptive data for field welding equipment, including type, voltage and amperage.
- 4. Prepare Shop Drawings under seal of a Professional Structural Engineer registered in the State of Ohio.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Storage of Materials
  - 1. Structural steel members stored at the project site shall be above ground on platforms, skids or other supports. Do not deliver to site any sooner than needed for erection
  - 2. Steel shall be protected from corrosion. Any joists showing signs of rust will be rejected by the Architect.
- 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. Bent joists must be straightened and reinforced if approved in writing by the manufacturer's engineer. All broken welds must be repaired.

#### **PART 2 PRODUCTS**

### 2.1 Materials

- A. Open Web Joist Members: SJI Type LH Open Web Joists and Joist Girders. Conform to the standard specifications. Identify each joist with its mark.
- B. Anchor Bolts, Nuts and Washers: ASTM A325.

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- C. Primer: SSPC 15, Type I, Grey.
- D. Extended Ends: To have a load carrying capacity at least equal to loads shown on the Drawings and the design loads of the joist.
- E. Bridging: Member sizes and end anchorage in accord with the standard specifications unless otherwise indicated on the Drawings.
- F. Welding Electrodes: AWS E70 Series, Suitable for position and other conditions of intended use, as per container instructions.
- G. Include bridging, headers, end and side wall anchors, ceiling extensions, etc. to provide a complete installation.

#### 2.2 Fabrication

- A. General: Fabricate all work in accord with the approved Shop Drawings and referenced standards. Take field measurements to verify or supplement dimensions. Be responsible for accurate fit of all work.
- B. Where joists are to be furnished of identical length and depth, but of different capacities, provide permanent, obvious means of identification of the stronger joists (such as using different color paint for all or part of the joists).
- C. Provide bottom and top joist chord extensions indicated.
- D. Drill holes in top chords necessary for attachment of wood blocking where detailed. Weld threaded lugs to top chords for attachment of wood blocking where detailed.
- E. Prepare and shop prime with one coat of primer.

#### PART 3 EXECUTION

#### 3.1 Surface Conditions

A. Inspection: Carefully inspect the installed work of all other trades and verify that all such work is complete and that the work of this Section can be installed in accord with the original design and approved shop drawings. In the event of discrepancies, notify Architect immediately for clarification.

#### 3.2 Erection

- A. Erect steel joists in accord with most current SJI Standards and Specifications and OSHA Guidelines.
- B. Construction Loads: Exercise care to insure that construction loads do not exceed carrying capacity of joists.
- C. Bear joists on supports in accord with SJI.

- D. During erection, provide temporary bracing for induced loads and stresses.
- E. Coordinate placement of anchorages in masonry construction for securing bearing plates.
- F. Field weld joist seat to placed bearing plates after alignment, positioning after installation of bridging.
- G. Joist contractor will verify lighting fixtures, piping, and ductwork with mechanical contractors, before installation of bridging.
- H. Do not permit erection of decking until joists are braced and bridged.
- I. Do not apply horizontal load until metal decking has been installed and fastened as detailed.
- J. Do not field but or alter joists without approval of the Architect.
- K. After erection, prime welds, abrasions and surfaces not primed. Use primer consistent with shop coat.

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### **SECTION 05 30 00 METAL DECKING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 2.2 1.1 Description Fabrication

> 1.2 Quality Assurance 2.3 Approved Manufacturers

1.3 Submittals 3.1 Inspection 1.4 Product Delivery, Storage & Handling 3.2 Installation 3.3 Protection 2.1 Materials

### **PART 1 GENERAL**

### 1.1 Description

A. Work Included: This Section shall include all materials, equipment and labor necessary for the installation of metal floor and roof decking, in accord with the Specifications and Drawings.

## B. Related Work Specified Elsewhere

1.	Structural Metal Framing	Section 05 12 00
2.	Steel Joist	Section 05 21 00
3.	Rigid Insulation	Section 07 21 00
4.	Membrane Roofing	Section 07 53 00
5.	Flashing and Sheet Metal	Section 07 60 00
6.	Painting	Section 09 91 00

### 1.2 Quality Assurance

- A. Qualifications of Manufacturers
  - 1. Regularly engaged in the production of metal decking.
  - 2. The fabricator shall be a member of the Steel Deck Institute.
- B. Erector Qualification: Minimum of 5 years experience on comparable metal deck projects.
- C. Welding: All welding shall be performed by operators who hold a valid certification for the type of weld performed according to the American Welding Society.
- D. Design Criteria:
  - 1. Decking less than 3 inches in depth and not over 10 feet in length: SDI Steel Roof Deck Design Manual and/or SDI Steel Deck Design Manual
  - 2. Decking over 3 inches in depth or over 10 feet in length, AISI Specification for the Design of Cold-Formed Steel Structural Members.
  - 3. Maximum unit design stress: 0.60 by minimum yield strength of steel.
  - 4. Maximum working stress: 20,000 psi.
  - 5. Moment coefficient:
    - a. Simple and dual spans: 1/8.
    - b. Three or more spans: 1/10.

- 6. Deflection coefficient:
  - a. Simple span: 5/384.
  - b. Two or more spans: 3/384.
- 7. Maximum deflection:
  - a. Roof deck: Under live load 1/240 span length, center to center of supports.
  - b. Floor Deck: Under total uniform live and dead load 1/360 span length, center to center of supports.
- 8. Anchorage to resist gross uplift loading:
  - a. Eave overhangs: 45 psf less dead load.
  - b. Other roof areas: 30 psf less dead load.
- 9. Design to be based upon loads indicated on Drawings.
- E. Requirements of Regulatory Agencies:
  - 1. Install metal deck to meet requirements of all applicable codes.
- F. Allowable Tolerances: Maximum variation in unit alignment 1/4 inch in 40 feet. (1/1920).
- G. Source of Quality Control: Inspection of welds shall be in accord with Section 9 of AWS Building Code.
- H. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with:
  - 1. American Society for Testing and Materials (ASTM):
    - a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. American Welding Society (AWS):
    - a. D1.1, Structural Welding Code.
  - 3. Steel Deck Institute (SDI):
    - a. SDI Manual of Construction with Steel Deck MOC2
    - b. SDI Standard Practice Details SPD2
    - c. SDI Diaphragm Design Manual DDM03
- Submittals: Within 35 days after award of Contract, and before any metal decking is delivered to the job site, submit complete to the Architect in accordance with the provisions of these Specifications;
  - A. Shop Drawings:
    - 1. Deck layout, framing and supports, with unit dimensions and sections, including acoustical and composite units.
    - 2. Type and location of welds.
    - 3. Details of accessories, showing sump pans, cant strips, ridge and valley plates, closure strips and insulation supports.
  - B. Manufacturer's Literature: Recommended installation instructions.
  - C. Certificates: Manufacturer's certificate that painted decking passes 100-hour salt spray test, ASTM B117, available upon request.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect metal decking before, during and after installation and to protect the installed work and materials of all other trades.
- B. Acoustical Insulation (where specified):
  - 1. Deliver to project site before installing roof deck.
  - 2. Store in an enclosed protected area.
- C. Storage of Materials
  - 1. Do not bend or mar decking.
  - 2. Store off ground with one end elevated for drainage.
  - 3. Cover deck with waterproof material.
  - 4. Do not deliver to site any sooner than needed for erection.
  - 5. Steel shall be protected from corrosion. Any deck showing signs of rust will be rejected by the Architect.
- 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.

#### **PART 2 PRODUCTS**

## 2.1 Materials

- A. Carbon Steel Metal Roof Deck: ASTM A1008, 33ksi minimum at all exposed painted ceilings as shown on plans. Exposed Ceilings to be field painted.
  - 1. Painted finish per manufacturer's standard.
  - 2. Baked-on rust inhibitive primer, applied to chemically cleaned phosphate coated surface.
- B. Galvanized Steel Metal Roof Deck: ASTM A653, 33ksi minimum at all concealed ceilings as shown on plans.
  - 1. Electrogalvanized Finish Class G90.
  - 2. Galvanized Repair Paint MIL-P-21035
- C. Flexible Closure Strips As provided by deck manufacturer.
- D. Joint Sealant Material: Non-skinning, gun-grade, bulk compound as recommended by deck Manufacturer.
- E. Acoustical Deck Insulation Batts and Fasteners: As provided by roof deck Manufacturer where specified. Supply to roofer for installation. Complete repair bay and mezzanine roof.

#### 2.2 Fabrication

- A. General
  - 1. Form deck units in length to span three or more supports, with flush, telescoped or nested 2 inch end laps and nesting side laps.

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- B. SDI Standard Deck Configurations.
  - 1. Wide Rib (Type B):
    - a. Depth approximately 1½ inch.
    - b. Ribs spaced approximately 6 inches on center.
    - c. Width of rib opening at roof surface not more than 2½ inches.
    - d. Width of bottom rib surface not less than 1¾ inches.
    - e. Gauge as noted on drawings.
  - 2. Intermediate Rib (Type F):
    - a. Depth approximately 1-1/2 inch.
    - b. Ribs spaced approximately 6 inches on center.
    - c. Width of rib opening at roof surface not more than 1% inches.
    - d. Width of bottom rib surface not less than ½ inch.
    - e. Gauge as noted on drawings.
  - 3. Narrow Rib (Type A):
    - a. Depth approximately 1½ inch.
    - b. Ribs spaced approximately 6 inches on center.
    - c. Width of rib opening at roof surface not more than 1 inch.
    - d. Width of bottom rib surface not less than 3/8 inch.
    - e. Gauge as noted on drawings.
  - 4. Deep Rib (Type N):
    - a. Depth approximately 3 inch.
    - b. Ribs spaced approximately 8 inches on center.
    - c. Width of rib opening at roof surface not more than 2¾ inches.
    - d. Width of bottom rib surface not less than 1½ inch.
    - e. Gauge as noted on drawings.
- C. Composite and Non-Composite Form Deck:
  - 1. Depth: as shown on drawings.
  - 2. Coverage: 36 inches.
  - 3. Finish: Galvanized.
  - 4. Gauge: As shown on drawings.
- D. Acoustical Deck Repair Bay Roof per plans
  - 1. SDI Standard Deck Configuration
  - 2. Surfaces perforated to provide 85NCR.
- E. Can't Strips:
  - 1. Fabricate from galvanized sheet steel of same quality as deck units.
  - 2. Minimum thickness before galvanizing: 0.0359 inches (20 gauge).
  - 3. Bend cant strips to form 45 degree slope not less than 5 inches wide, with top and bottom flanges not less than 3 inches wide.
- F. Metal Closure Strips:
  - 1. Fabricate of galvanized sheet steel of same quality as deck units.
  - 2. Bend to provide tight-fitting closures at open ends and sides of decking.
- G. Cover Plates:
  - 1. Sheet steel of same quality as deck units.
  - 2. 18 gauge minimum thickness before coating.

- H. Roof Sump Pans:
  - 1. Fabricate from single piece of galvanized sheet steel of same quality as deck units.
  - 2. Minimum thickness: 0.747 inches (14 gauge) before galvanizing.

#### 2.3 Approved Manufacturers

- A. Acceptable Manufacturers:
  - 1. Canam
  - 2. Cordeck
  - 3. New Millennium Building Systems
  - 4. Vulcraft

#### **PART 3 EXECUTION**

#### 3.1 Inspection

- A. Surface Conditions: Carefully inspect the installed work of all other trades and verify that all such work is complete and that the work of this Section can be installed in accord with the original design and approved Shop Drawings. In the event of discrepancies, notify Architect immediately for clarification.
- B. Check supporting member for correct layout and alignment. Verify that surfaces to receive roof deck are free of debris. Do not proceed with installation until defects are corrected.
- C. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Architect.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

#### 3.2 Installation

- A. General: Install metal deck units and accessories in accord with Manufacturer's recommendations and Shop Drawings.
- B. Scheduling: Coordinate the schedule for erection of metal decking with the schedules for related work to ensure prompt erection of the decking as soon as supporting elements are in place.
- C. Placing Metal Deck Units:
  - 1. Position floor deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened. Follow Manufacturer's recommendations for bearing length.
  - 2. Lap ends not less than 2 inches.
  - 3. Do not stretch or contract the side lap interlocks.
  - 4. Place deck units flat and square and secure to adjacent framing without warp or deflection.
- D. Fastening Deck Units
  - 1. Roof and Floor

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- a. Secure roof deck units to supporting members with fastening pattern shown on drawings.
- b. Welding to conform to AWS D 1.0.
- c. Lock side laps between adjacent deck units at intervals not over 30 inches on center or as shown on drawings.
- d. Power driven fasteners are acceptable as shown on the drawings. Conform to fastener manufacturer installation practice. Take special care at deck splices to assure full penetration.

### E. Joint Sealing:

- 1. Remove dust, dirt and moisture from joint surfaces.
- 2. Apply sealant in accord with Manufacturer's instructions.

## F. Cutting and Fitting:

- 1. Cut and fit floor deck units and accessories around projections through floor decking.
- 2. Make cuts neat, square and trim.
- 3. Cut openings in floor deck true to dimensions using metal saws drills or cutting torches.
- 4. Do not used cutting torches if neat appearance is required.

#### G. Can't Strips

- 1. Weld can't strip to top surface of roof decking at 12 inches on center.
- 2. Lap end joints not less than 3 inches.

## H. Closure Strips

- 1. Roof
  - a. Install metal closure strips at all open uncovered ends and edges of roof decking, and in voids between decking and other construction.
  - b. Weld into position to provide complete decking installation.

#### I. Roof Insulation Support

- 1. Provide metal closure strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings.
- 2. Weld closure strips into position.
- J. Damaged Deck: Repair or replace all damaged deck.
- K. Broken Welds: All broken welds must be repaired.

### K. Touch-up Painting

- 1. Wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of deck units and supporting steel members.
- 2. Touch-up galvanized surfaces with galvanizing repair paint applied in accord with Manufacturer's instructions.
- 3. Touch-up shop painted surfaces with same paint used in shop, and apply as recommended by Manufacturer.
- 4. Touch-up paint to match existing paint in exposed areas.

# 3.3 Protection

A. Do not use deck units for storage or working platforms until permanently secured in position.

B. Assure that construction loads do not exceed carrying capacity of deck.

\* \* \* \* \* \* \* \* \* \* \* \*

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### **SECTION 05 41 00 STRUCTURAL METAL STUD FRAMING**

SCOPE Applicable provisions of the General Conditions and Division 1 shall govern work under this Section.

INDEX 1.1 Description 3.1 Examination

> 1.2 Reference Standards 3.2 Installation & Studwalls

1.3 System Description 3.3 Installation Pre-Fab & Panel Const. 1.4 Submittals 3.4 Installation Non-Panel Members

1.5 Quality Assurance 3.5 Installation Joints

1.6 Delivery, Storage & Handling 3.6 Fastening & Attachments

2.1 Materials 3.7 Construction

3.8 Field Quality Control 2.2 Fabrication

#### **PART 1 – GENERAL**

## 1.1 Description

#### A. Section Includes:

- 1. Load-bearing metal stud walls and partition framing, with anchorage and bracing.
- B. Related Documents: The Contract Documents, as defined in the Summary of Work, apply to the work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related work specified elsewhere:

1. Cast-In-Place Concrete Section 03 30 00 2. Unit Masonry Section 04 20 00 3. Rough Carpentry Section 06 10 00 4. Gypsum Wallboard Section 09 29 00

#### 1.2 Reference Standards

- A. American Iron and Steel Institute (AISI)
  - 1. Cold-Formed Steel Framing Design Guide
  - 2. Cold-Formed Steel Design Manual (Latest).
- B. American Society of Civil Engineers (ASCE)
  - 1. ASCE 7 Minimum Design Loads for Buildings and Other Structures.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
  - 3. ASTM A1011 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.
  - 4. ASTM C955 Standard Specification for Cold-Formed Steel Structural Framing Members.

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- D. American Welding Society (AWS):
  - 1. AWS D1.1 Structural Welding Code Steel
  - 2. AWS D1.3 Structural Welding Code Sheet Steel
  - 3. AWS Standard Qualification Procedure
- E. Federal Specification.
  - 1. FS MIL-P-53030 Primer Coating, Synthetic, Rust-Inhibiting, Lacquer-Resistive.

### 1.3 System Description

- A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the building code in effect in the jurisdiction where the project is being constructed.
  - 1. Design shall use the superimposed design loads specified in the building code and as shown on the drawings.
  - 2. Design shall be based upon information shown on the drawings and specified herein.
  - 3. Additional Design Criteria ASCE 7 or:
    - a. Interior Load-bearing partitions:
      - (1) Lateral pressures: 5 psf
    - b. Interior Non-load-bearing partitions:
      - (1) Lateral pressures: 5 psf
    - c. Exterior curtain walls:
      - (1) Wind loads based on Applicable Building Code
    - d. Maximum allowable deflection with brick veneer:
      - (1) Calculated on 18 ga. stud capacity alone: 1/600.
  - 4. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load Resistance. All connections (member to member and member to structure) shall be designed and detailed.
  - 5. Incidental structural steel such as clip angles, etc. not shown on the drawings shall be indicated on the shop drawings and provided by this contractor.
- B. Qualification of Field Welding: Qualify welding process and welding operators in accordance with AWS Standard Qualification Procedure.
- C. Bidding Requirements: Prior to bidding, carefully review the drawings for adequate structural support of the Metal Stud Framing. Notify the Architect immediately if additional structural steel will be required to support the work of this section.

### 1.4 Submittals

A. Section 01 33 00 - Submittal Procedures: Procedures for submittals.

All shop drawings and calculations must bear the seal and signature of an engineer registered in the State of Ohio.

Product Data: Manufacturers' literature containing product and Installation specifications and details.

**Shop Drawings:** 

a. Documents illustrating materials, shop coatings, steel thickness, details of fabrication and erection, details of attachment, spacing of fasteners, required accessories and critical installation procedures.

#### Calculations:

a. Engineering calculations or data verifying the framing assembly's ability to meet or exceed design requirements as stated here-in and required by local codes; prepared under the supervision of a Professional Engineer licensed in the State of Ohio.

#### Assurance/Control Submittals:

- a. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with a copy to Contractor. Prepare reports in conformance with Section 01 45 00 Quality Control:
  - Testing/Inspection reports conducted on shop and field-bolted and welded connections. Include data on type(s) of tests conducted and test results. Note inspection findings.
- b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

### 1.5 Quality Assurance

#### A. Qualifications:

Manufacturer and Installer: Company specializing in the manufacturing and installation of Products specified in this specification.

## B. Pre-Installation Meetings:

- Convene a pre-installation meeting one week prior to commencing Work of this Section. Notify the Architect and Contracting Officer of the meeting date and time at least 7 days prior.
- 2. Require attendance of parties directly affecting Work of this Section
- 3. Review conditions of operations, procedures and coordination with related Work.
- 4. Agenda:
  - a. Tour, inspect, and discuss conditions of installation of other work including door and window frames and mechanical and electrical work.
  - b. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
  - c. Review required submittals, both completed and yet to be completed.
  - d. Review Drawings.
  - e. Review and finalize construction schedule related to cold formed metal framing installation and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
  - f. Review required inspections, testing, certifying, and material usage accounting procedures.
  - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
  - h. Review safety precautions relating to operations.

## 1.6 Delivery, Storage, and Handling

A. Section 01 60 00 – Material and Equipment: Transport, handle, store and protect products according to this section.

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B. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings and protect against mechanical damage to units. Store materials on a flat plane. Any damaged materials shall be removed from the site.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the plans or as required by manufacturer design, if called for. Studs, runners (track), bracing, and bridging shall be manufactured per ASTM Specification C-955.
- B. All galvanized studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A653, as set forth in the AISI Cold-Formed Steel Framing Design Guide (latest edition).
- C. All galvanized studs, joists and accessories shall have a minimum G-60 coating.
- D. All section properties shall be calculated in accordance with AISI Cold-Formed Steel Framing Design Guide (latest edition).

### 2.2 Fabrication

- A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.
- B. Fastenings: Attach similar components by welding or mechanical fasteners. Attach dissimilar components by screw Fasteners, as standard with manufacturer.
- C. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted
- D. Wire tying of framing components is not permitted.

### **PART 3 EXECUTION**

#### 3.1 Examination

- A. Execution Requirements: Verification of existing conditions before starting work
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work
- C. Report in writing to the General Contractor prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

### 3.2 Installation and Studwalls

A. Manufacturer's instructions: Install metal framing systems in accordance with manufacturer's printed or written Instructions and recommendations, unless otherwise indicated.

#### B. Stud Walls:

- Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches on center spacing for nail or power-driven fasteners, or 16 inches on center for other types of attachment. Provide fasteners at corners and ends of tracks
- 2. Position studs plumb in runners and space no greater than 16 inches and not more than 2 inches from abutting walls and at each side of openings. Connect studs to upper and lower tracks using self-drilling, screws or welding in accordance with Manufacturer's recommendations such that the connection meets or exceeds the design loads required at that connection
- 3. Brace all studs at mid-height for added strength and stiffness.
- 4. Construct corners using minimum of three studs. Double studs at door, window, and sidelight jambs. Install intermediate studs above and below openings to match wall stud spacing.
- 5. Provide deflection allowance below supported horizontal building framing in ceiling or head track for non-load-bearing framing in a method recommended by stud manufacturer.
  - a. Where walls and partitions must close out against the deck for smoke and fire separation provide a top track rigidly attached to vertical studs but free to move vertically in a break-formed deep leg track rigidly attached to deck with slack to accommodate structural live load deflections noted on drawings.
  - b. Where wall or partition studs pass by the structural deck provide vertical slide clips welded or screw attached to the structural support but do not attach rigidly to studs.

#### 3.3 Installation: Pre-Fabricated and Panelized Construction

A. Panels shall be designed to resist construction and handling loads as well as service loads.

## 3.4 Installation: Non-Panelized (Stick Built) Members

- A. Align track accurately at supporting structure and fasten to structure as shown on shop drawings.
- B. Track intersections shall butt evenly.
- C. Studs shall be plumbed, aligned, and securely attached to flanges or webs of upper and lower tracks. Axially loaded studs shall be seated squarely in both top and bottom tracks.

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#### 3.5 Installation: Joists

- A. Joist shall be located directly over bearing studs or a load distribution member shall be provided to transfer loads.
- B. Provide web stiffeners where necessary at reaction points, and at points of concentrated loads, as shown on the shop drawings.
- Bridging, either strap or solid, shall be provided as shown on the shop drawings.
- D. Provide additional joists under parallel partitions where the partition length exceeds 1/2 of the joist span.
- E. Provide additional joists around all floor/roof openings which are larger than the joist spacing and as noted on the shop drawings.
- F. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

## 3.6 Fastening and Attachments

- A. Anchorage of the tracks to the structure shall be with methods designed for the specific application of sheet to that surface. Size, penetration, type and spacing shall be determined by design.
- B. Welds shall conform to the requirements of AWS D1.1, AWS D1.3, and AISI requirements. Welds may be butt, fillet, spot, or groove type, the appropriateness of which shall be determined by, and within the design calculations. All welds shall be touched-up using zinc rich paint to galvanized members, and paint similar to that used by the manufacturer for painted members.
- C. Steel drill screws shall be of the minimum diameter indicated by the design of that particular attachment detail. Penetration through joined materials shall not be less than 3 exposed threads.
- D. Wire tying in structural applications is not permitted.

### 3.7 Construction

- A. Site Tolerances:
  - 1. Vertical alignment (plumbness) of studs shall be within 1/960<sup>th</sup> (1/8 inch in 10.0 inches) of the span.
  - 2. Horizontal alignment (levelness) of walls shall be within 1/960<sup>th</sup> (1/8 inch in 10.0 inches) of their respective lengths.
  - 3. Spacing of studs shall not be more than <u>+</u> 1/8 inch from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
  - 4. Squareness Prefabricated panels shall not be more than 1/8 inch out of square within the length of that panel.

## 3.8 Field Quality Control

- A. Section 01 45 00 Quality Requirements: Field testing and inspection.
  - 1. Inspect all work in order to assure strict conformance to the shop drawings at all phases of construction.
  - 2. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement, reinforcement, etc.
  - 3. All attachments shall be checked for conformance with the shop drawings. All welds shall be touched-up as specified herein.
  - 4. General Inspection of structure shall be completed prior to applying loads to those members.
  - 5. Inspections where and as required by local codes shall be controlled inspections.

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### **SECTION 05 50 00 METAL FABRICATIONS**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 2.2 Fabrication 1.1 Description

> 1.2 Quality Assurance 3.1 Surface Conditions

1.3 Submittals 3.2 Preparation

1.4 Product Delivery, Storage & Handling 3.3 Erection

3.4 Cleaning 2.1 Materials

### **PART 1 GENERAL**

#### 1.1 Description

- A. Work Included: Metal fabrications required for this work are indicated on the Drawings and include, but are not necessarily limited to:
  - 1. Handrails and railings
  - 2. Miscellaneous metal fabrications
  - 3. Metal Stairways
  - 4. Safety Tie-back Post

## B. Related Work Specified Elsewhere

1.	Cast-In-Place Concrete	Section 03 30 00
2.	Structural Precast Concrete	Section 03 41 00
3.	Masonry	Section 04 20 00
4.	Structural Metal Framing	Section 05 12 00
5.	Metal Decking	Section 05 30 00
6.	Prefabricated Light Gauge Steel Roof and Floor Trusses	Section 05 44 00
7.	Rough Carpentry	Section 06 10 00
8.	Finish Painting	Section 09 91 00

C. Work Furnished but Not Installed

1. Metal fabrications cast in concrete Section 03 30 00 Section 04 20 00 2. Metal fabrications embedded in masonry

## 1.2 Quality Assurance

### A. Qualifications

- 1. Fabricator: Fabricator shall have not less than 5 years experience in the fabrication of metal fabrications.
- 2. Welding: All welding shall be performed by operators who have been recently qualified as prescribed in "Qualification Procedure" of the American Welding Society.
- B. Requirements of Regulatory Agencies: In addition to complying with all pertinent codes and regulations, comply with:
  - 1. "Code for Welding in Building Construction" of the American Welding Society.
  - 2. Specifications for Structural Joints Using ASTM A-325 or A-490 Bolts, approved by the Research Council on Riveted and Bolted Joints of the Engineering Foundation.
  - 3. Specifications of the Structural Steel Painting Council.
  - 4. Applicable Building Code. All railings to meet requirements.

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- In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.
- C. Source Quality Control: Inspection of shop welds shall be in accord with Section 6 of AWS Building Code.
- D. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. A 36, Structural Steel
    - b. A 325, High Strength Bolts for Structural Steel Joints Including Suitable Nuts and Plain Hardened Washers.
    - c. A 501, Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
    - d. F 1554, Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
  - 2. American Welding Society (AWS)
    - a. D 1.1, Structural Welding Code.
  - 3. Federal Specifications (FS):
    - a. TT-P-645, Primer, Paint Zinc Chromate, Alkyd Type.
  - 4. Structural Steel Painting Council (SSPC)
    - a. Paint 13, Number 13 Red or Brown One-Coat Shop Paint.
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Shop Drawings: Show all shop and erection details including cuts, copes, connections, holes, threaded fasteners, rivets, and welds. All welds, both shop and field, shall be indicated by AWS "Welding Symbols" A 2.0. Indicate all required field measurements.
  - B. Maintenance Instruction: Procure from manufactures of exposed metals, recommendations describing procedures for maintaining, including cleaning materials, application methods and precautions as to use of materials which may be detrimental to finish when improperly applied.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect metal fabrications before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials to be Installed Under Other Sections:
  - 1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
  - 2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.
- C. Storage of Materials
  - 1. Metal fabrications which are stored at the project site shall be above ground on platforms, skids or other supports.
  - 2. Steel shall be protected from corrosion.

- 3. Other materials shall be stored in a weather tight and dry place, until ready for use in the work.
- 4. Packaged materials shall be stored in their original unbroken package or container.
- 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.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Steel: ASTM A 36.
- B. Bolts, Nuts and Washers: High strength type recommended for structural steel joints; **ASTM A 325.**
- C. Welding Materials: Applicable AWS D1.1, type required for materials being welded.
- D. Anchor Bolts: conform to ASTM F-1554 36.
- E. Steel Bar and Tube
  - 1. Carbon Steel Bar
    - a. Shape: round, square or rectangular
    - b. ASTM A 29
  - 2. Carbon Steel Tube
    - a. Shape: round, square or rectangular
    - b. ASTM A 501
  - 3. Fittings
    - a. Carbon Steel: ASTM A 36, 1010 low carbon plate.
    - b. Lead: FS QQ-C-40, type I grade AA, form ingots.
    - c. Machine screws: FS FF-S-92, type III style 2c.
    - d. Cement: Hydraulic, quick-setting, ASTM C 595, factory prepared with accelerator.
- F. Railings: Tube stock per details.
- G. Metal pan stairs and landings: tube or bar railings; stair as detailed. Pipe rail as detailed.
- H. Shop Paint Primer: Standard primer: SSPC Paint 13.
- I. Galvanized Coating: For materials called out as 'galvanized', provide G-90 hot-dipped coating per ASTM A-123.
- J. Other Materials: All other materials, not specifically described but required for a complete and proper installation of metal fabrications, shall be new, free from rust, first quality of their respective kinds, and subject to the approval of the Architect. Fabricate and supply to concrete or masonry subcontractor all cast-in weld plates to anchor railings. See Drawings for toe guards.
- K. Safety Tie Back Post
  - 1. Post 14.5"
  - 2. Strength 7,000 lbs.
  - 3. Backer Plate 14" x 14" x 1/2" A36 galvanized plate.

February 6, 2024 05 50 00-3 4. Welded direct to cast in plate in hollow core plank/ or complete thru bolted.

### 2.2 Fabrication

A. Fabricate metal fabrications in accord with the Shop Drawings and reference standards with the modifications and additional requirements specified in this Section. Fabricate items with joints nearly fitted and properly secured. Fit and shop assemble in largest practical sections, for delivery to site.

#### B. Connections:

- 1. Shop Connections: Welded or bolted.
- 2. Field Connections:
  - a. Provide bolted connections as follows:
    - (1) High strength threaded fasteners shall be used for bolted connections, except where standard threaded fasteners are permitted.
    - (2) High strength bolted construction assembly: tightening shall be done in accord with Section 5 RCSC of Specifications for Structural Joints.
    - (3) Fabricator is responsible for design and strength of connections unless otherwise noted on the Drawings.
- Exposed Mechanical Fastenings: Flush countersunk screws of bolts unobtrusively located consistent with design of structure, except where specifically noted otherwise.
- 4. Make exposed joints flush butt type hair line joints where mechanically fastened.
- 5. Supply components required for proper anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, unless otherwise specified.

#### C. Holes:

- 1. Punch holes as required for connection of other work per templates and directions of such trades.
- 2. Steel requiring accurate alignment shall be provided with slotted holes and shims for trueing up steel, as required for alignment.

## D. Welded Construction:

- 1. Welding process shall be limited to one or a combination of the following:
  - a. Manual shielded-arc
  - b. Submerged arc
  - c. Gas metal-arc
  - d. Flux cored arc
  - e. Electroslag
  - f. Electrogas
- 2. Welded assemblies shall be stress relieved by heat treatment.
- 3. Use equipment which will supply proper current in order that operator may produce satisfactory welds. Welding machine: 200 to 400 amperes, 25-40 volts capacity.
- 4. Field welding: by direct current. Remove paint within two inches of weld.
- 5. Grind exposed welds smooth and flush with adjacent finished surface.

### E. Pipe and Tube Railings

- 1. Cut pipe square within 2 degrees and to lengths within 1/8 inch.
- 2. Remove butts from cut edges.

- 3. Form and assemble joints which will be exposed to the weather so as to exclude water.
- F. Shop Painting: Shop paint all steel work unless noted as 'galvanized'.

#### **PART 3 EXECUTION**

### 3.1 Surface Conditions

#### A. Inspection

- 1. 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.
- 2. Verify that metal fabrications may be fabricated and erected in strict accord with the original design, the approved Shop Drawings and the reference standards.

### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 Preparation

A. Field Measurements: Take field measurements to verify or supplement dimensions. Be responsible for accurate fit of all work.

## 3.3 Erection

### A. Field Assembly

- 1. Metal fabrications shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerances.
- 2. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
- 3. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
- 4. Provide temporary bracing as necessary, and leave in place as long as may be required.
- 5. Obtain Architect's review prior to site cutting or making adjustments, which are not part of scheduled work.
- 6. After installation, touch-up field welds and scratches and damaged. Use a primer consistent with shop coat.

### 3.4 Cleaning

## A. Metals to receive paint

- 1. Wash thoroughly using clean water and soap; rinse with clean water.
- 2. Do not use acid solution, steel wool or other harsh abrasive.
- 3. If stain remains after washing, remove finish and restore in accord with recommendations of fabricator.

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### **SECTION 06 10 00 ROUGH CARPENTRY**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX	1.1	Description	3.2	Workmanship
	1.2	Quality Assurance	3.3	Installation
	1.3	Submittals	3.4	Fastening
	1.4	Product Handling	3.5	Nailing Schedule
	2.1	Grade Stamps	3.6	Protection
	2.2	Materials	3.7	Cleaning Up

3.1 Surface Conditions

### **PART 1 GENERAL**

## 1.1 Description

A. Work Included: All wood, nails, bolts, screws, framing anchors and other rough hardware, and all other items needed for rough carpentry in this Work but not specifically described in other Sections of these Specifications; and the installation of all blocking Required for scope of work.

## B. Related Work Specified Elsewhere

1.	Concrete	Section 03 30 00
2.	Precast Concrete	Section 03 41 00
3.	Light Gauge Steel Roof Trusses	Section 05 44 00
4.	Timber Decking	Section 06 15 19
5.	Fabricated Wood Trusses	Section 06 17 53
6.	Architectural Woodwork	Section 06 40 00
7.	Damproofing	Section 07 11 00
8.	Self-Adhering Sheet Waterproofing, Low Temperature	Section 07 13 00
9.	Fluid-Applied Membrane Air Barriers, Vapor Permeable	Section 07 27 26
10.	Shingles	Section 07 31 00
11.	Wood Doors	Section 08 14 29
12.	Gypsum Wallboard	Section 09 29 00
13.	Painting	Section 09 91 00

## 1.2 Quality Assurance

## A. Qualifications of Workmen

- Provide sufficient skilled workmen and supervisors who shall be present at all times during execution of this portion of the Work and who shall be thoroughly familiar with the type of construction involved and the materials and techniques specified.
- 2. Rejection: In the acceptance or rejection of rough carpentry, no allowance will be made for lack of skill on the part of workmen.

### B. Codes and Standards

1. Lumber grading rules and wood species to be in conformance with Voluntary Product Standard PS 20: Grading rules of the following associations apply to materials furnished under this Section:

- a. West Coast Lumber Inspection Bureau (WCLIB).
- b. Western Wood Products Association (WWPA).
- 2. Requirements of Regulatory Agencies
  - a. Pressure treated material: American Wood Preservers Bureau Standards.
  - b. American Wood Preservers Bureau (AWPB):
    - (1) LB-2, Standard for Softwood Lumber, Timber, and Plywood Pressure Treated with Water-borne Preservatives for Above Ground Use.
  - c. Federal Specifications (FS):
    - (1) FF-B-561, Bolts (Screw), Lag.
    - (2) FF-B-575, Bolts, Hexagon and Square.
    - (3) FF-B-584, Bolts, Finned Neck; Key Head; Machine; Ribbed Neck; Square Neck; Tee Head.
    - (4) FF-N-105, Nails, Wire, Brads and Staples.
    - (5) FF-N-836, Nuts, Square, Hexagon, Cap, Slotted, Castellated, Clinch Knurled and Welding.
    - (6) FF-S-111, Screw, Wood.
  - d. Product Standards (PS)
    - (1) 20, American Softwood Lumber Standard.
- 3. Conflicting requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.

#### 1.3 Submittals

- A. Certification (only on request of Architect)
  - Pressure-treated wood: Submit certification by treating plant stating chemicals and process used, net amount of salts retained, and conformance with applicable standards.

## 1.4 Product Delivery, Storage and Handling

#### A. Protection

- 1. Use all means necessary to protect the materials before 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.
- Store materials a minimum of 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.
- 4. Do not store seasoned materials in wet or damp portions of building.
- 5. Protect sheet materials from corners breaking and damaging surface, while unloading.
- 6. Identify all framing lumber as to grades and store all grades separately from other trades. Keep grade marks legible.
- 7. Protect all metal products with adequate weatherproof outer wrappings.
- 8. Keep all damaged material clearly identified as damaged, and separately store to prevent its inadvertent use.
- 9. Do not allow installation of damaged or otherwise noncomplying material.
- 10. Use all means necessary to protect the 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 2 PRODUCTS**

2.1 Grade Stamps: Identify all other materials of this Section by the appropriate stamp of the agency listed in the reference standards, or by such other means as are approved in advance by the Architect.

#### 2.2 Materials

#### A. Lumber

- 1. Dimensions
  - a. Specified lumber dimensions are nominal.
  - b. Actual dimensions to conform to PS 20.
- 2. Moisture Content: Unseasoned or 19% maximum at time of permanent closing in of building or structure, for lumber 2 inches or less nominal thickness.
- 3. Surfacing: Surface four sides (S4S), unless specified otherwise.
- 4. End Jointed Lumber
  - a. Structural purposed interchangeable with solid sawn lumber.
- 5. Framing lumber, any commercial softwood species
  - a. Light framing
    - (1) General framing: Standard and Better or Stud grade. Chloride treated at roof blocking and where in contact with concrete.
    - (2) Plates, blocking, bracing and nailers: Utility grade.
    - (3) Bracing, blocking, bulk headings and general utility purposes: Economy grade.
  - b. Beams and Headers Size and Grade as noted on drawings.

### B. Panel Sheathing

- 1. Plywood APA Rated; thickness or rating as shown on the drawings.
- 2. Exterior graded where sheathing is exposed to the weather for long periods of time.
- 3. Floor sheathing to have tongue and groove edge.
- 4. Fire Treated Plywood All exterior and interior plywood sheathing shall be Fire-Retardant-Treated Wood meeting the criteria outlined in Section 2303.2 of the International Building Code 2015. As specified in the code, wood shall be tested in accordance with ASTM E84 or UL723, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when test is continued for an additional 20-minute period.

### C. Building Paper

- 1. Tyvek commercial wrap membrane or approved equal.
- D. Preservative-Treated Wood Products
  - 1. Waterborne salt preservatives for painted, stained, or exposed natural wood product:
    - a. AWPB LP-2, above ground applications.
    - b. Lumber redried to maximum moisture content of 19%, stamped "DRY".

## E. Rough Hardware

- 1. Bolts
  - a. FS FF-B-575.
  - b. FS FF-B-584.

- 2. Nuts: FS FF-N-836.
- 3. Expansion shields: FS FF-B-561.
- 4. Lag screws and bolts: FS FF-B-561.
- 5. Toggle bolts: FS FF-B-588.
- 6. Wood Screws: FS FF-S-111.
- 7. Nails and staples: FS FF-N-105.
- 8. Metal nailing discs:
  - a. Flat caps, minimum 1 inch diameter.
  - b. Minimum 30 gauge sheet metal.
  - c. Formed to prevent dishing.
  - d. Bell or cup shapes not acceptable.

#### **PART 3 EXECUTION**

### 3.1 Surface Conditions

## A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that all rough carpentry may be performed in strict accord with the original design and all pertinent codes and regulations.

#### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 Workmanship

- A. General: All rough carpentry shall produce joints true, tight and well secured with all members assembled in accord with the Drawings and with all pertinent codes and regulations.
- 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 proper connections.
  - 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.

### 3.3 Installation

### A. General Framing

1. General: In addition to all framing operations normal to fabrication and erection indicated on the Drawings, install all backing required for the Work of other trades.

## 3.4 Fastening

### A. Nailing

- 1. Use only common wire nails or spikes, except where otherwise specifically noted in the Drawings.
- 2. 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.
- Do all nailing without splitting wood, preboring as required; replace all split members.

#### B. Boltina

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

#### C. Screws

- 1. For lag-screws and wood screws, prebore holes same diameter as root of thread; enlarge holes to shank diameter for length of shank.
- 2. Screw, do not drive, all lag screws and wood screws.
- 3.5 Nailing Schedule: Unless otherwise indicated on the Drawings or required by pertinent codes and regulations, provide at least the nailing shown in Table 2304.10.1 Fastening Schedule of the International Building Code 2015 Edition.
- **3.6 Protection:** Protect wood decking with protective waterproof covering until roofing has been installed.

## 3.7 Cleaning Up

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

### B. Sweeping

- 1. At the end of each working day, or more often if necessary thoroughly sweep all surfaces where refuse from this portion of the Work has settled.
- 2. Remove the refuse to the area of the job site set aside for its storage.
- 3. Upon completion of this portion of the Work, thoroughly broom clean all surfaces.

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## SECTION 06 17 53 FABRICATED WOOD TRUSSES (Salt Structure Alternate Bid #2)

Applicable provisions of the General and Supplementary Conditions and SCOPE Division 1 govern work under this Section.

INDEX 1.1 Description

1.2 Quality Assurance

1.3 Submittals

1.4 Product Handling

3.1 Erection

## and Handling

#### **PART 1 GENERAL**

# 1.1 Description

#### A. Work Included

- 1. Wood Construction to be prefabricated wood truss construction.
- 2. Provide all connectors, fasteners, gussets, galvanized.

### B. Related Work Specified Elsewhere

1. Decking by rough carpentry

Section 06 10 00

2.1 Acceptable Manufacturers

2.2 Materials

2.3 Fabrication

2. Insulation Section 07 21 00

## 1.2 Quality Assurance

### A. Qualifications of Manufacturers

- 1. Minimum of 3 years experience in successful fabrication of trusses comparable to type indicated for this project.
- 2. All trusses shall be fabricated in a properly equipped and maintained manufacturing facility of a permanent nature.

### B. Design Criteria

- 1. All truss designs shall bear the name and seal and registration number or the State of Ohio of a licensed professional engineer.
- 2. Trusses shall be designed for the loads shown on the Drawings. These shall include live, dead, excess snow drift and mechanical unit loads.

### C. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. A 36, Structural Steel.
  - b. A 90, Weight of Coating on Zinc-Coated (Galvanized Iron or Steel Articles.
  - c. A 446, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-dip Process, Structural (Physical) Quality.
- 2. Product Standards (PS)
  - a. 1, Construction and Industrial Plywood.
  - b. 20, American Softwood Lumber Standard.
- 3. Truss Plate Institute (TPI)
  - a. Design Specification for Metal Plate Connected Wood Trusses.
  - b. Quality Control Manual.

**1.3 Submittals**: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

## A. Shop Drawings

- 1. All Shop Drawings for trusses shall be submitted for examination and review by the Architect prior to truss fabrication.
- 2. Shop Drawings shall be submitted to the Architect.
- 3. The following information shall be contained on the truss design drawings.
  - a. Design loadings and load duration adjustments.
  - b. Pitch, span spacing and configuration.
  - c. Depth of parallel chord trusses.
  - d. Size, gage, location and orientation of connector plates.
  - e. Location of bearing requirements.
  - f. Maximum deflection.
  - g. Forces on all chords and webs.
  - h. Framed openings.
  - i. Lumber specifications, grade, species and size.
  - j. Permanent web bracing or bridging required to prevent compression buckling.
  - k. Anchorage details.
  - I. Number of truss plys required on girder designs.
  - m. Bearing sizes required.
- 4. Shop drawings to bear seal of Professional Engineer, registered in State of Ohio.
- B. Manufacturer's Recommendations: Submit manufacturer's instructions of lateral bracing.

## 1.4 Product Delivery, Storage and Handling

### A. Protection

- 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- 2. The Truss Contractor must provide protection from damage to the trusses that may be caused by on-site construction activities.

#### B. Handling

- 1. Trusses shall be handled in a manner that will not subject trusses to excessive lateral bending. Bundling with metal strapping is recommended.
- 2. Trusses shall be unloaded on relatively smooth terrain. Rough terrain that would cause undue lateral strain and distortion of the truss joints must be avoided.

#### C. Storage

- 1. Trusses shall be stored so as to prevent damage to overhangs.
- 2. Trusses to be stored out of standing water and mud holes.
- 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.

#### **PART 2 PRODUCTS**

**2.1** Acceptable Manufacturers: Fabricator certified to provide fabricated wood products in the jurisdiction of the project.

#### 2.2 Materials

#### A. Lumber

- 1. Species (Commercial Designation)
  - Douglas Fir, Larch Hem-Fir Eastern Hemlock Tamarack, Jack Pine Pacific Coast Yellow Cedar Coast Sitka, Ponderosa Pine, Pacific Spruce-Pine-Fir Eastern White Pine, Red Pine, Western Cedars, Western White Pine
- 2. Design values for lumber shall be in accord with the published values of lumber rules writing agencies approved by the Board of Review of the American Lumber Standards Committee, also published by the National Forest Products Association as a supplement to the NFPA National Design Specification for Wood Construction (NDS), "Design Values for Wood Construction".
- 3. Lumber shall be identified by the grade mark of a lumber inspection bureau or agency approved by the Board of Review of the American Lumber Standards Committee.
- 4. All lumber shall conform to or exceed the grades and sizes as shown on the truss design drawings.
- 5. All fire retardant treated lumber use in trusses shall be redried to 19% moisture content after treatment in accord with American Wood Preservers Association Standard C 20.
- B. Wood Chords and Webs: PS 20, graded to NFPA rules.
- C. Plates: Galvanized sheet steel, ASTM A 446.
- D. Lateral Support: Recommended by truss manufacturer.

### 2.3 Fabrication

### A. General

- 1. Fabricate trusses in jogs with member accurately cut to provide full bearing at joints.
- 2. Maintain configuration of trusses, member sizes, and calculated stresses for each member of a joints as detailed on Drawings unless modified by Architect.
- 3. All trusses shall be clearly identified and warning tags and stickers to be attached as necessary for truss erector to properly identify, orient and position trusses on building.

#### B. Metal Gussets

- 1. Press or nail plates into members to obtain full penetration without crushing outer surface of wood.
- 2. A stress increase for the value of a connector for duration of loading or other factors will not be allowed in any case.
- 3. Increase metal gusset plates (except for scissor trusses) one-third in size over and above that which is required for calculated stresses and balance on joint as stresses require. (Minimum bite of 2-1/2" on tension member).
- 4. Dimension exact location of each connector in joint.
- 5. Minimum size of connectors shall be 10 square inches.
- 6. Splices in bottom or top chords shall occur at a joint or not more than 1/4 of the panel span from a joint.
- 7. If lumber defects such as wane or knots occur in the connector plate area, the connector plate must be up-sized to as not to reduce the effective number of teeth in a truss member by more than ten percent.

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- 8. All connector plates shall be firmly embedded in the wood with a maximum gap of ten percent of the tooth length or a maximum gap of 1/16 inch. Connector plates showing evidence of flattening or dominoing of the teeth shall not be acceptable.
- 9. Excessive splitting of the truss wood members by the connector plate teeth is not acceptable.

#### **PART 3 EXECUTION**

### 3.1 Erection

- A. Trusses shall be erected and installed in accord with approved Shop Drawings or any other installation guide provided by truss fabricator.
- B. During erection, care shall be exercised to keep horizontal bending of the trusses to a minimum.
- C. Set and secure wood trusses level, plumb, and in correct locations.
- D. Proper erection (temporary) bracing shall be installed to hold trusses true and plumb and in safe condition until permanent bracing can be properly installed to form a structurally sound framing system.
- E. All erection (temporary) and permanent bracing shall be installed and securely fastened before the application of any loads to the trusses.
- F. Temporary construction loads which cause member stresses beyond design limits are not permitted. Plywood or drywall must be adequately distributed to spread out the concentrated loads.
- G. Web bracing as specified on truss drawings must be properly installed.
- H. Field erection of the trusses, including items such as proper handling, safety precautions, temporary bracing to prevent toppling or dominoing of the trusses during erection and any other safeguards or procedures consistent with good workmanship and good building erection practices, shall be the responsibility of the truss contractor and/or the framing contractor.
- I. Ensure truss ends have sufficient bearing area and attachment to precast deck weld plates.
- J. Adequate anchors must be installed at all bearing points to secure trusses against wind uplift of roof trusses.
- K. Trusses shall not be altered, cut or modified in any way without the written approval of the truss fabricator and with the accompanying repair drawing by the Fabricator's Structural Engineer.

\* \* \* \* \* \* \* \* \* \* \* \* \*

### **SECTION 06 40 00 ARCHITECTURAL WOODWORK**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 2.1 Materials 1.1 Description 2.2 Fabrication Quality Assurance 1.2

> 1.3 Submittals 3.1 Surface Conditions

Product Delivery, Storage 1.4 3.2 Preparation And Handing 3.3 Installation

3.4 Adjusting and Cleaning

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Furnish all architectural woodwork shown on Drawings and specified herein. Architectural woodwork includes all exterior and interior woodwork exposed to view in finished building except as exempted in paragraph B below; and includes plywood, doors and high-pressure laminates.
  - 1. Standing and running trim
  - 2. Sink Tops
  - 3. Plastic laminate cabinetry, shelves & countertops
- B. Related Work Specified Elsewhere

1. Rough Carpentry Section 06 10 00 2. Solid Polymer Fabrications Section 06 61 00 3. Wood Doors Section 08 14 29 4. Plumbing utilities and Fixtures Division 22

### 1.2 Quality Assurance

A. Qualifications of Fabricators and Installers: Use only personnel who are thoroughly trained and experienced in the fabrication and installation of architectural woodwork. The approved woodwork Manufacturer must have a reputation for doing satisfactory work on time and shall have successfully completed comparable work. The Architect reserves the right to approve and woodwork Manufacturer selected to furnish all of the woodwork. In the acceptance or rejection of architectural woodwork, no allowance will be made for lack of skill on the part of workmen.

## B. Reference Standards

- 1. The "Quality Standards: of the Architectural Woodwork Institute shall apply and by reference are hereby made a part of this Specification. Any reference to Premium, Custom, or Economy in this Specification shall be a defined in the latest edition of the AWI "Quality Standards".
- 2. Any item not given a specific quality grade shall be Custom grade as defined in the latest edition of the AWI "Quality Standards".
- 3. Federal Specifications (FS):
  - a. MM-L-736, Lumber, Hardwood
  - b. MMM-A-130, Adhesive, Contact
- 4. National Electrical Manufacturers Association (NEMA)

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- a. LD3. High Pressure Decorative Laminates
- 5. National Bureau of Standards (PS)
  - a. 1, Construction and Industrial Plywood
  - b. 20, American Softwood Lumber Standard
  - c. 51, Hardwood and Decorative Plywood
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with the provisions of these Specifications; the following:
  - A. Shop Drawings
    - 1. Submit Shop Drawings in accord with Contract Conditions for all cabinets, identified with location, quality grade, type of finish and species of wood. Include component profiles, fastening methods, assembly methods, joint details, accessory listings and schedule of finishes.
    - 2. Show cabinets in related and dimensional position with sections either full-size or 3 inches equal 1 foot scale.
    - 3. The mill shall be responsible for details and dimensions not controlled by job conditions.
    - 4. Show all required field measurements beyond control of the mill.
    - 5. Drawings required for:
      - a. Shelving

- b. Standing/Running Trim
- c. Hardwared. Cabinetwork
- B. Brochures: Submit Manufacturer's descriptive literature of specialty items not manufactured by the architectural woodworker, and laminate color samples, as requested by the Architect.
- 1.4 Product Delivery, Storage and Handling: Deliver, store and handle wood cabinets in manner to prevent damage and deterioration.
  - A. Protection
    - 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
    - 2. Protect all surfaces of cabinets subject to damage while in transit.
  - B. Delivery of Materials: The woodwork Manufacturer and the Contractor shall be jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes is moisture content.
  - 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 2 PRODUCTS**

## 2.1 Materials

A. Quality Grade: Materials and fabrication; custom grade for transparent finish, in accord with "Quality Standards Illustrated" of the Architectural Woodwork Institute, Latest Edition.

#### B. Wood Materials

- 1. Softwood Lumber: PS20; graded in accord with AWI; maximum moisture content of 6 percent.
- 2. Hardwood Lumber: FS MM-L-736; graded in accord with AWI; maximum moisture content of 6 percent.

### C. Sheet Materials

- 1. Softwood Plywood: PS 1; graded in accord with AWI; core material of lumber or particleboard.
- 2. Hardwood Plywood: PS 51; graded in accord with AWI; core material of lumber or particleboard type of glue recommended for application.
- 3. Wood Particleboard: Per AWI standard composed of wood chips, made with high waterproof resin binders.

#### D. Laminate Materials

- Plastic Laminate: NEMA LD3, GP 50 general purpose type; colors as selected.
  - a. Architect to select from full range of colors.
  - b. Manufacturers Formica, Pionite, Wilsonart.
- 2. Laminate Backing Sheet: NEMA LD3: BK20 backing grade, undecorated plastic laminate.
- 3. PL-1: Cabinets. All faces and exposed edging.
- 4. PL-2: Counter Tops. All faces and exposed edging.

### E. Accessories

- 1. Adhesive: Type recommended by laminate manufacturer to suit application.
- 2. Edge Banding:
  - a. Casework and shelf edges 1mm PVC
  - b. Drawers and doors 3mm PVC
- F. Hardware: All hardware shall be furnished and installed by the architectural woodwork Manufacturer.
  - 1. Hardware to be as follows:
    - a. Shelf standards, poles and brackets as shown on drawings
    - b. Pulls and handles Brushed Wire type
    - c. Hinges
    - d. Catches
    - e. Locks
    - f. Support Brackets Factory Finished Steel for support of counters without base cabinets.
- G. Standing and Running Trim (AWI Section 300)
  - 1. Interior for <u>Transparent</u> Finish
    - a. AWI quality grade: Custom
    - b. Solid wood: Red Oak
    - c. Plywood: Red Oak
- H. Casework AWI Section 400)
  - 1. Casework with high pressure laminate finish
    - a. AWI quality grade: Custom
    - b. Construction: Details shall conform to design: Standard overlay.
    - c. Exposed surfaces: Laminate

- d. Semi-exposed surfaces: As governed by selected AWI quality grade; melamine laminated.
- 3. Casework Doors: Doors 3/4" thick shall be laminate. Door edges to match 3mm PVC edging, no tape allowed.
- 4. High pressure laminate counter tops
  - a. AWI quality grade: Custom
  - b. Laminate selection: Color as selected by Architect.
- 5. Fabrication: Comply with Section 400 AWI Quality Standards.
- Closet and Storage Shelving (AWI Section 600) 1. AWI quality grade: Custom
- J. Miscellaneous Ornamental Items (AWI Section 700)
  - 1. AWI quality grade: Custom
  - 2. Solid Wood: Red Oak
  - 3. Plywood: Red Oak
    - a. grommet trim at main counter (4) required verify locations with owner.
- K. Other Materials: All other materials, not specifically described but required for a complete and proper installation of architectural woodwork, shall be as selected by the Contractor subject to the approval of the Architect.

#### 2.2 Fabrication

- A. Fabricate all woodwork in accord with the approved Shop Drawings and referenced standards.
- B. Machine sand at mill, make joints to conceal shrinkage. Set nails for putty stopping. Same mill to fabricate all cabinetwork. All cabinetwork to have one coat of preservative.
- C. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- D. Fit shelves, doors and exposed edges with matching hardwood and matching veneer or plastic edging. Use full length pieces only.
- E. Door and drawer fronts: 3/4 inch thick.
- F. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cuttings.
- G. Apply plastic laminate finish in full uninterrupted sheets consistent with manufacturer sizes. Make corners and joints hairline. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- H. Mechanically fasten splashbacks to countertops with steel brackets at 16 inches on center.
- Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- J. Provide cutouts for plumbing fixture, inserts, appliances, outlet boxes and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

- K. Factory Finishing (AWI Section 1 50 00)
  - 1. Field Touch-up: Field touch-up shall be the responsibility of the installing Contractor and shall include the filling and touch-up of exposed job made nail or screw holes. refinishing of raw surfaces resulting from job fittings, repair of job inflicted scratches and mars, and final cleaning up the finished surfaces.

### **PART 3 EXECUTION**

### 3.1 Surface Conditions

- A. Inspection: Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that the architectural woodwork may be fabricated and installed in accord with the original design, approved Shop Drawings and reference standards. Verify adequacy of backing and support framing.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

- A. Field Dimensions: The woodwork Manufacturer is responsible for details and dimensions not controlled by job conditions and shall show on his Shop Drawings all required field measurements beyond his control. The Project Manager and the woodwork Manufacturer shall cooperate to establish and maintain these field dimensions.
- B. Before installing any materials, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.
- C. Examine pre-fabricated woodwork, before installation, and verify that back priming has been completed and all packing has been removed.

## 3.3 Installation

- A. Install all woodwork true, square, plumb, level, true and straight without distortions, firmly anchored.
- B. Tops and woodwork shall be scribed and trimmed to fit adjoining work.
  - 1. Accurately fit all face plates, filler strips and trim strips to irregularities of adjacent surfaces. Leave gaps of 1/32 inch maximum. Do not use additional overlay trim for
  - 2. Where cuts occur, refinish surfaces and repair damaged finishes.
- C. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.
  - 1. Secure woodwork to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.
  - 2. Use thin gauge finishing nails for exposed nailing, countersunk and filled flush with woodwork finished surface.

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- 3. Use purpose designed fixture attachments at concealed locations for wall mounted components.
- 4. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
- 5. Conceal with solid plugs of species to match surrounding wood. Finish flush with surrounding surfaces.

# D. Standing and Running Trim:

- 1. Install trim with a minimum number of joints using maximum lumber lengths furnished to the jobsite.
- 2. Stagger joints in adjacent and related members.
- 3. Comply with AWI Quality Standards for joinery.
- 4. Cope at returns and miter at corners.

#### E. Casework:

- 1. Install casework with distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
- 2. Adjust casework hardware centering the doors and drawers in the openings, and provide unencumbered operation.
- 3. Complete the installation of hardware and accessory items as indicated.
- 4. Maintain veneer sequence matching of casework with transparent finish, where so manufactured.
- 5. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
- F. Tops: Anchor tops securely to base units and to other support systems as required.
- G. Finishing: Leave all woodwork ready for finishing by painter. Refer to the finishing sections in Division 9 for site finishing of installed woodwork.

# 3.4 Adjustments and Cleaning

- A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- B. Clean exposed and semi-exposed surfaces of casework, counters, shelves, hardware, fittings and fixtures. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.
- C. Repair damaged and defective woodwork where possible eliminating defects and blemishes. Where not possible to repair damaged or defective work, replace with matching new work at direction of the Architect and at no additional cost to the Owner.
- D. Adjust joinery for uniform appearance. Adjust and lubricate hardware.

\* \* \* \* \* \* \* \* \* \* \* \* \*

### **SECTION 06 61 00 - SOLID POLYMER FABRICATIONS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this section.

INDEX 1.1 Description 1.6 Warranty

1.2 References 2.1 Solid Polymer Fabrications

1.3 Submittals 2.2 Fabrication 1.4 Quality Assurance 3.1 Installation

1.5 Delivery, Storage & Handling

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work included in this section:
  - 1. Lavatory tops with cut-outs for bowls provided by others.
  - 2. Miscellaneous Millwork as shown on the drawings.
- B. Related work specified elsewhere:

Architectural woodwork
 Tile work
 Plumbing
 Section 06 40 00
 Section 09 31 00
 Division 22

## 1.2 References

- A. Applicable Standards: Standards of the following, as referenced herein:
  - 1. American National Standards Institute (ANSI)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. National Electrical Manufacturers Association (NEMA)
  - 4. Federal Specifications (FS)

# 1.3 Submittals

- A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 2" x 2" (50 mm x 50 mm) samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.
- C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

## 1.4 Quality Assurance

- A. Allowable tolerances:
  - 1. Variation in component size: ± 1/8" (3 mm).
  - 2. Location of openings: ± 1/8" (3 mm) from indicated location.

# 1.5 Delivery, Storage, and Handling

- A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

# 1.6 Warranty

A. Provide manufacturer's 10-year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

#### **PART 2 - PRODUCTS**

# 2.1 Solid Polymer Fabrications

- A. Acceptable Manufacturers:
  - 1. FORMICA® Solid Surface Products
  - 2. WILSONART® Solid Surface Material
  - 3. Architects Approved Equal.
- B. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.
  - 1. Material shall have minimum physical and performance properties specified in the following Section U.
  - 2. Superficial damage to a depth of 0.010" (,25 mm) shall be repairable by sanding and polishing per the manufacturer recommended methods.
- C. Solid Surface Tops (SS-1):
  - 1. Construction: ½" (13 mm) thick countertop of solid polymer material, having edge details as indicated on the Drawings. Provide cut-outs from template provided by Plumber. Provide countertops complete with backsplashes of size shown on the Drawings.
  - 2. Color: Corian "Artista Canvas" or approved equal.
- D. Wall Protection (SS-2):
  - 1. Construction: Protection Panels (locations per plans) 1/4" thick solid surface, with butt joints. Sealed with silicone sealant per solid surfacing manufacturer's recommendation, adhesively applied to approved substrate.
  - 2. Size: 48" (W) x 60" (H) / Shower Walls 8'-0" Height (See Plans)
  - 3. Color: Corian "Glacier White"

#### E. Performance characteristics:

- 1. Reference Standards:
  - a. ISSFA-2, "Classification and Standards Publications of Solid Surfacing Material".
  - b. Sinks and Vanities: ANSI Z124-3 (vanities) / ANSI Z124-6 (sinks)
  - c. Splash and Food Service Areas: NSF Standard 51.
  - d. Fungal Resistance: ASTM G21 Method [A] [B] no growth.

- e. Bacterial Resistance: ASTM G22 no growth.
- f. Stain Resistance: ANSI Z124-6-5.2 1997.
- 2. Mechanical Properties:
  - a. Tensile Strength: ASTM D 638 (4,000 psi).
  - b. Tensile Modulus: ASTM D 638 (1,100,00 psi).
  - c. Tensile Elongation: ASTM D 638 (2.10%).
  - d. Flexural Strength: ASTM D 790 (8,000 psi).
  - e. Barcol Hardness: ASTM D 2583 (60).
  - f. Rockwell Hardness: ASTM D 785 (86).
  - g. Ball Impact: NEMA LD3-3.8 (>150 degrees).
- 3. Thermal Properties:
  - a. Coefficient of Thermal Expansion: ASTM D 696
  - b. Boiling Water Resistance: ISSFA SST 9.1-100 (No Effect)
  - c. High Temperature Resistance: ISSFA SST 9.1-100 (No Effect).
  - d. Flame Spread Index: ASTM E 84 (<25)
  - e. Smoke Development: ASTM E 84 (<25)

# G. Accessory Products:

- a. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
- Powder Coated concealed metal "L" brackets for support in areas b. without base cabinets, spaced per manufacturer's recommendations.

#### 2.2 **Fabrication**

- Α. For warranty coverage, solid polymer manufacturer shall approve fabricator/installer.
- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.
- C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2" (50 mm) wide reinforcing strip of solid polymer material under each joint
- D. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.
- E. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- F. Finish: All surfaces shall have uniform finish.
  - 1. Matte, with a gloss rating of 5 20.

#### PART 3 – EXECUTION

#### 3.1 Installation

- Α. Install components plumb and level, in accordance with approved shop drawings and product installation details.
- В. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Provide backsplashes and end splashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.

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- D. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.
- E. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to architect's satisfaction and invoice for the cost of repairs. Architect to pre-approve cost estimate before repairs are made.
- F. Fabricator/Installer is to provide a commercial care and maintenance video, review maintenance procedures and warranty details with the director of maintenance upon completion of project.

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### **SECTION 07 11 00 DAMPPROOFING & VAPOR RETARDERS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

1.2 Quality Assurance 3.1 Surface Conditions

1.3 Submittals1.4 Product Handling3.2 Preparation3.3 Application

1.5 Warranty

### **PART 1 GENERAL**

# 1.1 Description

#### A. Work Included

- 1. Prepare and prime surfaces to receive dampproofing.
- 2. Apply bituminous dampproofing on perimeter foundation walls at elevator shaft.
- 3. Seal/caulk joints and protrusions through dampproofing.
- 4. Waterstops
- 5. Under Slab Vapor Retarders

# B. Related Work Specified Elsewhere

1. Concrete Section 03 30 00

2. Rigid perimeter insulation Section 07 21 00

# 1.2 Quality Assurance

- A. Qualifications of Applicators: for actual application of dampproofing, use only workers who are thoroughly trained and experienced in the skills required, who are completely familiar with the Manufacturer's recommended methods of application, and who are completely familiar with the requirements of this Section of these Specifications.
- B. Contractor Certification: Prior to start of installation of the Work of this Section the Contractor shall inspect and shall certify:
  - 1. That the surfaces to which dampproofing was applied were in condition suitable for that application.
  - 2. That the materials applied conform in all respects with the requirements of this Section of these Specifications.
  - 3. That the materials were applied in complete accord with the Manufacturer's current recommendations.

#### C. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. D 41, Primer for Use with Asphalt in Dampproofing and Waterproofing.
  - b. D 449, Asphalt for Dampproofing and Waterproofing.
  - c. D 491, Asphalt Mastic for Use in Waterproofing.
  - d. E 1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

- Submittals: Within 35 days after award of Contract, and before any materials of this Section are delivered to the job site, submit to the Architect in accordance with the provisions of these Specifications; the following:
  - A. Manufacturer's Recommendations: Submit Manufacturer's instructions for application recommendations.
  - B. Material List: Complete list of all materials proposed to be furnished and installed.

# 1.4 Product Handling

- A. Protection: Use all means necessary to protect materials before, during and after installation and to protect the 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.
- **1.5 Warranty:** Warranty that the dampproofing will remain intact and resist water for a period of five years following date of application.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Bituminous Dampproofing
  - Dampproofing: ASTM D 449; liquid asphalt; free of toxic solvents; once applied and cured, capable of retaining adhesion and will not re-emulsify when in contact with moisture; will not settle or slide detrimentally once applied; resistant to calcium chloride salt and alkali; fibre reinforced; suitable for spray, trowel, brush, application. Similar to Hydrocide Spray Mastic as manufactured by Sonneborn.
  - 2. Primer: ASTM D 41; asphalt type; free of toxic solvents; compatible with dampproofing; type recommended by dampproofing Manufacturer.
  - 3. Sealing Mastic: ASTM D 491; asphalt type; compatible with dampproofing; free of toxic solvents; thick mastic consistency, smooth and uniform in composition; type recommended by dampproofing manufacturer.
  - 4. Protective Cover: As detailed.
- B. Acceptable Manufacturers
  - 2. Karnak
  - 3. W. R. Meadows
  - 4. Sonneborn
  - 5. Substitutions: Items of same function and performance are acceptable in conformance with Section 01 60 00.
- C. Waterstops: Neoprene rubber, ASTM D 412, 6 inches by 1/4 inch with 1 inch center bulb.

# D. Under Slab Vapor Barriers:

- 1. Thickness, Nominal: 10 mil
- 2. Weight: 49 lbs / MSF
- 3. Tensile Strength, New Material: 52 lbs/in
- 4. Puncture Resistance (ASTM D1709, Method B): >2600 g
- 5. Permeance, New Material: 0.0146 perms
- E. Flashing Tape and Accessories: Air-Shield 25mil Flashing Tape: Self-adhering, flexible membrane flashing. Minimum roll size 3" x 75'. Prime surfaces as required by manufacture. By W.R. Meadows or equal. Installed at concrete slab by 03 30 00, at windows by 08 41 13 and at roof to wall line by 07 53 00.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

# A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that dampproofing may be installed in accord with the original design and the Manufacturer's current recommendations.

# B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 Preparation

### A. Bituminous Dampproofing

- Ensure surfaces are firm, dry, and free from frost, loose particles, cracks, pits, rough projections, grease, oil and other foreign matter detrimental to adhesion and monolithic application of dampproofing.
- Remove loose particles and foreign matter with scraper, wire brush or other effective means. Remove grease or oil with safety solvent, effective alkaline cleaner or detergent. If safety solvents are use, follow with an application of alkaline cleaner or detergent, scrub surfaces clean with water.
- 3. Comply strictly with Manufacturer's recommendations.

### 3.3 Application

#### A. Bituminous Dampproofing

- 1. Prime surfaces prior to applying dampproofing, at rate of one gallon per 100 sq. ft.
- Apply dampproofing in accord with Manufacturer's recommendations. Apply in two
  continuous and uniform coats, from 2 inches below finished grade elevation down to
  bottom of footings. Obtain inspection by Architect of first coat before applying
  second coat.

- 3. Do not apply dampproofing during temperatures below 40 degrees F.
- 4. Seal around items and services projecting through dampproofing surfaces. Apply in accord with Manufacturer's recommendations. Ensure sealed areas are moisture tight.
- 5. Protect dampproofing from damage during backfill operations.
- B. Waterstops: Supply material to concrete subcontractor for installation in forms.
- C. Vapor Barriers and Flashing Tape: Install where shown on the Drawings in accordance with manufacturer's recommendations.

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# SECTION 07 13 00 SELF-ADHERING SHEET WATERPROOFING, LOW TEMPERATURE

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX	1.1	Description	1.7	Warranty
	1.2	Quality Assurance	2.1	Materials
	1.3	Reference Standards	2.2	Acceptable Manufacturers
	1.4	Submittals	3.1	Examination
	1.5	Product Delivery, Storage & Handling	3.2	Preparation of Substrates
	1.6	Job Conditions	3.3	Installation
			3.4	Cleaning and Protection

# **PART 1 — GENERAL**

# 1.1 Description

- A. The work of this section includes, but is not limited to, the following:
  - 1. Rubberized asphalt sheet membrane waterproofing horizontal application.
  - 2. Prefabricated drainage composite
  - 3. Protection board
- B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1.	Cast-In-Place Concrete	Section 03 30 00
2.	Precast Concrete	Section 03 41 00
3.	Dampproofing & Vapor Retarders	Section 07 11 00
4.	Insulation	Section 07 21 00
5.	Fluid-Applied Membrane Air Barriers	Section 07 27 26
6.	Flashing and Sheet Metal	Section 07 60 00
7.	Joint Sealants	Section 07 92 13

#### 1.2 Quality Assurance

- A. Manufacturer: Sheet membrane waterproofing shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
- B. Installer: A firm which has at least 3 years experience in work of the type required by this section.
- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

#### 1.3 Reference Standards

- A. The following standards and publications are applicable to the extent referenced in the text.
- B. American Society for Testing and Materials (ASTM)
  - C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
  - D 412 Standard Test Methods for Rubber Properties in Tension
  - D 570 Standard Test Method for Water Absorption of Plastics
  - D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
  - D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
  - D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)
  - D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous
  - Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
  - D 3767Standard Practice for Rubber Measurements of Dimensions
  - D 5385Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
  - E 96 Standard Test Methods for Water Vapor Transmission of Materials
  - E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with
  - Earth Under Concrete Slabs, on Walls, or as Ground Cover

# 1.4 Submittals

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.
- B. Samples: Submit representative samples of the following for approval:
  - 1. Sheet membrane
  - 2. Protection board
  - 3. Prefabricated drainage composite

#### 1.5 Product Delivery, Storage, and Handling

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
  - 1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
  - 2. Protect mastic and adhesive from moisture and potential sources of ignition.
  - 3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.

07 13 00-2 SELF-ADHERING SHEET WATERPROOFING, LOW TEMPERATURE B. Sequence deliveries to avoid delays, but minimize on-site storage.

### 1.6 Job Conditions

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

# 1.7 Warranty

A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

### **PART 2 — PRODUCTS**

#### 2.1 Materials

- A. Sheet Membrane Waterproofing: A self-adhesive, cold-applied composite sheet consisting of a thickness of 1.4 mm (0.056 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film. Provide rubberized asphalt membrane covered with a release sheet, which is removed during installation. No special adhesive or heat shall be required to form laps.
- B. Properties: Membrane shall conform to the following:

Property	Test Method	Typical Value
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	1.5 mm (0.060 in.) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -43°C (-45°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412 Modified <sup>1</sup>	2240 kPa (325 lbs/in.²) minimum
Tensile Strength, Film	ASTM D 882 Modified <sup>1</sup>	34.5 MPa (5,000 lbs/in.2) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 Modified <sup>1</sup>	300% minimum
Crack Cycling at -32°C (- 25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Adhesion at Minimum Application Temperature	ASTM D 1876 Modified <sup>2</sup>	700 N/m (4 lbs/in.) – Bituthene 3000 880 N/m (5 lbs/in.) – Low Temp
Peel Strength	ASTM D 903 Modified <sup>3</sup>	1576 N/m (9 lbs/in.)

Puncture Resistance,	ASTM E 154	222 N (50 lbs) minimum
Membrane		
Resistance to Hydrostatic	ASTM D 5385	60 m (200 ft) of water
Head		, ,
Permeance	ASTM E 96,	2.9 ng/m <sup>2</sup> sPa
	Section 12 – Water	(0.05 perms) maximum
	Method	
Water Absorption	ASTM D 570	0.1% maximum

#### Footnotes:

- 1. The test is run at a rate of 50 mm (2 in.) per minute.
- 2. The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.)per minute at -4°C (25°F).
- 3. The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.
  - C. Prefabricated Drainage Composite: Drainage Composite shall be designed to promote positive drainage while serving as a protection course.
    - 1. Vertical Applications: Hydroduct® 220 by Grace Construction Products or equivalent compatible with manufacturer's system.

#### D. Protection Board:

- 1. Expanded Polystyrene Protection Board: 25 mm (1 in.) thick for vertical applications with the following characteristics. Adhere to waterproofing membrane with Bituthene Protection Board Adhesive.
  - a. Normal Density: 16 kg/m³ (1.0 lb/ft³)
  - b. Thermal Conductivity, K factor: 0.24 at 5°C (40°F), 0.26 at 24°C (75°F)
  - c. Thermal Resistance, R-Value: 4 per 25 mm (1 in.) of thickness.
- 2. Asphalt Hardboard: A pre-molded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 3 mm (0.125 in.) thick hardboard on horizontal surfaces receiving concrete topping.
- E. Waterstop: Adcor<sup>™</sup> ES hydrophilic non-bentonite waterstop by Grace Construction Products for non-moving concrete construction joints.
- F. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

## 2.2 Acceptable Manufacturers

- A. Bituthene® 3000/Low Temperature Membrane by Grace Construction Products
- B. System meeting or exceeding these specifications by WR Meadows, Inc.
- C. Other manufacturers as approved by Architect.

#### **PART 3 EXECUTION**

#### 3.1 Examination

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

# 3.2 Preparation of Substrates

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.
- B. Cast-In-Place Concrete Substrates:
  - Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).
  - 2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
  - 3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
  - 4. Remove scaling to sound, unaffected concrete and repair exposed area.
  - 5. Grind irregular construction joints to suitable flush surface.
- C. Precast Concrete Panel Substrates:
  - 1. Precast concrete panel contractor will install panels and caulk vertical joints.
  - 2. Install additional strip of membrane over all joints, minimum 2'-0" wide or greater as recommended by membrane system.
- D. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

#### 3.3 Installation

- A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:
  - Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer.
  - 2. Delay application of membrane until primer is completely dry. Dry time will vary with weather conditions.
  - 3. Seal daily terminations with troweled bead of mastic.
  - 4. Apply protection board and related materials in accordance with manufacturer's recommendations.

#### 3.4 Cleaning and Protection

- A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
- B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

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### **SECTION 07 21 00 INSULATION**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 1.8 Sequencing

1.2 Quality Assurance 1.9 Project Materials

1.3 Submittals 2.1 Materials

1.4 Product Delivery, Storage & Handling 3.1 Surface Conditions

1.5 Job Conditions
1.6 Quality Assurance
1.7 Pre-Application Meeting
3.2 Preparation
3.3 Installation
3.4 Cleaning

### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Building insulation required for this Work includes, but is not limited to:
  - 1. Roof Insulation
  - 2. Rigid wall panel insulation
  - 3. Batt Insulation
  - 4. Below Grade Insulation
  - 5. Sound Insulation

# B. Related Work Specified Elsewhere

1.	Concrete	Section 03 30 00
2.	Precast Concrete	Section 03 41 00
3.	Masonry	Section 04 20 00
4.	Carpentry	Section 06 10 00
5.	Shingles	Section 07 31 00
6.	Single Ply Elastomeric Sheet Roofing	Section 07 53 00
7.	Gypsum Wallboard	Section 09 29 00
8.	Mechanical System Insulation	Division 23

- C. Work Furnished by Installer
  - 1. Below grade perimeter rigid insulation by Concrete Contractor.
  - 2. Roof insulation by Roofing Contractor.
  - 3. Sound insulation at interior metal stud walls and rigid wall insulation at exterior furred walls by Gypsum Wallboard Contractor.
  - 4. Wall panel insulation by Precast Contractor.

### **1.2** Quality Assurance

A. Design Criteria: The Heating and Air Conditioning system for the Project was designed for the insulation values listed for each type of insulation in Part 2 of this Section. The Contractor will insure that all insulation used meets or exceeds those values. The Architect will order the removal of all material not meeting this Specification. All insulation will meet State Fire Code.

Thickness of roof insulation supplied shall not exceed the space available that would require additional blocking, or raising of parapet, door sills, flashing or curbs.

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- B. Testing: Flame spread: ASTM E 84, 25 or less.
- C. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. E 84, Standard Method of Test for Surface Burning
    - b. C 1289, closed cell polyisocyanurate foam core board.
    - c. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
    - d. ASTM C 177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
    - e. ASTM C 1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
    - f. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.
    - g. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
    - h. ASTM D 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
    - i. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
    - j. ASTM D 1623 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
    - k. ASTM D 2126 Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
    - ASTM D 2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics.
  - 2. Federal Specifications (FS):
    - a. HH-I-521, Insulation Blankets, Thermal (Mineral Fiber for Ambient Temperatures)
    - b. HH-I-524, Insulation Board, Thermal (Polystyrene)
    - c. HH-I-1972, Insulation Board, Thermal (Urethane)
    - d. L-P-375, Plastic Film, Flexible, Vinyl Chloride
- **1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accord with the provisions of these Specifications; the following:
  - A. Manufacturer's Literature: Manufacturer's recommended installation instructions.
  - B. Material List: Submit to the Architect for review a complete list of all insulation material proposed to be furnished. Any material which differs from that specified, shall have engineering data submitted to show that its performance is equal to insulation specified. See Section 01 33 00.
  - C. Technical Data: Submit technical data indicating thermal conductance factors of furnished insulation.
  - D. Certificates: Manufacturer's certification that materials meet Specification requirements.
- 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver materials to Project site in Manufacturer's original unopened packaging.
- C. Identify contents, Manufacturer, brand name, thermal values and applicable standards.
- D. Store materials in area protected from weather, moisture, and open flame or sparks.
- E. Replacements: In the event of damage, immediately replace materials at no additional cost to the Owner. Tears in foil face insulation will not be acceptable.

# 1.5 Job Conditions

- A. Environmental Requirements: Do not install insulation when temperature is 40 degrees F. or below, during rain or wet weather, or when surfaces are wet.
- B. Scheduling: Coordinate installation with other trades whose work may be affected or have effect.

# 1.6 Quality Assurance

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years' experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.
- C. 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 is approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

# 1.7 PRE-APPLICATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

# 1.8 **SEQUENCING**

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

# 1.9 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. Do not apply insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.

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- C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.
- D. To avoid overspray, product should not be applied when conditions are windy.

#### **PART 2 PRODUCTS**

# **2.1** Materials (See Drawing Details for applicable products)

#### A. Roof Insulation

- 1. Expanded Polystryene (E.P.S.) Board
  - a. E.P.S. roof insulation FS-HH-I-524, one pound density, R = 4.17 per inch. All roof cant insulation should be E.P.S.
  - b. Size 4 feet by 8 feet
  - c. Two layers with staggered joints, total thickness per Drawings.
  - d. Install over 3/4" perlite board or other approved thermal barrier at metal deck. Use of EPS insulation approved for use without thermal barrier is also acceptable.
  - e. .006" polyethylene vapor barrier on metal deck.
- 2. Polyisocyanurate (ISO) Board
  - a. Size 4 feet by 8 feet.
  - b. Type II -25 psi density minimum, R = -7.4/inch at 40 degrees F.
  - c. Two layers (3 inches each) staggered joints, total thickness per drawings.
  - d. Vapor Barrier 0.006mil, polyethylene loose laid.
- 3. Tapered Insulation Provided Tapered pieces to obtain profiles shown on Roof Plan.
- 4. Loose Insulation
  - a. Fiberglass Batt or Blown-In
  - b. Thickness (R-Value) and location per drawings
  - c. 0.006 mil Vapor Barrier with GWB (by others)
  - d. Heavy Duty Reinforced Vapor Barrier without GWB as detailed.

### B. Building Insulation

- 1. Precast Concrete Installation: Install expanded polystyrene or polyisocyanurate precast concrete wall panels, thickness to achieve an R-value of 22.
- 2. Rigid Below Grade Insulation
  - a. Adhesive: As recommended by insulation Manufacturer.
  - b. Extruded polystyrene board, ASTM C578 Type IV 1.80 density minimum, 40 psi compressive strength, R 5.00 per inch at 75 degrees F.
  - c. Total thickness per drawings 2 layers with staggered joints.
- Stud sound insulation shall be 3½" unfaced fiberglass sound attenuation batts. Sound batts shall comply with the property requirements of ASTM C665, Type I and ASTM E136 as well as all applicable codes for interior wall use.
- 4. Wall Insulation at metal or wood stud walls.
  - a. Cavity insulation fiberglass batt R = 19 for installation in a wall cavity.
  - b. Vapor Barrier 0.006 mil, at all exterior walls.
  - c. Exterior wall insulation extruded polystyrene insulation thickness per drawing.
  - d. Building wrap.

### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

- A. Inspection: Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may be installed in accord with original design and the Manufacturer's recommendation.
  - 1. Examine space allocated for insulation for proper depth to receive material.
  - 2. Check surfaces to receive rigid insulation to assure they are in uniform plane; and free of mortar chips, debris, grease, oil or other items detrimental to installation.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- 3.2 Preparation: Remove or protect against projections in construction framing that may damage or prevent proper installation.

#### 3.3 Installation

- A. Below grade perimeter insulation: mechanically bond to concrete.
- B. Gypsum Wallboard: per manufacturer's recommendations.
- C. CMU Foam in place insulation installation guidelines:
  - 1. Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface. Insulation is not to be injected into wet walls.

#### 3.4 Cleaning

A. Any installer using mastic will clean all excess material from all surfaces to be exposed or to receive the work of other trades. Follow criticisms of Architect completely.

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# SECTION 07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR PERMEABLE

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Primers

> 1.2 Definitions 2.3 Penetrations & Termination Sealant

1.3 Performance Requirements 2.4 Acceptable Manufacturers

1.4 References 3.1 Examination

1.5 Submittals 3.2 Surface Preparation

1.6 Quality Assurance 3.3 Joint treatment

1.7 Delivery, Storage, & Handling 3.4 Air barrier membrane installation

1.8 Project Conditions 3.5 transition membrane installation

1.9 Warranty 3.6 Field Quality Control

2.1 Fluid-Applied, Vapor Permeable 3.7 Cleaning And Protection Membrane Air Barrier

#### <u>1.1</u> **Description**

Α. This Section includes the following:

- Materials and installation methods for fluid-applied, vapor permeable air barrier membrane system located in the non-accessible part of the wall.
- Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.
- B. Related Sections include the following:

1.	Cast-In-Place Concrete	Section 03 30 00
2.	Unit Masonry	Section 04 20 00
3.	Rough Carpentry	Section 06 10 00
4.	Dampproofing	Section 07 11 00
5.	Self-Adhering Sheet Waterproofing	Section 07 13 00
6.	Elastomeric Membrane Roofing	Section 07 53 00
7.	Flashing Sheet Metal	Section 07 60 00
8.	Sealants and caulking	Section 07 92 13

#### <u>1.2</u> **DEFINITIONS**

Air Barrier Assembly: The collection of air barrier materials and auxiliary materials Α. applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

# 1.3 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The air barrier shall have the following characteristics:
  - 1. It must be continuous, with all joints made airtight.
  - It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2178.
  - It shall have an air permeability not to exceed 0.04 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2357.
  - 4. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
  - 5. It shall be durable or maintainable.
  - 6. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
    - a. Foundation and walls
    - b. Walls and windows or doors
    - c. Different wall systems
    - d. Wall and roof
    - e. Wall and roof over unconditioned space
    - f. Walls, floor and roof across construction, control and expansion joints
    - g. Walls, floors and roof to utility, pipe and duct penetrations
  - All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

## 1.4 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.

B. American Society for Testing and Materials (ASTM	B.	American	Society	for Testing	and Materials	(ASTM
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1.	ASTM C1193	Guide for Use of Joint Sealants
2.	ASTM D412	Standard Test Methods for Rubber Properties in Tension
3.	ASTM D570	Test Method for Water Absorption of Plastics
4.	<b>ASTM D1004</b>	Test Method for Initial Tear Resistance of Plastic Film and
		Sheeting
5.	<b>ASTM D1876</b>	Test Method for Peel Resistance of Adhesives
6.	ASTM D1938	Test Method for Tear Propagation Resistance of Plastic Film and Sheeting
<b>7</b> .	<b>ASTM D1970</b>	Standard Specification for Self-Adhering Polymer Modified
		Bitumi-nous Sheet Materials Used as Steep Roofing
		Underlayment for Ice Dam Protection
8.	ASTM D4258	Practice for Surface Cleaning Concrete for Coating
9.	<b>ASTM D4263</b>	Test Method for Indicating Moisture in Concrete by the Plastic
		Sheet Method
10.	ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using
		Portable Adhesion Testers
11.	ASTM E96	Test Methods for Water Vapor Transmission of Materials
12.	ASTM E154	Test Methods for Water Vapor Retarders Used in Contact with
		Earth Under Concrete Slabs, on Walls, or as Ground Cover
13.	<b>ASTM E1186</b>	Practice for Air Leakage Site Detection in Building Envelopes
		and Air Retarder Systems
14.	<b>ASTM E2178</b>	Standard Test Method for Air Permeance of Building Materials
15.	<b>ASTM E2357</b>	Standard Test Method for Determining Air Leakage of Air
		Barrier Assemblies
16.	NPFA 285	Standard Fire Test Method for Evaluation of Fire
		Propagation Characteristics of Exterior Non-Load-Bearing
		Wall Assemblies Containing Combustible Components

# 1.5 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 1. Include details of interfaces with other materials that form part of air barrier
  - 2. Include details of mockups
- C. Samples: Submit representative samples of the following for approval:
  - 1. Fluid-Applied membrane
  - 2. Self-Adhered Transition Membrane
  - 3. Self-Adhered Through Wall Flashing
- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

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- E. Qualification Data: For Applicator.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.
- G. Warranty: Submit a sample warranty identifying the terms and conditions stated in Article 1.10.

# 1.6 QUALITY ASSURANCE

- A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. Source Limitations: Obtain primary air-barrier material and through wall flashing through one source from a single manufacturer. Should project require a vapor permeable and a vapor impermeable air barrier on same project, obtain vapor-permeable and vapor impermeable air barrier and through wall flashing from one source from a single manufacturer. See specification Section 07 60 00 for fully-adhered vapor impermeable air barrier.
- C. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- D. Mockups: Before beginning installation of air barrier, provide air barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
  - Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed
  - 2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved
- E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
  - 1. Review of submittals
  - 2. Review of surface preparation, minimum curing period and installation procedures
  - 3. Review of special details and flashings

- 4. Sequence of construction, responsibilities and schedule for subsequent operations
- 5. Review of mock-up requirements
- 6. Review of inspection, testing, protection and repair procedures

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect fluid-applied membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

### 1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a wet substrate or during snow, rain, fog, or mist.

# 1.9 WARRANTY

- A. Submit manufacturer's warranty that air barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical proper ties and material specifications.
- B. Warranty Period: Five years from date of completion of the air barrier membrane installation.

#### **PART 2 PRODUCTS**

# 2.1 FLUID-APPLIED, VAPOR PERMEABLE MEMBRANE AIR BARRIER

- A. BASIS OF DESIGN: Perm-A-Barrier® VPL, as manufactured by Grace Construction Products, 62 Whittemore Avenue, Cambridge, MA has been used as a basis for design. Products meeting or exceeding these specifications from other manufacturers will be acceptable. System must contain products of a single manufacturer's system.
- B. FLUID-APPLIED AIR BARRIER MEMBRANE: Basis of Design: Perm-A-Barrier® VPL, as manufactured by Grace Construction Products, 62 Whittemore Avenue, Cambridge, MA; a fluid-applied, vapor permeable, acrylic membrane that cures to form a resilient, monolithic, fully bonded elastomeric membrane when applied to construction surfaces.

The membrane provides superior protection against the damaging effects of air and liquid water ingress on the building structures. Product shall meet the following requirements:

- 1. Membrane Air Permeance: ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa)
- 2. Assembly Air Permeance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.04 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 L/s. x sq. m. of surface area at 75 Pa) when tested in accordance with ASTM E2357.
- 3. Water Vapor Permeance: ASTM E96, Method B: Greater then 10 perms
- 4. Pull Adhesion: ASTM D4541: minimum 20 psi or substrate failure to glass faced wall board, minimum 100 psi to concrete/CMU
- 5. Low temperature flexibility: ASTM D1970: Pass at minus 20 degrees Fahrenheit (at minus 29 degrees Celsius).
- 6. Water resistance of in-place membrane: ASTM E331: Pass. No water penetration after 90 minutes @ 299 Pa (6.24 psf) tested over OSB and gypsum sheathing.
- 7. Nail seal ability: ASTM D1970: Pass UV Exposure Limit: Equal to or greater than 180 calendar days
- 8. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly
- C. TRANSITION MEMBRANE: Basis of Design: Perm-A-Barrier Detail Membrane manufactured by Grace Construction Product; a 0.9 mm (36 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (4 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
  - 1. Water Vapor Transmission: ASTM E96, Method B: 0.05 perms (2.9 ng/Pa s. sq. m.) maximum
  - 2. Air Permeance at 75 Pa (0.3 in. water) pressure difference: 0.0006 L/s. sq. m (0.00012 cfm/ sq. ft.) maximum
  - 3. Puncture Resistance: ASTM E154: 178 N (40 lbs.) minimum
  - 4. Lap Adhesion at minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
  - 5. Low Temperature Flexibility: ASTM D1970: Unaffected to minus 43 degrees Celsius (minus 45 degrees Fahrenheit)
  - 6. Tensile Strength: ASTM D412, Die C Modified: minimum 2.7 MPa (400 psi)
  - 7. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: minimum 200%
- D. TRANSITION ALUMINUM MEMBRANE: Basis of Design: Perm-A-Barrier Aluminum flashing manufactured by Grace Construction Products; a 0.9 mm (35 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (5 mil) of aluminum film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

- 1. Water Absorption: ASTM D570: max 0.1% by weight
- 2. Puncture Resistance: ASTM E154: 355N (80 lbs) min.
- 3. Lap Adhesion at minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876 Modified: 880 N/m (5.0 lbs./in.) of width
- 4. Low Temperature Flexibility: ASTM D1970 Modified: Unaffected to minus 26 degrees Celsius (minus15 degrees Fahrenheit)
- 5. Tensile Strength: ASTM D412, Die C Modified: minimum 4.1 MPa (600 Psi)
- Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C Modified: minimum 200%
- E. FLEXIBLE MEMBRANE WALL FLASHING: Basis of Design: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products; a 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
  - 1. Water Vapor Transmission: ASTM E96, Method B: 0.05 perms (2.9 ng/ Pa s. sq. m.) maximum
  - 2. Water Absorption: ASTM D570: max. 0.1% by weight
  - 3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) minimum
  - 4. Tear Resistance
    - a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
    - b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
  - 5. Lap Adhesion at minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
  - 6. Low Temperature Flexibility: ASTM D1970: Unaffected to minus 43 degrees Celsius (minus 45 degrees Fahrenheit)
  - 7. Tensile Strength: ASTM D412, Die C Modified: minimum 5.5 MPa (800 psi)
  - 8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: minimum 200%

### 2.2 PRIMERS

- A. Primer for Self-Adhered Transition Membrane and Flexible Membrane Wall Flashing: Basis of Design: Perm-A- Barrier WB Primer manufactured by Grace Construction Products; a water-based primer which imparts an aggressive, high tack finish on the treated substrate.
  - 1. Flash Point: No flash to boiling point
  - 2. VOC Content: Not to exceed 10 g/L
  - 3. Application Temperature: minus 4 degrees Celsius (25 degrees Fahrenheit) and above
  - 4. Freezing point (as packaged): minus 7 degrees Celsius (21 degrees Fahrenheit)

- B. Primer for Self-Adhered Transition Membrane and Flexible Membrane Wall Flashing: Bias of Design: Perm-A-Barrier Primer Plus manufactured by Grace Construction Products; a water-based primer which imparts an aggressive, high tack finish on the treated substrate. Product shall have the following minimum physical properties:
  - 1. Color: Milky White (wet), Clear (dry)
  - 2. Weight: 8.25 lbs./gal.
  - 3. Solids Content (by weight): 53-57%
  - 4. Solvent Type: Water
  - 5. VOC Content: Not to excess 1 g/L
  - 6. Application Temperature: 4 degrees Celsius (40 degrees Fahrenheit) and above

### 2.3 PENETRATIONS & TERMINATION SEALANT

- A. Liquid Membrane for Details and Terminations and Substrate Patching: Bituthene Liquid Membrane manufactured by Grace Construction Products; a two-part, elastomeric, trowel grade material designed for use with fluid-applied membranes, self-adhered membranes and tapes. 10 g/L maximum VOC content.
- B. Sealant for Details, Final Terminations and Sheathing Joint Treatment: Grace S100 Sealant manufactured by Grace Construction Products: a one-part, neutral curing, and ultra-low modulus material designed for use with fluid-applied membranes, self-adhered membrane and tapes. 98 g/L maximum VOC content.

# 2.4 ACCEPTABLE MANUFACTURERS

- A. The following systems, meeting or exceeding the Basis of Design, shall be acceptable:
  - 1. Grace Construction Products Perm-A-Barrier® VPL
  - 2. Polyquard Products Polyquard Airlox Flex VP
  - 3. TK Products TK-AirMax 2104
  - 4. WR Meadows Air-Shield LMP

#### PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that substrates and conditions are ready to accept the Work of this section. Notify Architect in writing of any discrepancies. Commencement of the Work or any parts there of shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps and spalled areas in substrate to provide an even plane. Strike masonry joints full-flush. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.

# 3.2 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, and loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier assembly.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 50 75 mm (2-3 in.) wide, manufacturer's recommended mesh-style wallboard tape. Gaps greater than 6 mm (1/4 in.) should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the mesh-style wallboard tape and fluid applied air barrier system.
- C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.
- D. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- E. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- F. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- G. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- H. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
- I. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- J. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.
- K. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

### 3.3 **JOINT TREATMENT**

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.

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- 1. Prime substrate as required.
- B. Gypsum Sheathing: Fill joints with Grace S100 Sealant per manufacturer's written instructions.

# 3.4 AIR BARRIER MEMBRANE INSTALLATION

- A. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
  - 1. Vapor-Permeable Membrane Air Barrier: 70-mil (1.8-mm) wet film thickness, 40-mil (1.0-mm) dry film thickness.
- Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

# 3.5 TRANSITION MEMBRANE INSTALLATION

- A. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
- B. Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.
  - Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition membrane to substrate with termination sealant.

- E. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition membrane so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
  - 1. Transition Membrane: Roll firmly to enhance adhesion.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Repair punctures, voids, and deficient lapped seams in strips and transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches (150 mm) beyond repaired areas in strip direction.

# 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  - 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes
  - 2. Continuous structural support of air barrier system has been provided
  - 3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings
  - 4. Site conditions for application temperature and dryness of substrates have been maintained
  - Maximum exposure time of materials to UV deterioration has not been exceeded
  - 6. Surfaces have been primed, if applicable
  - 7. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths
  - 8. Termination sealant has been applied on cut edges
  - 9. Strips and transition membrane have been firmly adhered to substrate
  - 10. Compatible materials have been used
  - 11. Transitions at changes in direction and structural support at gaps have been provided.
  - 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal
  - 13. All penetrations have been sealed

- C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
  - 1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.
- D. Remove and replace deficient air barrier components and retest as specified above.

# 3.7 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace main air barrier material exposed for more than 180 days.
- C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Remove masking materials after installation.

# SECTION 07 31 00 SHINGLES (Salt Structure Alternate Bid #2)

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

**INDEX** 1.1 Description 1.6 Warranty 1.2 Quality Assurance 2.1 Materials

> 1.3 Submittals 2.2 Acceptable Manufacturers

1.4 Product Delivery, Storage & Handing 3.1 Surface Conditions

1.5 Job Conditions 3.2 Application

3.3 Adjust and Clean

# **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Shingle roofing required for this Work is indicated on the Drawings and includes, but is not necessarily limited to asphalt shingle roofing, underlayment, eaves, valley, and ridge protection.

B. Related Work Specified Elsewhere

1. Rough Carpentry Section 06 10 00 2. Wood Trusses Section 06 17 53 3. Roof and Deck Insulation Section 07 21 00 4. Flashing and Sheet Metal Section 07 60 00

# 1.2 Quality Assurance

- A. Requirements of Regulatory Agencies
  - 1. Underwriters' Laboratories, Inc.: Class A label.
  - 2. International Code Council
- B. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. D 225, Asphalt Shingles Surfaced with Mineral Granules.
  - 2. Underwriters' Laboratories, Inc. (UL)
    - a. 790, Test Methods for Fire Resistance of Roof Covering Materials.
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accord with the provisions of these Specifications; the following:
  - A. Samples: Shingles: Two of each style selected indicating full range of color.
  - B. Manufacturer's Literature: Material description and recommended installation procedures.
  - C. Extra Stock: One percent of total shingles laid.

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# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials
  - 1. Deliver materials with Manufacturer's labels intact and legible.
  - 2. Deliver materials in sealed packages with Underwriters' Laboratories Inc. labels.
- C. Storage of Materials
  - 1. Store materials on raised platforms and protect with coverings at outdoor locations.
  - 2. Do not stack bundles of shingles more than 3 feet high.
  - 3. Store rolled goods on end.
- 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.

# 1.5 Job Conditions

- A. Do not install underlayment or shingles on wet surfaces.
- B. Do not apply shingles when air temperature is below 40 degrees.

# 1.6 Warranty

- A. At completion of roofing, furnish Owner with Manufacturer's Lifetime Limited written warranty or bond.
- B. In addition to Manufacturer's Standard Product Warranty, Contractor shall furnish a written two year guarantee covering repairs and replacement at no cost to Owner for any defects or failure due to faulty workmanship.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Individual Shingles
  - 1. ASTM D 3018, Type 1 and D3161, Type 1
  - 2. Size: 39-3/8" inches long by 13-1/4 inches wide, 5-5/8 inch exposure.
  - 3. Algae protection.
  - 4. Limited lifetime warranty with 110 mph limited wind warranty and 10 year algae warranty.
  - 5. Color: as selected.
- B. Underlayment: High-Traction Synthetic Roof Felt GAF FeltBuster or equal.
  - 1. ASTM D226 and D4869
  - 2. Size: 48" roll
  - 3. UV-stabilized spunbound polypropylene construction.
  - 4. Roll Weight: 23 lb.
  - 5. Exposure: Up to 90 days
  - 6. Slip-resistant coating on back side.

- C. Hip and Ridge Shingles: Preformed, manufacturer's standard.
- D. Nails
  - 1. Self-clinching, Manufacturer's standard.
  - 2. Minimum Pullout Strength: 40 pounds per nail.
- E. Bituminous Plastic Cement: FS-SS-C-153, Type I.
- F. Attic ventilation accessories Commercial Grade.
- G. Ice and Water Shield: ASTM D146, 60 mil, adhesive backed membrane, 36" wide.

# 2.2 Acceptable Manufacturers:

- 1. G.A.F.Materials Corporation Timberline HD Architectural Shingle
- 2. Certainteed Landmark Pro AR Series Architectural Shingle
- 3. Owens Corning Oak Ridge Algae Resistant Architectural Shingle

#### **PART 3 EXECUTION**

### 3.1 Surface Conditions

# A. Inspection

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

## 3.2 Application

#### A. Ice and Water Shield

- 1. Apply two rows of Ice and Water Shield at eave, or past building wall, whichever is greater.
- 2. Apply one row of Ice and Water Shield at all valleys.

## B. Synthetic Underlayment

- 1. Decks with slope 4 inches in 12 inches or greater:
  - a. Nail metal drip edge along the bottom edge (eaves) before underlayment is laid and to the sides (rakes) after the underlayment is laid.
  - Lay one layer of underlayment horizontally over entire roof, lapping each course over lower course 2 inch minimum at horizontal joints and 4 inch side lap at end joints.
  - c. Lap underlayment 6 inches from both sides over hips and ridges.
  - d. Secure underlayment to deck with sufficient fasteners to hold in place until shingles are applied.
  - e. For winter ice-dam protection applications: Where January average daily temperature is 25 degrees F. or where there is a possibility of ice forming along the eaves and causing roof leaks from a back-up of water, apply eaves flashing strip of heavy roll roofing to overhang drip edge 1/4 inch and extend to a point 12 inch minimum inside the interior wall line of building.

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If horizontal lap is required, it must occur outside the wall line.

- 2. Decks with slope less than 4 inches in 12 inches:
  - a. Nail metal drip edge along the bottom edge (eaves) before underlayment is laid and to the sides (rakes) after the underlayment is laid.
  - b. Lay two layers of underlayment horizontally over entire roof, lapping each course over lower course 17 inch minimum at horizontal joints and 4 inch side lap at end ioints.
  - c. Lap underlayment 6 inches from both sides over hips and ridges.
  - d. Secure underlayment to deck with sufficient fasteners to hold in place until shingles are applied.
  - e. For winter ice-dam protection applications: Where January average daily temperature is 25 degrees F. or where there is a possibility of ice forming along the eaves and causing roof leaks from a back-up of water, apply eaves flashing strip of heavy roll roofing to overhang drip edge ¼ inch and extend to a point 12 inch minimum inside the interior wall line of building. If horizontal lap is required, it must occur outside the wall line.
- 3. Valley underlayment:
  - a. Apply 36 inch wide underlayment, centered in valley, and nail in position.
  - b. Cut horizontal courses of underlayment to overlap valley underlayment 6 inches minimum.
- 4. Install ventilation accessories where shown.

# C. Underlayment Flashings

- 1. Eaves Flashing:
  - a. Decks with slope 4 in 12 or greater:
    - (1) Apply course of mineral surface roofing or smooth roll roofing to overhand underlayment and metal drip edge 3/8 inch.
    - (2) Extend roll roofing to 12 inch minimum inside interior wall line of building.
  - b. Decks with slope less than 4 in 12:
    - (1) Apply bituminous plastic cement at 2 gallons per 100 square feet to surface of underlayment.
    - (2) Apply second course of underlayment to extend up roof to minimum 30 inches beyond interior wall line.
- 2. Open Valley Flashing:
  - a. Place 18 inch wide mineral surfaced roll roofing, centered in valley, surfaced side down, lower edge cut flush with bottom of eaves flashing strip.
  - b. Nail 1 inch in from each edge to hold strip in place.
  - c. Splice by overlapping ends of upper segments 12 inches over lower segments, and secure with bituminous plastic cement.
  - d. Place second strip of 3 foot wide mineral surfaced roll roofing over first strip with surfaced side up, centered in valley, secured and lapped same as underlaying strip.
- 3. Closed Valley Flashing: Center smooth surface roll roofing in 3 feet within valley over underlayment.
- D. Tab Butt Strip Shingles
  - 1. Starter strip: Apply 9 inch minimum wide mineral surfaced roll roofing even with lower edge of eave.
  - 2. First and succeeding courses:
    - a. Start first course with full shingle at break.

- b. Cutouts break joints on halves:
  - (1) Start second course with full shingle minus 1/2 first tab.
  - (2) Start third course with full shingle minus first tab.
- 3. Nailing
  - a. Nail on horizontal line at 5/8 inch above cutouts and 1 inch in from shingle ends.
- 4. Apply bituminous plastic cement over 1 square inch on underlying shingle in center of tabs, and press tabs against cement.
- E. Hips and Ridges: Use Manufacturer's standard hip and ridge shingles.

### F. Valleys

- 1. Open Valleys:
  - a. Before roofing is applied, snap two chalk lines along full valley length, one on each side, 6 inches apart at ridge, diverging at rate of 1/2 inch per foot toward
  - b. Clip upper corner of each shingle end at angle parallel to valley.
  - c. Cement last shingle to valley lining with bituminous plastic cement.
- 2. Closed Valleys:
  - a. Lay shingles along eaves of roof crossing valley, extending over adjoining roof deck 12 inches minimum.
  - b. Lay first course along eaves of adjoining roof and extend across valley on top of previously applied shingle 12 inches minimum.
  - c. Lay succeeding courses alternately.
  - d. Nail no closer than 5 inches to valley centerline and apply two nails at end of each terminal strip.

# 3.3 Adjustments and Cleaning

- A. Replace damaged shingles.
- B. Remove excess shingles not part of extra stock and debris from project side.

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# SECTION 07 53 00 SINGLE PLY ELASTOMERIC SHEET ROOFING (Fully adhered)

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

**INDEX** 1.1 Description 2.1 Materials

1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage 3.2 Preparation and Handling 3.3 Application 1.5 Job Conditions 3.4 Field Tests 1.6 Warranty 3.5 Cleaning

## **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Membrane roofing required for this Work is indicated on the Drawings and includes, but is not necessarily limited to:
  - 1. Fully Adhered rubber membrane roofing.
  - 2. Cleaning substrate.
  - 3. Insulation installed.
  - 4. Counterflashing and sealing sheet at termination.
  - 5. PVC vapor barrier over metal deck / liquid applied over wash bay deck.
  - 6. Underlayment or Cover Board (where required by manufactures system).
  - 7. Roof scuttle(s).
  - 8. Equipment shown on roof plans is not limited to these plans. See all mechanical drawings for all required roof penetrations.

# B. Related Work Specified Elsewhere

1.	Project Meeting	Section 01 31 19
2.	Concrete	Section 03 30 00
3.	Precast Concrete	Section 03 41 00
4.	Wood Nailers (treated)	Section 06 10 00
5.	Roof Insulation	Section 07 21 00
6.	Flashing and Sheet Metal	Section 07 60 00
7.	Roof Drains	Division 22
8.	Prefabricated Curbs	Division 23
9.	Mechanical Equipment Penetrations	Division 23

C. Work Installed but Furnished by Others: Head flashing at roof drains and plumbing vents – Division 22.

## 1.2 Quality Assurance

- A. Qualifications of Installers
  - 1. The membrane roofing installer shall be currently licensed by the Manufacturer of the selected membrane roofing.
  - 2. For actual installation of membrane roofing, use only competent and skilled roofers completely familiar with the products and the Manufacturer's currently recommended methods of installation.

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3. Applicator shall have applied accepted roofing system on two or more projects which have been completed for at least five years.

# B. Requirements of Regulatory Agencies

- 1. FM Global (Factory Mutual)
  - a. ANSI FM 4474 American National Standard for Evaluating the Simulated Wind Uplift Resistance for Roof Assemblies Using Static Positive and/or Negative Differential Pressures
- 2. International Code Council (ICC)
  - a. International Building Code Edition currently in effect in the project jurisdiction.
- 3. Single Ply Roofing Industry (SPRI)
  - a. ANSI/SPRI RP-4 Wind Design Standard for Ballasted Single-ply Roofing Systems (for ballasted roof systems).
- 4. Underwriters' Laboratories, Inc. (UL)
  - a. UL 580 Standard for Tests for Uplift Resistance of Roof Assemblies
  - b. UL 790 Standard Test Methods for Fire Tests of Roof Coverings
  - c. UL 1897 Standard for Uplift Tests for Roof Covering Systems

#### C. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension
  - b. D 624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - c. D 1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
  - d. D 3746 Standard Test Method for Impact Resistance of Bituminous Roofing Systems
  - e. D 4272 Standard Test Method for Total Energy Impact of Plastic Films by Dart Drop
  - f. E 96 Standard Test Methods for Water Vapor Transmission of Materials
  - g. E 108 Standard Test Methods for Fire Tests of Roof Coverings

# D. Performance Requirements

- 1. Minimum Roof Covering Classification: Class B
- 2. Maximum Wind Speed Coverage: Peak gusts of 72mph measured at 10m above ground level.
- 3. Wind Load Pressures: Per Drawings

# E. Source Quality Control

- 1. Manufacturer's Certifications: Prior to start of, during and at completion of installation of the work of this Section, secure a visit to the job site by a representative of the manufacturer of the membrane roofing used, who shall inspect and shall certify that:
  - a. The surfaces to which the membrane roofing was applied were in a condition suitable for this application.
  - b. The materials installed complied in all respects with the requirements of this Section of these Specifications.
  - c. The materials were installed in complete accord with the manufacturer's current recommendations.

**1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accord with the provisions of these Specifications; the following:

#### A. Samples

- 1. Membrane: 12" X 12"
- 2. Membrane flashing: 12" X 12"
- B. Shop Drawings: Complete installation showing joint locations, splice details, flashing details and fastening methods to cants and parapets. Manufacturer's standard detail sheets are not acceptable unless modified for actual conditions.

#### C. Product Data

- Selection of roofing: Submit to the Owner a letter stating which of the specified membrane roofing systems has been selected by the Contractor for installation in this Work.
- 2. Submit Manufacturer's instructions for surface conditioner compatibility, elastic flashing, joint cover sheet and joint and crack sealants, with temperature range for application of roofing membrane.
- Latest edition of acceptable Manufacturer's roofing (and base flashing) specifications selected.
- 4. List of materials proposed for use.
- D. Field Inspection Reports: Manufacturer's field inspector will submit to the Owner a copy of the report for each inspection that is made.

# E. Certificates

- 1. Submit evidence of acceptance of roof applicator by roofing Manufacturer prior to Contract award.
- 2. Submit evidence of roof applicator's experience.
- 3. Submit prior to fabrication, delivery or installation:
  - a. That materials and components furnished conform with requirements of the Project Specifications.
  - b. That materials furnished are compatible for the deck indicated, each one to the other and to adjacent related work.

# 1.4 Product Delivery, Storage and Handling

## A. Protection

- 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- 2. Provide continuous protection of materials against wetting and moisture absorption.
- 3. Protect materials against damage by construction traffic. Comply with fire and safety regulations.
- 4. Select and operate material handling equipment so as not to damage existing construction of applied roofing.

### B. Delivery of Materials

- 1. Deliver materials in Manufacturer's original, unopened containers and rolls with labels intact and legible.
- 2. Deliver materials in sufficient quantity to allow continuity of Work.

# C. Storage of Materials

- 1. Store roofing materials on clean raised platforms with weather protective covering when stored outdoors.
- 2. Store asphalt rolled goods on end and EPDM materials flat.
- 3. Store adhesives in temperature between 60 degrees F. and 80 degrees F. for five days prior to use.
- 4. Do not store any materials on the roof to exceed weight of 30 pounds per sq. ft.
- D. Handling of Materials: Handle rolled good so as to prevent damage to edges or ends.

# E. Replacements

- 1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost.
- 2. Remove wet materials from project.

## 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Apply roofing in dry weather.
  - 2. Do not apply sheet roofing during inclement weather or when air temperature is below 40 degrees F.
  - 3. Do not apply sheet roofing to damp, frozen dirty, dusty or deck surfaces unacceptable to Manufacturer.

#### B. Protection

- Provide special protection or avoid heavy traffic on completed work for 24 hours after application.
- 2. Restore to original condition or replace work or materials damaged during handling of roofing materials.
- 3. Protect paving and building walls adjacent to hoist prior to starting work.
  - a. Lap suitable protective material at least 6 inches.
  - b. Secure protective coverings against wind.
  - c. Leave protective covering in place for duration of roofing work.
- 4. After completion of the work of this Section, the Roofing Contractor will be responsible to provide protection of finished roofing against damage by the work of following trades.

## 1.6 Warranty:

- A. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Owner a written warranty signed by the installer and endorsed by the membrane roofing material Manufacturer warranting that the installed membrane roofing will remain intact and free from leaks for a period of at least ten years following date of installation. Limit to ordinary wear and tear by the elements or defects due to faulty materials and workmanship. Make repairs at no expense to Owner.
- B. Pro-rated System Warranties shall not be accepted.
- C. Evidence of the manufacturer's warranty reserve shall be included as part of the project submittals of the specifier's approval.

## **PART 2 PRODUCTS**

#### 2.1 Materials

## A. System Design

 Roofing system shall be comprised of products of a single manufacturer or manufacturer's system. Roofing manufacturer is responsible to include all fasteners, flashings, adhesives, insulation, underlayment, and cover boards necessary to meet the minimum requirements specified herein.

### B. Membrane

1. 0.060 inch thick EPDM; black color, conforming to the following criteria:

Properties	Test	Results
Thickness	ASTM D 412	0.059 in minimum
Tensile Strength	ASTM D 412	1450 psi minimum
Elongation	ASTM D 412	620% minimum
Tear Strength	ASTM D 624	215#/in. minimum
Water Vapor Perm	ASTM E 96	2.0 perms-mils
Dimensional Stability	ASTM D 1204	± 1% maximum

- C. Joint Tape: Same material as membrane with adhesive joint adhesion.
- D. Sealant: As recommended by the membrane Manufacturer.
- E. Thinner and Cleaner: As recommended by adhesive Manufacturer, compatible with membrane.
- F. Flashing: Roofing membrane Manufacturer's standard flashing system.
- G. Insulation: As specified in Section 07 21 00. Facing paper to meet requirements of the roofing system. Install in multiple layers. Mechanically fasten to substrate at direct glue systems. Loose laid at ballasted systems.
- H. Underlayment or Cover Boards: As required by roofing system to meet design requirements.
- I. Vapor Barrier: 0.006 mil. polyethylene sheeting.
- J. Roof Scuttle: Bilco #E-20 36" x 36" steel roof scuttle with "ladder up" safety post.(office)
- K. Roof Scuttle: Bilco #L-20 30" x 96" steel roof scuttle with "ladder up" safety post.(Garage)

# 2.2 Acceptable Manufacturers

- A. Base Bid
  - 1. Carlisle
  - 2. Firestone
  - 3. JM
  - 4. Verisco
  - 5. Sikaplan EnergySmart

#### **PART 3 EXECUTION**

# 3.1 Surface Conditions

### A. Inspection

- 1. Verify that work of other trades which penetrates roof deck or requires workers and equipment to traverse roof deck has been completed.
- 2. Examine surfaces for inadequate anchorage, cracks, projections, foreign material, moisture and unevenness which would prevent the execution and quality of application of the roofing system as specified.
- 3. Verify that membrane roofing can be installed in strict accord with the original design, the Manufacturer's current recommendations and all pertinent codes and regulations.
- 4. Verify that drains, sleeves, curbs which pass through surfaces to receive roofing are rigidly installed.
- 5. Verify flatness and tight joints of deck sheathing.
- 6. Starting work of this Section means acceptance of substrate and site conditions.
- 7. Discrepancies
  - a. In the event of discrepancy, immediately notify the Architect.
  - b. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

- A. Protect adjacent surfaces not designated to receive roofing.
- B. Seal cracks and joints with recommended material and sealant. Use proper depthwidth ratio as recommended by the sealant Manufacturer and in accord with Section 07 92 13.
- C. Clean surfaces of foreign matter detrimental in installation of roofing.
- D. Apply surface conditioner at a rate recommended by Manufacturer.

#### 3.3 Application

- A. Vapor Barrier
  - 1. Install on deck prior to installing insulation.
- B. Underlayment: Install as required by roofing system over vapor barrier.
- C. Insulation
  - At fully adhered system. The insulation to be mechanically fastened as noted in 2.1
     Fastening as required per manufacturer's system meeting performance requirements.
  - 2. Install rigid insulation loosely over deck, or bonded to deck with compatible adhesive, in accord with requirements of Manufacturer of insulation roofing system for amount, method and type of bitumen or adhesive, and mechanical fasteners.
  - 3. Install total nominal thickness in 2 layers; stagger joints.
  - 4. Do not rupture vapor barrier during installation of insulation.

- 5. Install no more insulation at one time than will be protected from wetting or other damage by the elements by installation of roofing membrane on the same day or prior to rain or dew.
- 6. Install with longitudinal joints, of layer to receive roofing membranes, parallel to short dimension of roof.
- 7. Stagger joints in each layer. Joints not to exceed 1/4 inch.
- 8. Lay with edges in moderate contact but do not force into place.
- 9. Stagger end joints.
- 10. See Section 07 21 00 for Insulation Specification.
- 11. Provide tapered E.P.S. cants as shown on roof plan. Install cants of E.P.S. insulation tapered from 6" to 0" as shown on roof plan to provide positive drainage to roof drains at low point of roof warp.
- 12. Install acoustical deck insulation strips provided by the deck manufacturer where required. (In section 05 30 00; 2.1 E)

# D. Base Flashing

- Install in accord with requirements of roofing system Manufacturer and as detailed on drawings.
- 2. Install where roofing system abuts vertical surfaces.
- 3. Nail base flashing at top edge.
- 4. Install counterflashing immediately or seal top edge of base flashing with approved sealant from roofing Manufacturer.

#### E. Membrane Roofing

- 1. Tape sheathing joints.
- 2. Install sheet roofing in accord with the Manufacturer's instructions and the following requirements.
- 3. Wipe underside of sheet clean with thinner prior to installation.
- 4. Adhesive apply sheet roofing to perimeter edges, lay seam edges 2 inches and seal.
- 5. Seal sheet roofing with 4 inch lap where metal collars or flanges are required.
- 6. Seal sheet roofing to laminated metal flashing, conforming to requirements of Section 07 60 00.
- 7. Solvent weld by hand or by machine. Apply sealant in accord with Manufacturer's instructions and Section 07 92 13.
- 8. Apply isolating sections of roof control/expansion joints. Seal sheet roofing to one side to allow for structural movement.
- Seal ends and edges to each other and to adjoining surfaces with uniform fillet bead of sealant.
- 10. Seal watertight items projecting through membrane with counterflashing membrane material.
- 11. Complete application of roofing system without pockets or blisters.
- F. Complete installation of roofing system, including aggregate surfacing, up to line of termination of days' work.

### G. Walkways

- 1. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the drawings.
- 2. Heat weld walkway pads to the membrane in accordance with the manufacturer's specifications.

H. At completion of roofing work, post at point of roof access and identification sign containing the name of the membrane manufacturer, name and type of product and year of installation.

# 3.4 Field Test

- A. Deck Dryness Test
  - 1. Test for dryness before applying roofing.
  - 2. Should rain occur during application, retest for dryness, as above, before continuing roof application.

# 3.5 Cleaning:

- A. Perform daily clean up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the Contractor must perform a preinspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

\* \* \* \* \* \* \* \* \* \* \* \*

## **SECTION 07 60 00 FLASHING AND SHEET METAL**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

**INDEX** 1.1 Description 2.1 Materials

1.2 Quality Assurance 3.1 Surface Conditions

1.3 Submittals3.2 Preparation1.4 Product Delivery, Storage3.3 Installationand Handling3.4 Repairing1.5 Warranty3.5 Cleaning

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Furnish and install 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 buildings.

# B. Related Work Specified Elsewhere

Shingles
 Single Ply Elastomeric Sheet Roofing
 Section 07 31 00
 Section 07 53 00
 Sealants and Caulking
 Plumbing
 Louvers and Vents
 Section 07 92 13
 Division 22
 Division 23

# **1.2** Quality Assurance

A. Qualifications of Installers: Provide at least one person who shall be present at all times during execution of the Work of this Section and who shall be thoroughly trained and experienced in the materials and methods required and who shall direct the entire flashing and sheet metal fabrication and installation.

#### B. Mock-ups

- 1. Before work of this Section begins, fabricate for review a one (1) ft. mock-up of the edge flashing using identical project materials and methods.
- 2. Include seams, fasteners.
- 3. Maintain accepted mock-up for comparison with finished work.

# C. Reference Standards

- American Society for Testing and Materials (ASTM):
  - a. A 525, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements
  - b. A 526, Steel Sheet, Zinc-Coated (Galvanized by the Hot-Dip Process, Commercial Quality
- 2. Federal Specifications (FS):
  - a. FF-S-107, Screws, Tapping and Drive
- 3. Sheet Metal and Air Conditioning Contractors National Assn., Inc. (SMACNA)

a. Sheet Metal Manual

Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

#### A. Samples

- 1. Two, 12 inch by 12 inch samples of each sheet metal material.
- 2. Show pattern, finish color and thickness.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the 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.
- **1.5 Warranty:** All sheet metal work done in conjunction with the roofing membrane shall be warranted for two years against defects in materials and workmanship.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

A. Materials and Gages: Where sheet metal is required and no materials or gage is indicated on the Drawing, furnish and install the highest quality and gage commensurate with the referenced standards.

## B. Sheet Metal

- 1. Aluminum:
  - a. ASTM B 209, alloy 3003, temper H14
  - b. Finish: AS-C22A41
  - c. Minimum thickness of gage: 0.032 inches
- 2. Wall Cap:
  - a. Base Clip: 22 gauge galvanized steel, ASTM A 526 commercial quality, coating G-90, ASTM A 525.
  - b. Cap" Prefinished galvanized steel, 24 gauge, with Kynar 500 coating, smooth surface. "Colorklad" by Vincent Metals, color as selected from all standard colors.
- 3. Galvanized Steel:
  - a. ASTM A 526, commercial quality

#### C. Fasteners:

- 1. Nails: galvanized, flathead roofing nails.
- 2. Screws: Self-tapping sheet metal type, FS FF-S-107.

### D. Gutters and Downspouts

- 1. Seamless stock 5" aluminum with 4" x 5" stock rectangular downspouts. Pipe covers at grade connection to pipe.
- 2. Color as selected.

- E. Standing Seam Roofing Panels: Firestone UNA-CLAD UC-6 or equal; installation per manufacturer standards/industry. Color as selected by Architect.
  - 1. Basis of Design: Firestone UNA-CLAD UC-6
    - a. Base Metal: AISI-G90 galvanized steel Kynar 500 finish
    - 1. Nominal Thickness: 24 gage coated thickness, with smooth surface.
      - 1) Exterior Finish: Modified silicone-polyester two-coat system/smooth
      - 2) Color: As selected by Architect from manufacturer's standard colors.
      - 3) Panel Width: 16 inches.
      - Panel Thickness: 2 inches.
- F. Soffit Panels: Pac-Clad 22 Gauge Flush/Solid Aluminum Soffit Panel.
  - 1. Size: 12" Soffit Panel
  - 2. Finish: Office: Pac Clad Wood Grain. Color Selected by Architect. Salt Structure: Architect selection from standard colors.
  - 3. Venting: Fully vented panel at salt structure (building 05).
- G. Flush Wall Panels: Pac-Clad 22 Gauge Flush/Solid Aluminum Wall Panel.
  - 4. Size: 12" Wall Panel Horizontal
  - 5. Pencil Rib: 1 Pencil Rib (centered)
  - 6. Finish: Office: Pac Clad Standard Color Match (Building 01). Color Selected by Architect.
  - 7. Accessories: Provide all accessories needed for panel system installation. Coping, Flashing, and Trim related to a successful install.
- Metal Plate Wall Panels (Building 01): Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into dry-joint pressure equalized rainscreen system with interlocking gutter and drainage system integral to the panel with single horizontal factory pre-punched attachment to complete dry-joint rainscreen assembly. The use of secondary drainage channels, brackets, support pins, joint sealants or gaskets to manage the drainage of the system are not allowed.
  - 1. Basis of Design: Modular AL manufactured by Petersen Aluminum Corporation.
  - 2. Material: Tension-leveled, smooth 3003-H14 Aluminum. Thickness shall be .050" minimum.
  - Nominal Thickness: 1.375" minimum
  - Exterior Finish: Kynar finish as manufactured by Sherwin Williams
  - Color: As selected by Architect from manufacturer's standard colors.
  - 6. Panel Width: See elevations (406 mm)
  - Accessories:
    - A. Provide components required for a complete metal plate wall panel assembly including trim, copings, fascia, sills, corner units, flashings, and similar items. Match material and finish of panels unless otherwise indicated.
    - B. Manufacturers Extrusions: Formed from extruded aluminum. Provide integral drainage system and manufactures standard extrusions at termination of dissimilar materials.
    - C. Copings, Flashing and Trim Essential to System: Same material, finish, and color as adjacent metal plate panels, minimum .040 inch thick unless otherwise indicated. Provided by panel manufacturer and installed in accordance with approved shop drawings.

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D. Weather Resistive Barriers: Provide a weather barrier with performance characteristics for Air Penetration, Water Vapor Transmission and Water Penetration Resistance. Weather Barriers can be climate specific. Subject to compliance with manufacturer's requirements provide the following: Carlisle air/vapor barrier 705 HT underlayment.

# **PART 3 EXECUTION**

### 3.1 Surface Conditions

- A. Inspection Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  - Verify that flashing and sheet metal may be installed in accord with the original design, all pertinent codes and regulations, the reference standards, and the approved Shop Drawings.
  - 1. Verify that substrates are smooth and clean to extent needed for sheet metal Work.
  - 2. Verify that reglets, nails, cants and blocking to receive sheet metal are installed and free of concrete and soil.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- **3.2 Preparation:** Before installing sheet metal verify shapes and dimensions of surface to be covered.

# 3.3 Installation

- A. General
  - 1. Install work watertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
  - 2. Angle bottom edges of exposed vertical surfaces to form drips.
- B. Reglets: Install in accurate locations, straight, in-line and with leak proof joints.
- C. Sealant Installation: Apply 1/4 inch diameter bead, centered on full length of joint.
- D. Roof Counterflashing
  - 1. Overlap base flashing 4 inch minimum.
  - 2. Install bottom edge tight against base flashing.
  - 3. Lap seam vertical joints 3 inch minimum and apply sealant.
  - 4. Miter, lap seam and close corner joints with solder or sealant.
- E. Copings
  - 1. Space drive lock or cover plate seam 8 feet apart maximum.
  - 2. Miter and join corners with seams to match others in coping.
  - 3. Parapet Walls
    - a. Lock exterior edges over continuous cleats secured to substrate.
    - b. Slope 3/4 in 12 toward inside of parapet.
    - c. Lock interior edges to substrate with cleats anchored at seams.

### F. Gravel Stops

- 1. Form gravel stop 3/4 inch minimum height.
- 2. Fabricate joints with lap seams spaced 10 feet apart, maximum.
- 3. Fill roof flange joints with bituminous plastic cement.
- 4. Lock drip edge over continuous cleats secured to substrate.
- 5. Extend roof flange 4 inches on top of roofing, set in plastic cement bed and secure to substrate with nails spaced apart.
- 6. Miter and bend round corners 12 inches minimum.
- 7. Provide at built-up roofing edges raised less than 3-1/2 inches above roof deck substrate.

# G. Roof Penetration Flashing

- 1. Base Flashing
  - a. Extend flange onto roof 6 inches minimum away from penetration.
  - b. Extend flange upward around penetration to at least 8 inches above roofing felts.
  - c. Fold back upper and side roof flange edges 1/2 inch minimum.
  - d. Solder-lap joints.
- 2. Counterflashing
  - a. Overlap base flashing one inch minimum with storm collar sloped away from penetration.
  - b. Secure to penetration with draw band and sealant.

# H. Equipment Support Flashing

- 1. Full cap support.
- 2. Overlap base flashing 4 inches.
- 3. Solder-lap joint.
- 4. Provide sealant around penetration through flashing.
- I. Gutters and Downspouts
  - 1. Install where shown on drawings.
  - 2. Provide metal cap at pipe connection at grade.
- **3.4** Repairing: Repair or replace damaged work at no additional cost to the Owner.

#### 3.5 Cleaning

- A. As work progresses, neutralize excess flux with 5 to 10% washing soda solution and thoroughly rinse.
- B. Leave work clean and free of stains, scrap and debris.

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#### **SECTION 07 84 00 FIRESTOPPING**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Acceptable Manufacturers

> 1.2 Quality Assurance 2.3 Materials 1.3 References 3.1 Preparation 3.2 Coordination 1.4 Submittals 1.5 Installer Qualifications1.6 Delivery, Storage & Handling 3.3 Installation

3.4 Field Quality Control

1.7 Project Conditions 3.5 Identification

2.1 General 3.6 Adjustment and Cleaning

## **PART 1 - GENERAL**

#### 1.1 Description

- A. Work Included: Fire stopping work includes both "Through-Penetration Firestop Systems" and "Fire-resistive Construction Joints. Refer to Division 21-27 specifications for additional information. In resolving conflicts between this section and Division 21-27, the more stringent standard will apply. Only tested firestop systems shall be used in specific locations as follows:
  - 1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
  - 2. Openings between structurally separate sections of wall or floors.
  - 3. Gaps between the top of walls and ceilings or roof assemblies.
  - 4. Openings and penetrations in fire-rated partitions or walls containing fire doors.
  - 5. Openings around structural members which penetrate floors or walls.

#### B. **Definitions**

1. Firestopping: Material or combination of materials used to retain integrity of firerated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

### C. Related Work Specified Elsewhere

1.	Cast in Place Concrete	Section 03 30 00
2.	Precast Concrete	Section 03 41 00
3.	Masonry	Section 04 20 00
4.	Structural Metal Framing	Section 05 12 00
5.	Steel Joists and Girders	Section 05 21 00
6.	Metal Decking	Section 05 30 00
7.	Sealants and Caulking	Section 07 92 13
8.	Gypsum Wallboard	Section 09 29 00
9.	Mechanical and Electrical	Divisions 21-27

# 1.2 Quality Assurance

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

# 1.3 References

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems"
- Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their
   "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Firestop Devices (XHJI)
    - b. Fire Resistance Ratings (BXRH)
    - c. Through-Penetration Firestop Systems (XHEZ)
    - d. Fill, Voids, or Cavity Material (XHHW)
    - e. Forming Materials (XHKU)
    - f. Joint Systems (XHBN)
    - g. Perimeter Fire Containment Systems (XHDG)
- E. Test Requirements: ASTM E 1966, "Standard Test Method for Fire Resistive Joint Systems"

- F. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"
- G. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops"
- H. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials"
- I. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- J. Ohio Building Code and OBC 2019. (or Current Addition)
- K. NFPA 101 Life Safety Code
- L. NFPA 70 National Electric Code

#### **Fire Stopping Systems**

#### **UL Classification System**

		Construction	Type Of	System
		Penetrated	Construction	Identification
4	N 5 4 4 4	- W 0		0004 0000
1	No Penetrating Items:	F, W, C	A, B, J, K, L	0001-0999
2	Metallic Pipes, Conduit or Tubing:	F, W, C	A, B, J, K, L	1001-1999
3	Nonmetallic Pipe, Conduit or Tubing:	F, W, C	A, B, J, K, L	2001-2999
4	Electric Cables:	F, W, C	A, B, J, K, L	3001-3999
5	Cable, Trays with Electric Cables:	F, W, C	A, B, J, K, L	4001-4999
6	Insulated Pipes:	F, W, C	A, B, J, K, L	5001-5999
7	Electrical Bussduct Penetrations:	F, W, C	A, B, J, K, L	6001-6999
8	Mechanical Ductwork Penetrations:	F, W, C	A, B, J, K, L	7001-7999
9	Multiple Penetrations Through Common Openings:	F, W, C	A, B, J, K, L	8000-8999

## **Construction Penetration**

Floor
F penetration
W Wall penetration
Either floor or wall
C penetration

## **Type of Construction**

A-	Concrete floors equal to of less than 5-inches thic	K
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Concrete floors greater than 5-inches

B- thick

J- Concrete or masonry walls equal to or less than 8-inches thick

K- Concrete of masonry walls greater than 8-inches thick

L- Framed walls

#### THROUGH-PENETRATION UL CLASSIFICATION SYSTEM

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UL

# **JOINT UL CLASSIFICATION SYSTEM**

Fire-Resistant Joint Systems		Classification System		
		Joint System	Movement Capability	Joint Width
1	Floor-to-Floor	FF	D	0000-0999
2	Wall-to-Wall	WW	D	0000-0999
3	Floor-to-Wall:	FW	D	0000-0999
4	Head of Wall:	HW	D	0000-0999

## **Movement Capability**

Has movement capability

# Joint Width

D-

0000-0999 Less than or equal to 2-inches

# 1.4 Submittals

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.
- B. Submit Manufacturer's engineering judgment identification number and drawing details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- C. Submit material safety data sheets provided with product delivered to job-site.

#### 1.5 Installer Qualifications

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. The work is to be installed by a contractor with at least one of the following qualifications:

FM 4991 Approved Contractor
UL Approved Contractor
Hilti Accredited Fire Stop Specialty Contractor

C. Installer shall have not less than 3 years experience with fire stop installation.

# 1.6 Delivery, Storage, and Handling

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

# 1.7 Project Conditions

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

#### **PART 2 - PRODUCTS**

## 2.1 General

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

# 2.2 Acceptable Manufacturers

- A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:
  - 1. Hilti, Inc., Tulsa, Oklahoma 800-879-8000 / www.us.hilti.com
  - 2. Substitution requests shall be considered in accordance with contract provisions.

# 2.3 Materials

- A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
  - 1. Hilti CP 680-P Cast-In Place Firestop Device
    - a. Add Aerator adaptor when used in conjunction with aerator ("sovent") system.
  - 2. Hilti CP 681 Tub Box Kit for use with tub installations.
  - 3. Hilti CP 680-M Cast-In Place Firestop Device for use with noncombustible penetrants.
  - 4. Hilti CP 653 Speed Sleeve for use with cable penetrations.
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Hilti FS-ONE Intumescent Firestop Sealant
  - 2. Hilti CP 604 Self-leveling Firestop Sealant
  - 3. Hilti CP 620 Fire Foam
  - 4. Hilti CP 606 Flexible Firestop Sealant
  - 5. Hilti CP 601s Elastomeric Firestop Sealant
- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
  - 1. Hilti CP 601s Elastomeric Firestop Sealant
  - 2. Hilti CP 606 Flexible Firestop Sealant
  - 3. Hilti FS-ONE Intumescent Firestop Sealant

- E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
  - 1. Hilti CP 672 Speed Spray
  - 2. Hilti CP 601s Elastomeric Firestop Sealant
  - 3. Hilti CP 606 Flexible Firestop Sealant
  - 4. Hilti CP 604 Self-leveling Firestop Sealant
- F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.
  - 1. Hilti CP 777 Speed Plugs
  - 2. Hilti CP 767 Speed Strips
- G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
  - 1. Hilti FS-ONE Intumescent Firestop Sealant
- H. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti FS-ONE Intumescent Firestop Sealant
  - 2. Hilti CP 620 Fire Foam
  - 3. Hilti CP 601s Elastomeric Firestop Sealant
  - 4. Hilti CP 606 Flexible Firestop Sealant
- I. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti CP 618 Firestop Putty Stick
  - 2. Hilti CP 658T Firestop Plug
- J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
  - 1. Hilti CP 617 Firestop Putty Pad
  - 2. Hilti Firestop Box Insert
- K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
  - 1. Hilti CP 643N Firestop Collar
  - 2. Hilti CP 644 Firestop Collar
  - 3. Hilti CP 648E/CP648S Wrap Strips
- L. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

- 1. Hilti CP 637 Firestop Mortar
- 3. Hilti FS 657 FIRE BLOCK
- 4. Hilti CP 620 Fire Foam
- 5. Hilti CP 675T Firestop Board
- M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti FS 657 FIRE BLOCK
  - 2. Hilti CP 675T Firestop Board
- N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
  - 1. Hilti CP 672 Speed Spray
  - 2. Hilti CP 601s Elastomeric Firestop Sealant
  - 3. Hilti CP 606 Flexible Firestop Sealant
  - 4. Hilti CP 604 Self-Leveling Firestop Sealant
- O. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
- P. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

#### **PART 3 - EXECUTION**

## 3.1 Preparation

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - Verify penetrations are properly sized and in suitable condition for application of materials.
  - Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.2 Coordination

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

#### Installation 3.3

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
  - Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
  - Protect materials from damage on surfaces subjected to traffic.

#### <u>3.4</u> Field Quality Control

- Examine sealed penetration areas to ensure proper installation before concealing or Α. enclosing areas.
- В. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- Perform under this section patching and repairing of firestopping caused by cutting D. or penetrating of existing firestop systems already installed by other trades.

#### Identification 3.5

- Α. Identify through-penetration firestop systems with pressure-sensitive, selfadhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
  - Contractor's Name, address, and phone number.
  - Through-Penetration firestop system designation of applicable testing and inspecting agency.

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- 4. Date of Installation.
- 5. Through-Penetration firestop system manufacturer's name.
- 6. Installer's Name.

# 3.6 Adjusting and Cleaning

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

\* \* \* \* \* \* \* \* \* \* \* \*

## **SECTION 07 92 13 SEALANTS AND CAULKING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description

1.2 Quality Assurance1.3 Submittals2.2 Caulking Equipment2.3 Acceptable Manufacturers

1.4 Product Delivery, Storage 3.1 Surface Conditions

and Handling 3.2 Preparation 1.5 Warranty 3.3 Installation

3.4 Caulking Schedule

2.1 Caulking Materials

#### **PART 1 GENERAL**

# 1.1 Description

# A. Work Included

- 1. The purpose of caulking in this work is to provide a positive barrier against penetration of air and moisture at joints between items where caulking is essential to continued integrity of the barrier.
- Such caulking will normally be performed under the work of various Sections of these Specifications but shall be performed in strict accord with the provisions of this Section.
- 3. Exterior of Building: Joints and cracks around windows, aluminum entrances, door frames, columns, louvers, wall penetrations, connections and other joints necessary to seal off building from outside air and moisture.
- 4. Interior of Building:
  - a. Inside jambs and heads of exterior door frames.
  - b. Interior hollow metal door frames. Both sides of interior hollow metal frames at exposed masonry or precast concrete.
  - c. Inside perimeter of windows.
  - d. All masonry Control Joints
  - e. Mezzanine floors adjacent to perimeter walls.
- B. Related Work Specified Elsewhere: Individual requirements for caulking are described in various other Sections of these Specifications.

1.	Precast Concrete	Section 03 41 00
2.	Masonry	Section 04 20 00
3.	Roofing	Section 07 53 00
4.	Flashing and Sheet Metal	Section 07 60 00
5.	Metal Doors and Frames	Section 08 11 00
6.	Aluminum Entrances and Storefronts	Section 08 41 13
7.	Glazing	Section 08 80 00
8.	Acoustical Treatment	Section 09 51 00

## **1.2** Quality Assurance

A. Qualifications of Applicators: Installation of caulking shall be performed only by workers thoroughly skilled and specially trained in the techniques of caulking, and who are completely familiar with the published recommendations of the manufacturer of the caulking materials being used. Minimum two years experience and approved by manufacturer.

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- B. Rejection of Installed Caulking: Indication of lack of skill on the part of caulking installers shall be sufficient ground for the Architect to reject installed caulking and to require its immediate removal and complete recaulking at no additional cost to the Owner. This item will be strictly enforced and no excuses accepted.
- C. Manufacturer's Representative: Arrange for manufacturer's technical representative to be on project site to advise installer of proper procedures and precautions for the use of materials and to check installation.

### D. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. C 790, Recommended Practices for Use of Latex Sealing Compounds.
  - b. C 804, Recommended Practice for Use of Solvent-Release Type Sealants.
  - c. C 920, Elastomeric joint sealants.
  - d. D 1056, Flexible Cellular Materials Sponge or Expanded Rubber.
  - e. D 1565, Flexible Cellular Materials Vinyl Chloride Polymers and Co-polymers (Open Cell Foam).
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accord with the provisions of these Specifications; the following:
  - A. Product Data: Copies of product manufacturer's specification, recommendations and installation instructions for sealant, backing and associated materials.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Deliver materials in original, tightly sealed containers or unopened packages with Manufacturer's name, labels, product identification and lot numbers where appropriate.
- 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.

# 1.5 Warranty

- A. Provide Manufacturer's standard year 10 material warranty. Replace sealants which fail because of loss of cohesion or adhesion, or do not cure.
- B. Guarantee workmanship against leakage for two years.

#### **PART 2 PRODUCTS**

- **2.1** Caulking Materials: All caulking materials shall be a single or double component, non-sagging type.
  - A. Sealants

- 1. Silicone base, solvent curing conforming to requirements of C 920, Type S; Grade NS; Class 25; Use NT; Shore 'A' hardness of minimum 15 and maximum 50; nonstaining; non-bleeding; color as selected.
- 2. Polyurethane base, multi-component, chemical curing; self leveling type for application in horizontal joints and non-sagging type for application in vertical joints; capable of being continuously immersed in water, withstand movement of up to 25 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees F.; uniform, homogeneous, and free from lumps, skins and coarse particles when mixed; Shore 'A' hardness of minimum 15 and maximum 50; nonstaining; non-bleeding; color as selected.
- 3. Precast Wall Panels (Installed by Precast Contractor): Sikaflex 2c NS or equal; Interior sealant must be paintable

### B. Foams

Precast wall joints shall be filled with a 2-component polyurethane spray foam -Touch 'n Seal Standard Two Component Spray Foam manufactured by Convenience Products in Fenton, MO, or equal. Apply per manufacturer's instructions. Exterior joints must be caulked prior to foam install.

#### C. Accessories

- 2. Primer: Non-staining type, as recommended by sealant Manufacturer to suit application.
- 3. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant Manufacturer: compatible with joint forming materials.
- 4. Joint Filler: as recommended by sealant manufacturer to suit application.
- 5. Bond Breaker: Pressure sensitive tape recommended by sealant Manufacturer to suit application.
- 6. Masking Tape: Pressure sensitive adhesive paper tape.
- 2.2 Caulking Equipment: All caulking equipment shall be only such equipment as is specifically recommended by the manufacturer of the caulking material being installed.

## 2.3 Acceptable Manufacturers

- A. Dow Chemical
- B. General Electric
- C. Tremco
- D. Sika

# **PART 3 EXECUTION**

#### 3.1 Surface Conditions

## A. Inspection

- 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that caulking may be installed in accord with the manufacturer's recommendations.
- 3. Examine joints to be sealed for construction defects which would adversely affect execution of work.

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4. Ensure that masonry and concrete have cured 28 days minimum.

### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

- A. Cleaning: Clean joint surfaces, using joint cleaner as necessary to be free of dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, or other matter which might adversely affect adhesion of sealant.
- B. Do not apply caulking to painted surfaces. Remove old paint and caulking material before applying new caulking.
- C. Masking: Mask area adjacent to joints.
- D. Very porous surfaces require priming.
- E. Before caulking, clean and prime surfaces to receive caulking per manufacturer's recommendations.
- F. Verify that joint shaping materials and release tapes are compatible with sealant.
- G. Examine joint dimensions and size materials to achieve required width/depth ratios.
- H. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- I. Use bond breaker where required.

#### 3.3 Installation

- A. Application of Backing
  - 1. Verify the compatibility of filler material with caulking before installation.
  - 2. Polyurethane for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing.
  - 3. Backing shall fill up joint do depth of joint is approximately 1/2 of its width for joints from 1/2" to 1".
  - 4. Install backing material in joints using blunt instrument to avoid puncturing. Do not twist rod while installing. Install backing so that joint depth is 50% of joint width, but a minimum of 1/4" deep.
- B. Mixing: (Two Part)
  - 1. Mix in exact proportions recommended by Manufacturer.
  - 2. Do not thin.
  - 3. Secure a perfect blend by thorough slow mixing.
  - 4. Mix five minutes mechanically (one gallon units) or ten minutes by hand.
  - 5. Do not mix in direct sunlight.
- C. Application of Caulking
  - 1. General:

- a. Do not caulk under weather conditions or sun conditions potentially harmful to the set and curing of the caulking material.
- b. Perform work in accord with ASTM C 804 for solvent release.

#### 2. Installation

- a. Install caulking in strict accord with the manufacturer's recommendations, taking care to produce beads of proper width and depth, to tool as recommended by the manufacturer, and to immediately remove all surface caulking.
- b. Apply with hand caulking gun. Use gun nozzles of proper size to fit joints.
- c. A minimum adhering surface should be as lease 1/2". For joints from 1/2" to 1" wide, depth of sealant shall be 1/2 the width. For joints over 1", maintain depth of sealant to 1/2". (For unusual requirements, consult supplier.)
- d. Seal joint when it is normal; not in a contracted or expanded condition.
- e. Use masking tape to protect surrounding surfaces. Remove tape immediately after drawing bead with inner edge drawn away first to eliminate feather edging.
- f. Tool with putty knife of suitable size within 10 minutes after gunning. Tool may be moistened with solvent to avoid sticking. Tool joints as indicated.
- g. Do not apply caulking at temperatures under 50 degrees F.
- h. Caulk entire perimeter of all openings unless otherwise indicated.
- i. Joints: Free of air pockets, foreign embedded matter, ridges and sags.
- D. Cleaning: Remove excess materials adjacent to joints by mechanical means or with xylol (xylene) or mineral spirits as work progresses to eliminate evidence of spillage or damage to adjacent surfaces. Note: When using flammable solvents, avoid heat, sparks and open flames. Always provide adequate ventilation and follow all precautions listed on solvent container label. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

## 3.4 Caulking Schedule

- A. Carefully study the Drawings and furnish and install the proper caulking of each point where called for on the Drawings plus all other points where caulking is essential in maintaining the continued integrity of the watertight barrier. In general, caulk all joints of masonry meeting non-masonry surfaces including interior and exterior door and window frames, caulk all masonry expansion joints.
  - 1. Silicone base, "Silicone": Glazing systems, toilet rooms.

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#### **SECTION 08 11 00 METAL DOORS AND FRAMES**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Materials

> 1.2 Quality Assurance 2.3 Fabrications 1.3 Submittals 3.1 Inspection 1.4 Product Delivery, Storage 3.2 Installation

and Handling 3.3 Adjustment and Cleaning

2.1 Acceptable Manufacturers

#### **PART 1 GENERAL**

## 1.1 Description

#### A. Work Included

1. The metal doors and frames required for this work are indicated on the Drawings and include non-labeled and labeled hollow metal doors and frames and hollow metal frames for borrowed lites.

## B. Related Work Specified Elsewhere

1.	Unit Masonry	Section 04 20 00
2.	Metal Fabrications	Section 05 50 00
3.	Architectural Woodwork	Section 06 40 00
4.	Sealants and Caulking	Section 07 92 13
5.	Finish Hardware	Section 08 71 00
6.	Glazing	Section 08 80 00
7.	Finish Painting	Section 09 91 00
8.	Electrical	Division 26

# 1.2 Quality Assurance

 Qualifications of Installers: For actual installation of metal doors and frames and installation of finish hardware on metal doors and frames, use only personnel who are thoroughly trained and experienced in the skills required and who are completely familiar with the Manufacturer's current recommended methods of installation as well as the requirements of this Work. Minimum two years experience.

# B. Requirements of Regulatory Agencies

- 1. Testing agency: Underwriters Laboratories, Inc.
- 2. Door assembly fire test
  - a. Procedure: ASTM E 152.
  - b. Exposure: As labeled on Door Schedule.

## C. Reference Standards

- 1. American National Standards Institute (ANSI):
  - a. A 115, Series on Door and Frame Preparation.
  - b. A 151.1, Performance Test for Standard Steel Doors, Frames, Anchors, Hinge Reinforcing and Exit Device Reinforcings.

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- 2. Hollow Metal Manufacturers Association (HMMA)
  - a. Standard 800, Hollow Metal Manual
- 3. Steel Door Institute (SDI)
  - a. 100, Recommended Specification, Standard Steel Doors and Frames.
  - b. 105, Recommended Erection Instructions for Steel Frames.
  - c. 107, Hardware on Steel Doors, (reinforcement application).
  - d. 110, Standard Steel Doors and Frames for Modular Masonry Construction.
  - e. 113, Standard Thermal Performance Tests ply Steel Door and Frame Assemblies.
- 4. In addition to complying with all pertinent codes and regulations:
  - a. Manufacturer all labeled doors in strict accord with the specifications and procedures of Underwriters' Laboratories, Inc.
  - In Warranty and Shop Drawings, comply with nomenclature established in American National Standards Institute Publication A 123.1 "Nomenclature for Steel Doors and Steel Door Frames".
- **1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

## A. Samples

- 1. A sample of door, showing edge, top and/or bottom construction, insulation, hinge reinforcement and face stiffening.
- 2. A sample of a typical frame, showing welded corner joint, welded hinge reinforcements, dust cover boxes and floor anchor.
- 3. All samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the Manufacturer. No work represented by the samples shall be fabricated until the samples are approved and any downgrading of quality demonstrated by the samples may be cause for rejection of the work.
- B. Shop Drawings: Illustrations and schedule of door and frame sizes, types, materials, construction, finishing, anchoring, accessories and preparation for installing hardware.
- C. Product Data: Manufacturer's descriptive literature and installation instructions.
- D. Certificates: Manufacturer's certificates that materials meet specification requirements.

## 1.4 Product Delivery, Storage and Handling

#### A. Protection:

- 1. Deliver, store and handle all metal doors and frames in a manner to prevent damage and deterioration.
- 2. Provide packaging such as cardboard or other containers, separators, banding, spreaders and paper wrappings as required to completely protect all metal doors and frames during transportation and storage.
- 3. Store doors upright, in a protected dry area, at least one inch off the ground and with as least 1/4" air space between individual pieces; protect all prefinished and hardware surfaces as required.

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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.

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#### **PART 2 PRODUCTS**

- **2.1** Acceptable Manufacturers: All metal doors and frames shall be the product of one Manufacturer.
  - A. Hollow metal doors and frames Pioneer, Amweld, Ceco, Republic, Precision, Steelcraft, Curries, Corrim Co. and Mesker.

#### B. FRP/Aluminum

- 1. Series 100BE FRP, Cline Aluminum Doors, Bradenton, FL
- 2. D9 heavy duty doors, U.S. Metal & Mfg. Corp, South Bend, IN
- 3. SL-17 FRP Flush, Special-Lite, Inc. Decatur MI
- 4. Flushline Series "FRP Faced", Kawneer Co., Inc., Frankline, WI.

## 2.2 Materials (Hollow Metal)

- A. Steel Fabrications: Carbon Steel: Cold rolled, ASTM A 366.
- B. Coating Materials: Primer: Manufacturer's standard rust inhibitive primer.
- C. Core Filler Material: Manufacturer's standard.
- D. Anchors, Fasteners, Hardware and Accessories: Manufacturer's standard.

## 2.3 Fabrication (Hollow Metal)

#### A. General

- 1. Fabricate hollow metal work to be rigid, neat in appearance and free from defects, warp or buckle.
- 2. Completed fabrications to meet ANSI A 151.1.
- 3. Accurately form metal to required sizes and profiles, including astragals if utilized.
- 4. Clearly identify work, that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.
- 5. Grind and dress exposed welds to form smooth, flush surfaces.
- 6. Do not use metallic filler to conceal manufacturing defects.

#### B. Doors

- 1. Form interior face sheets of 18 gauge and exterior face sheets of 16-gauge metal.
- 2. Stiffener and Core
  - a. Stiffen face sheet with continuous vertical formed steel sections over full thickness of interior space between door faces.
  - b. Stiffeners of 22 gauge minimum spaced not more than 6 inches apart, spot welded to both face sheets not more than 4 inches on center.
  - c. Fill spaces between stiffeners with core material on interior doors.
  - d. Fill spaces on exterior doors with urethane foam.
- 3. Join door faces at vertical edges by continuous weld extending full height of door, grind welds flush.
- 4. Form astragal on meeting edge of door.
- 5. Close top and bottom edges of doors with steel channel minimum 16 gauge, extending full width of door and spot welded to both faces.

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- 6. Form door seal mortise on door bottom.
- 7. Edge profiles shall be provided on both vertical edges of doors as follows:
  - a. Single-acting swing doors beveled 1/8 inch in 2 inches.
  - b. Double-acting swing doors rounded on 2-1/8 inch radius.
- 8. Hardware reinforcements
  - a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule and templates provided by the hardware contractor. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only; all drilling and tapping shall be done by others.
  - b. Minimum gages for hardware reinforcing plates shall be as follows:
    - (1) Hinge and pivot reinforcements: 7 gauge
    - (2) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge
    - (3) Reinforcements for all other surface-mounted hardware: 16 gauge
- 9. Vision Panels
  - a. Openings to meet ADA requirements.( ADA code 43" to bottom of the glass)
  - b. Framed for glazing
  - c. Glazing beads:
    - (1) Manufacturer's standard mitered corners.
    - (2) Form beads from minimum 20 gauge metal, prefitted for field glazing.
    - (3) Locate beads on nonsecurity side of opening.
    - (4) Locate screws within one inch of ends of beads and spaced not more than 8 inches apart.

#### C. Frames

- 1. Anchors: T-strap or stirrup strap type.
- 2. Dust cover boxes: Minimum 26 gauge at hardware mortises.
- 3. Welded frames
  - a. 14 gauge exterior and 16 gauge interior minimum.
  - b. Weld frames to form rigid, neat, square and true units free of defects, warp or buckle.
  - c. Close corner joints tight with trim faces mitered and continuously welded and ground smooth.
  - d. Weld temporary steel brace to both feet of jambs to serve as brace during shipping handling.
  - e. Head assemblies integrally reinforced and mitered joints with 18 gauge minimum channel section.

## D. Edge Clearances

- 1. Between doors and frame at head and jamb: 1/8 inch.
- 2. At sills without thresholds: 3/4 inch maximum.
- 3. At sills with thresholds: 1/4 inch maximum between threshold and door.
- 4. Between meeting edges of pairs of doors: 1/8 inch.
- E. Preparation for Hardware: ANSI A 115.

#### F. Finish

- 1. Dress tool marks and surface imperfections to smooth surfaces and remove irregularities.
- 2. Chemically treat and clean doors and frames.

3. Apply Manufacturer's standard prime and finish coating. Frames to be painted by the dipping process.

#### **PART 3 EXECUTION**

## 3.1 Inspection

- A. Assure that frame openings correspond to dimensions of frame furnished.
- B. Check that surfaces to contact frame are free of debris.
- C. Verify that metal doors and frames may be installed in strict accord with all pertinent codes and regulations, the original design, approved Shop Drawings and Manufacturer's recommendations.
- D. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Architect.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

## 3.2 Installation

## A. Anchorage

- 1. Attach anchor to opening.
- 2. Minimum number of anchors.
  - a. Masonry walls.
    - (1) Frames up to 7 feet 6 inches: 3 anchors per jamb.
    - (2) Frames 7 feet 6 inches to 8 feet 0 inches: 4 anchors per jamb.
    - (3) Frames more than 8 feet 0 inches: 1 anchor for each 2 feet of jamb or fraction thereof.
  - b. Stud partitions
    - (1) Frames up to 7 feet 6 inches: 3 anchors per jamb.
    - (2) Frames 7 feet 6 inches to 8 feet 0 inches: 4 anchors per jamb.
    - (3) Frames more than 8 feet 0 inches: 4 anchors plus one additional anchor for each 2 feet of jamb or fraction thereof.

#### B. Frames

- 1. Remove shipping spreaders if used.
- 2. Attach frames square, plumb and true to line with adjacent construction.
- 3. All frames in masonry or precast openings to be mortar filled by mason..
- C. Finish Hardware: Install all finish hardware supplied under Section 08 71 00 in strict accord with the Manufacturer's recommendations, eliminating all hinge-bound conditions and making all items smoothly operating and firmly anchored into position.
- D. Doors: SDI 100.
- E. Installation: Install hollow metal work in accordance with Manufacturer's instructions.

## 3.3 Adjustments and Cleaning

A. Remove dirt and excess sealants or glazing compound from exposed surfaces.

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- B. Touch up marred or abraided surfaces to match original finish.
- C. Adjust moving parts for smooth operation.
- D. Remove debris from project site.

\* \* \* \* \* \* \* \* \* \* \* \*

# **SECTION 08 14 29 WOOD DOORS (PRE-FINISHED)**

Applicable provisions of the General and Supplementary Conditions and SCOPE Division 1 govern work under this Section.

1.1 Description
1.2 Quality Assurance INDEX 1.5 Warranty 2.1 Materials

3.1 Surface Conditions

1.4 Product Delivery,
Storage and Handling 3.2 Installation

3.3 Adjustments and Cleaning

#### **PART 1 GENERAL**

## 1.1 Description

A. Work Included: Wood doors and wood transoms not matched grain to doors required for this Work are indicated on the Drawings and include rated and non rated passage doors. See Door Schedule in Drawings.

## B. Related Work Specified Elsewhere

1.	Metal Fabrications	Section 05 50 00
2.	Rough Carpentry	Section 06 10 00
3.	Architectural Woodwork	Section 06 40 00
4.	Metal Door Frames	Section 08 11 00
5.	Finish Hardware	Section 08 71 00
6.	Glazing	Section 08 80 00
7.	Painting	Section 09 91 00

## **1.2** Quality Assurance

#### A. Qualifications of Manufacturers

- B. Qualifications of Installers: For actual installation of wood doors, and installation of finish hardware on wood doors, use only skilled journeyman carpenters who are completely familiar with the recommended methods of installation and the requirements of this Work.
- C. Allowable Tolerances
  - 1. Size: Not prefit: +1/16 inch, overall dimensions.
  - 2. Maximum warp: 1/4 inch.
  - 3. Squareness: Length of diagonal measured on face of door from upper right corner to lower left corner between length of diagonal measured on upper left corner to lower right corner: maximum difference of 1/4 inch.
  - 4. Show-through (photographing): 1/1000 inch deviation from true plane in any 3 inch span on door face.
- D. Source Quality Control
  - 1. Door Standards: AWI Quality Standard Section.
- E. Reference Standards
  - 1. American National Standards Institute (ANSI):

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- a. A 135.4. Basic Hardboard
- 2. Commercial Standards (CS)
  - a. 171, Hardwood Veneered Doors (Solid-core, Hollow-core and Panel and Sash)
  - b. 262
- 3. National Woodwork Manufacturers Association, Inc. (NWMA):
  - a. I.S.I, Wood Flush Doors
  - b. I.S.4, Water-Repellant Preservative Non-Pressure Treated for Millwork
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Samples: Submit samples showing face veneers and finish of doors.
  - B. Shop Drawings
    - 1. Show details of door construction.
      - a. Wood transoms per schedule.
      - b. Face veneer species.
    - 2. Prefitting and prematching doors: Prepare in accord with hollow metal frame shop drawings and schedule, hardware schedule and templates, furnished before doors are fabricated.
    - Door Schedule: Indicate opening identifying symbol, sizes, door type and grade and show elevation, fire classification marking, swing, light and louver cutout sizes and locations, undercuts, stile and rail reinforcement, and internal blocking for hardware attachment.
  - C. Certificates: Certificates of compliance with fabrication and test requirements signed by an authorized representative of the door manufacturing company.
- **1.4 Product Delivery, Storage and Handling**: Package, deliver and store doors in accord with <u>AWI</u> requirements.
  - A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
  - B. Delivery of Materials
    - 1. Deliver doors to site after plaster and cement are dry and building has reached average prevailing relative humidity of locality.
    - 2. Seal all four edges of doors when delivered to project site.
  - C. Storage of Materials, Equipment and Fixtures
    - 1. Stack flat on 2" x 4" lumber, laid 12 inches from ends and across center.
    - 2. Under bottom door and over top of stack provide plywood or corrugated cardboard to protect door surfaces.
    - 3. Store doors in area where there will be no great variations in heat, dryness and humidity.
    - 4. Protect from weather and construction activities.
  - D. Handling Materials and Equipment: Do not drag doors across one another.

- E. 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.
- **1.5 Warranty:** Warranty materials and workmanship under conditions of NWMA Standard Door Warranty.
  - A. Warranty to begin at date of substantial completion of the project or from date of approved repair work for Manufacturer's defects listed on the Punch List.

## **PART 2 PRODUCTS**

## 2.1 Materials

- A. Door Standards: AWI flush door standards.
- B. Wood Veneer
  - 1. Basis of Design: Oshkosh Door or Approved Equal
  - 2. Quality grade: Custom
  - 3. Species: Sliced White Oak
  - 4. Finish: Desert 600-1510
- C. Adhesives: CS 171, Type I exterior and Type II interior.
- D. Core
  - 1. Particleboard solid core: Type I Density C, CS 236.
  - 2. Mineral solid core.
    - a. Minimum density of 16 pcf and maximum density 28 pcf, ASTM C 303.
    - b. Moisture absorption by weight, maximum of 10% when core is in equilibrium with 90% relative humidity and 70 degrees F.
- E. Finish: Prefinish door and transoms with factory applied stain and varnish.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

## A. Inspection

- 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that wood door work may be performed in accord with all pertinent codes and regulations, the original design and the reference standards.
- 3. Verify that doorframes are of type required for door and are installed as required for proper installation of doors.
- 4. Do not install doors in frames, which would hinder the operation of the doors.
- 5. Do not proceed with installation until conditions are satisfactory.
- 6. Beginning of installation means acceptance of substrate.

## B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

## 4.2 Installation

## A. Fitting and Machining

- 1. Fit doors for width by planning equally on both jamb edges; for height by sawing.
  - a. 1/2 inch from bottom
  - b. 1/8 inch maximum from top.
  - c. Bevel lock and hinge edges 1/8 inch in 2 inches.
- 2. Machine doors for hardware to clearance tolerances specified in Paragraph 2.3.J
- 3. Cut light and louver openings in door not exceeding maximum sizes as specified in Paragraph 2.3.H and 2.3.l.
- 4. Seal all job site cut surfaces with two coats of Manufacturer's standard sealer.

## B. Installation of Doors

- 1. Install in accord with requirements of AWI and NWMA Standards.
- 2. Install all finish hardware in strict accord with the Manufacturer's recommendations and AWI requirements, eliminating all hinge bound conditions and making all items smoothly operating and firmly anchored into position.
  - a. Machine cut relief for hinges and closers and coring for handsets and cylinders.
  - b. Pilot drill screw and bolt holes. Use threaded through bolts for half surface hinges.
- 3. Coordinate installation of glass and glazing.

# 3.3 Adjustments and Cleaning

- A. Replace or rehang doors which are hinge bound and do not swing or operate freely.
- B. Replace prefinished doors damaged during installation.
- C. Replace all doors that can not be modified to fit opening due to lack of proper field measurement or coordination with other contractors
- D. Refinish or replace pre-finished doors damaged during installation.

## E. Touching up:

- 1. Using fine-grained sandpaper, completely eliminate all scratches and abrasions in finished wood surfaces.
- 2. Set all nails and fasteners for putty. Firmly putty all holes. Use putty tinted to match door finish.

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## **SECTION 08 30 00 SPECIAL DOORS**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

> 1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage 3.2 Installation and Handling 3.3 Touching Up 3.4 Instructions 1.5 Warranty

## **PART 1 GENERAL**

## 1.1 Description

- A. Work Included: Special doors required for this Work are indicated on the Drawings and include, but are not necessarily limited to:
  - 1. Electrically Operable, Insulate Overhead Sectional Doors.
  - 2. Operable Coiling Door.
    - a. Electrically Operated and Manual
    - b. Insulated and Non-Insulated
    - c. Rated and Non-Rated
  - 3. Operable Counter Shutter Doors.
    - (1) Electrical Operated and Manual
    - (2) Rated and Non-Rated

#### B. Related Work Specified Elsewhere

1.	Concrete	Section 03 30 00
2.	Precast Concrete	Section 03 41 00
3.	Steel Joists	Section 05 21 00
4.	Finish Painting	Section 09 91 00

5. Electrical Hook-up (line voltage by electrical contractor and low voltage by door contractor). Door contractor to supply all equipment to Electrical contractor.

Division 26

# 1.2 Quality Assurance

- A. Qualifications of Installers: For actual installation of the special door, use only personnel who are thoroughly trained and experienced in installation of the selected products and who are completely familiar with the requirements of this Work.
- B. Requirements of Regulatory Agencies: In addition to meeting all local standards and codes, comply with the provisions of Standards of the American Rolling Door Institute, National Electrical Manufacturer's Association and Factory Mutual.
- C. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. A 526, Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Commercial Quality.

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- 2. American Institute of Steel Construction "Manual of Steel Construction".
- 3. American Iron and Steel Institute "Light Gage Steel Design Manual".
- 4. American Welding Society "Code for Arc and Gas Welding".
- 5. Metal Building Manufacturer Association "Recommended Design Practices Manual".
- 6. Aluminum Association "Aluminum Construction Manual".
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and details, anchorage methods, hardware locations and installation details.
  - B. Operation and Maintenance information.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver doors in Manufacturer's packaging complete with installation instructions.
- 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.
- **1.5 Warranty:** Doors and motors Two year on workmanship and materials.

## **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Electrically Operable Insulated Overhead Sectional Doors
  - Door Panels: Panels shall be 2" or 3" thick, roll formed from commercial quality hot dip galvanized steel per ASTM A-525 and A-526. Door sections constructed of 26 gauge interior and exterior skins-mechanically interlocked and pressure bonded to an extruded polystyrene core.
    - Door panels shall have a minimum thermal resistance value of R-17. Interior and exterior skins to be separated by a continuous dual durometer vinyl extrusion to form an effective thermal break and complete weather tight seal along section joint. Thermal break extrusion to be held in place by means of a mechanical interlock. End stiles to be minimum 14 gauge, separated from exterior skin with vinyl thermal break. Built in backup plates for attaching all end style hardware to be minimum 14 gauge. Backup plates for attaching all other hardware to be minimum 16 gauge.
  - 2. Finish: Exterior and interior of door skins pre-coated prior to roll forming with a two coats process of baked on Kynar Beige finish for the exterior and white for the interior over epoxy primer.
  - 3. All overhead doors to have lift clearance type track operation.

- 4. Weatherstripping: Doors to be furnished with complete weatherstripping system to reduce air infiltration. Top of door provided with EPDM rubber sealing strip. Bottom of door to have flexible U-shape vinyl seal encased in extruded aluminum retainer to conform to irregularities in floor. Jamb seal to be EPDM rubber blade type attached to track angle mounting with rigid vinyl snap-on extrusion. Weatherstripping to be replaceable without removal of track, angle mounting or door hardware. Maximum air leakage per foot of door perimeter (floor, jamb, and header) shall not exceed 0.19 cfm/sf @ 25 M.P. H. when tested in accordance with ASTM E-283.
- 5. Track: All tracks to be galvanized 3" type 11 gauge. Track to have Graduated Seal for weather tight closing. Tracks to be continuous angle mounted and fully adjustable for sealing door to jamb. Continuous angle size to be not less than 3-1/2" x 6" x 1/8" 3" tracks. Horizontal track to be adequately reinforced with continuous angle. Installation to be for Operation as high as possible to room framing.
- 6. Hardware: All hinges and brackets made from galvanized hardened steel balls per roller (3"). Cylinder locks at manual doors only.
- 7. Springs: Heavy duty 100,000 cycle oil tempered wire torsion springs on continuous ball bearing cross header shaft. Galvanized aircraft type lifting cables with minimum safety of 7 to 1. All doors to have Heavy Duty Pusher Bumpers.
- 8. Wind Load: Doors designed to withstand 20 lbs. per square foot. Deflection of door in horizontal position to be maximum 1/120 of door width.
- 9. Glazing: Lite inserts to be 24" x 8" thermal type, 5/8" insulated glass. Glass unit to be encased in one piece vulcanized EPDM rubber frame. All doors to have lites in third section maximum quantity available as per door width. Doors under 10 ft. wide use minimum of 2 vision strips as shown on exterior elevations. Doors over 10 ft. wide use 4 vision strips. See elevations for full vision panels within each door.
- 10. Electric Operators:
  - a. Shall be heavy duty, gear-driven with a continuous-duty, relay logic, WIFI interface with smart phone (Lift Master WF 'MyQ'), overload protected motor with high starting torque, jackshaft type with chain hoist 480 volts, 3 phase. See electrical drawings for final voltage / phase requirements. Operator shall have heavy-duty industrial ball bearings, worm gear driven in oil bath and an electromechanical brake. Horse power determined by door size. All doors to have electric Millers safety edge to stop and reverse door upon striking an object and photo safety eyes. Activation Station 1-3 button open close and stop NEMA 1 surface mounted with 24 volt circuit. Motion loop detectors to open doors only where indicated on plans. Timers to close door, by overhead door contractor. Required at all doors.
  - b. Shall be heavy duty, gear-driven with a continuous-duty, relay logic, WIFI interface with smart phone (Lift Master WF 'MyQ'), overload protected motor with high starting torque, jackshaft type with chain hoist 480 volts, 3 phase. See electrical drawings for final voltage / phase requirements. Operator shall have heavy-duty industrial ball bearings, worm gear driven in oil bath and an electromechanical brake. Horse power determined by door size. All doors to have electric Millers safety edge to stop and reverse door upon striking an object and photo safety eyes. Activation Station 1-3 button open close and stop NEMA 1 surface mounted with 24 volt circuit. Motion loop detectors to open doors only where indicated on plans. Timers to close door, by overhead door contractor. The prior noted items are required at all doors. Overhead doors in Repair 130 will have a 6-button open/closed station mounted on building column 1-10/1-E and a 6 button open/closed station mounted on building column 1-10/1 -A in addition to the 1-3 button station at each door.

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Both added stations will be off the same conduit feed for the main 1-3 button station.

- 11. Wiring: All electrical wiring to be done by electrical contractor. Door Contractor to supply all materials necessary to Electrical Contractor. Low voltage wiring by Door Contractor. See details on electrical sheets.
- 12. Overhead Doors at wash bay needs to be designed for moisture conditions. All door rollers should have stainless steel rollers or nylon rollers. Motors and activation stations must be NEMA 4 Rated. All exposed Non-galvanized hardware must be powder coated.

## B. Operable Coiling Doors

- a. General
  - a. Curtain:
    - (1) Slats: No. 5F, 22 gauge for doors up to 14'-4" wide, 20 gauge for doors between 14'-4" and 25'-4" wide, Grade 40, ASTM A 653 (A 653M), Commercial Quality, galvanized steel with G-90 (Z 275) zinc coating.
    - (2) Bottom Bar: Two 2x2x1/8 inch (50x50x3.2 mm) structural steel angles.
    - (3) Fabricate interlocking sections with high strength nylon endlocks for doors up to 16'x16' and cast iron endlocks for larger doors on alternate slats each secured with two 1/4" rivets. Provide windlocks as required to meet design windload.
    - (4) Slat Finish Galvanized Steel: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
    - (5) Bottom Bar Finish Steel: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
  - b. Guides: Fabricate with minimum 3/16-inch (5mm) structural steel angles. Provide windlock bars of same material when windlocks are required to meet design wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar. Top 16 ½" (419.10 mm) of installation and as needed for future curtain service.
    - (1) Finish Steel: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
  - c. Counterbalance Shaft Assembly:
    - (1) Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
    - (2) Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.
  - d. Brackets: Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

- (1) Finish Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- e. Hood: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4-inch (6 mm) steel intermediate support brackets as required to prevent excessive sag.
  - (1) Finish Galvanized Steel: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- f. Weatherstripping:
  - (1) Bottom Bar: Replaceable, 3-point, compressible vinyl gasket extending into guides.
- g. Operation Manual Chain Hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.
- 2. Electrically Operated Doors Where doors are scheduled for electric operation, add the following:
  - a. Operation
    - (1) Motor Operated: Cornell Model M26 or equivalent, UL listed, gear head, worm gear in oil bath, horsepower as recommended by manufacturer, 115v single phase service. Provide open drip-proof motor, removable without affecting auxiliary hand chain or setting of limit switches; auxiliary hand chain operator interlock; UL listed thermal overload protection; electric brake and rotary limit switches; transformer with 24 v control secondary; and all integral electrical components prewired to terminal blocks. Include removable electrical control panel.
      - (a) Control Station: Flush mounted, "Open/Close/Stop" push buttons; NEMA 1B.
  - b. Weather/Sensing Edge: Provide automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.
    - (1) Contact with switch before fully closing shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
    - (2) Provide retracting safety cord and reel connection to control circuit.
  - c. Wiring: All electrical wiring to be done by electrical contractor. Door Contractor to supply all materials necessary to Electrical Contractor. Low Voltage wiring by Door Contractor. See details on electrical sheets.
- 3. Insulated Doors Where doors are scheduled to be insulated, add/substitute the following:
  - a. Curtain:
    - (1) Slats: No. 6F, 22/24 gauge ASTM A 653 (A 653M), Commercial Quality, galvanized steel with G-90 (Z 275) zinc coating, 7/8" ((22 mm) foamed-in-place, closed cell urethane insulation, total slat thickness 15/16 inch (24 mm).
    - (2) Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin to match curtain material and gauge.

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- (3) Fabricate interlocking sections with high strength nylon end locks on alternate slats each secured with two rivets. Provide wind locks as required to meet design wind load.
- (4) Slat Finish (Interior and Exterior) Galvanized Steel: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- (5) Bottom Bar Finish:
  - (a) Exterior Face: Match slats.
  - (b) Interior Face: Powder coat to match slats.
- b. Weatherstripping:
  - (1) Bottom Bar, Motor Operated Doors: Weather/sensing edge within neoprene or rubber astragal extending full width of door bottom bar.
  - (2) Guides: Vinyl strip sealing against fascia side of curtain.
  - (3) Hood: Neoprene/rayon baffle to impede air flow above coil.
- 4. Locking Doors Where doors are scheduled to be locking Add the following:
  - a. Locking: Master keyable cylinder operable from both sides of bottom bar.
- 5. Rated Doors Where doors are scheduled to be Fire-Rated, add/substitute the following:
  - a. Manual Operation (Where Scheduled):
    - (1) Manual M100 Chain Hoist: Provide combination chain/controlled closing system operator including endless steel chain, geared reduction unit, chain keeper and a combination close operation/automatic drop test cable located at floor level. Integral to the unit is a locking mechanism to hold the door at any position of travel during normal door operation mode and a governor to control automatic closing speed. Automatic closure shall be activated by fusible link [or a local smoke/fire detector by means of a fail-safe releasing device] [or a central smoke/fire alarm system by means of a fail-safe releasing device]. Doors shall maintain an average closing speed of not more than 9" (229 mm) per second during normal and automatic closing. Resetting of spring tension or mechanical dropouts shall not be required.
  - b. Motor Operation (Where Scheduled):
    - (1) Motor Operated: M100 Series Motor Operated: Model FS, UL listed and FM approved, NEMA 1 enclosure rating, horsepower as recommended by manufacturer, 120 Volts, Single Phase at doors up to 10' x 10'; 480 Volts, Three Phase at larger doors. Provide open drip-proof motor, removable without affecting setting of limit switches; UL listed thermal overload protection; solenoid brake; planetary reduction gearing and rotary limit switches; transformer with 24 v control secondary; and all integral electrical components prewired to terminal blocks. Include removable electrical control panel. Automatic closure shall be activated by fusible link. Doors shall not require a releasing device when activated by an alarm signal. Doors shall maintain an average closing speed of not more than 9" (229 mm) per second during automatic closing. When automatic closure is activated, electric sensing edge and push button are inoperable. Doors shall be fail-safe and close upon power failure. Resetting of spring tension of mechanical dropouts shall not be required. Upon restoration of power, replacement of fusible link or clearing of the alarm signal, doors shall immediately reset by opening with the push button.
    - (2) Control Station: Flush mounted, "Open/Close/Stop" push buttons; NEMA 1B.

- (3) Safety Features: All doors to have auto-reverse sensing edge per 7. below and photo eyes.
- c. Smoke Seal/Sensing Edge: (Motor Operated Doors) Provide automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.
  - (1) Contact with switch before fully closing shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
  - (2) Provide retracting safety cord and reel connection to control circuit.
- d. Fusible Link with M100 FireGard™ Motor Operated System: (Motor Operated Doors)
  - (1) Activation: Power outage or melting of fusible link.
  - (2) Operation: Motor operator shall close door upon signal from power outage or melting of fusible link.
  - (3) Closing Speed: Not more than 9 inches (229 mm) per second.
  - (4) Reset Procedure: Operation of control station after alarm is cleared or power is restored or replace fusible link; resetting of spring tension or mechanical dropouts shall not be required.
- e. Wiring: (Motor Operated Doors) All electrical wiring to be done by electrical contractor. Door Contractor to supply all materials necessary to Electrical Contractor. Low voltage wiring by Door Contractor. See details on electrical sheets.
- C. Operable Coiling Doors Salt Structure
  - 1. General Basis of Design Overhead Door Company, 610 Series
    - a. Slats shall be No. F265, 20 gauge.
    - b. Bottom bar angles shall be galvanized.
    - c. Slat and Hood Finish shall be Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
    - d. Guides Finish shall be -- PowderGuard Zinc Finish for guides, bottom bar and head plate.
    - e. Brackets shall be Galvanized steel to support counterbalance, curtain and hood.
  - 2. Electrically Operated Doors Where doors are scheduled for electric operation, add the following:
    - a. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot or more than 1 foot per second.
      - i. Sensing Edge Protection:
        - 1.) Pneumatic sensing edge.
      - ii. Operator Controls:
        - 1.) Push-button operated control stations with open, close, and stop buttons. Controls for exterior location, surface mounted inside building.
      - iii. Motor Voltage: Per electrical drawings.

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- D. Rolling Counter Shutter Door SH12BA (Room 128)
  - 2. Curtain: The curtain shall be interlocking flat-faced extruded aluminum (6063 TS) slats not less than .05" (1.3mm) thick. The bottom of the curtain to be extruded aluminum (6063 T5) with a rubber vinyl astragal for sill protection.
  - 3. Guides: Series CA: All guides shall be extruded aluminum (6063 T5) with wood pile inserts on both sides.
  - 3. Brackets: Bracket plates for mounting curtain and barrel assembly shall be a minimum of 10 gauge, hot dipped, galvanized steel.
  - 4. Barrel: The barrel shall be made from a minimum 4-1/2" (114.3mm) O.D. x .120 (3.1mm) wall structural steel pipe. Deflection of pipe under full load shall not exceed .03" (.8mm) per foot of span.
  - 5. Hood: Hood shall be rectangular type formed from .04" (1.0mm) thick aluminum.
  - 6. Operation: Manual operation to be provided with lifting handles and slide bolt lock.
  - 7. Finish: Series CA: Aluminum Curtain, guides, and hood to be clear anodized 204-R-1 finish.

## 2.2 Acceptable Manufacturers

- A. Sectional Doors
  - 1. Clopay Building Products
  - 2. Overhead Door Corporation
  - 3. Raynor Manufacturing Company
- B. Coiling Doors
  - 1. The Cookson Company Inc.
  - 2. Cornell Iron Works
  - 3. Overhead Door Corporation
  - 4. Raynor Manufacturing Company

## **PART 3 EXECUTION**

#### 3.1 Surface Conditions

- A. Inspection Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Discrepancies In the event of discrepancy, immediately notify the Owner. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

#### 3.2 Installation

- A. Install all special doors in strict accord with all pertinent codes and regulations, the original design, the approved Shop Drawings and the Manufacturer's current recommendations, anchoring all components firmly into position for long life under hard use.
- B. Fit, align and adjust complete door assemblies level and plumb and to provide smooth operation.

- C. Securely brace overhead door tracks suspended from structure. Secure tracks to structural members only.
- **3.3 Touching Up:** Upon completion of the installation, touch up all scuffs and abrasions in the shop priming coat, using primer specified above.
- 3.4 Instructions: Upon completion of the installing, and as a condition of its acceptance, instruct the Owner's maintenance and operation personnel with the operation and maintenance of the special door and grilles.

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## **SECTION 08 41 13 ALUMINUM ENTRANCES AND STOREFRONTS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 2.3 Fabrication

1.4 Product Delivery, Storage

3.1 Surface Conditions

and Handling 3.2 Preparation 1.5 Warranty 3.3 Installation

3.4 Adjustments and Cleaning

#### **PART 1 GENERAL**

## 1.1 Description

A. Work Included: Aluminum door, window and sash, complete with finish hardware.

## B. Related Work Specified Elsewhere

1.	Precast Concrete	Section 03 41 00
2.	Masonry	Section 04 20 00
3.	Metal Fabrications	Section 05 50 00
4.	Rough Carpentry	Section 06 10 00
5.	Caulking	Section 07 92 13
6.	Anchors and Inserts	Section 08 10 00
7.	Cylinders for locks	Section 08 71 00
8.	Glazing	Section 08 80 00
9.	Electrical	Division 26

#### C. Work Installed but Furnished by Others:

1. Door hardware others than specified in this Section 08 71 00.

## **1.2** Quality Assurance

### A. Qualifications of Installers

- For actual installation of the work of this Section use only personnel who are thoroughly trained and experienced in the skills required and who are completely familiar with the Manufacturer's current recommended methods of installation as well as the requirements of this Work.
- 2. In acceptance or rejection of installed doors and frames, no allowance will be made for lack of skill on the part of installers.

## B. Design Criteria

- System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F. without causing detrimental effects to system or components.
- 2. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accord with the applicable building codes.

- 3. Limit mullion deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.
- 4. Drain water entering joints, condensation occurring in glazing channels or migrating moisture occurring within system, to exterior.
- 5. Limit air infiltration through assembly to 0.06 cubic feet per minute per square foot of assembly surface area, measured at a reference differential pressure across assembly of 0.3 inches water gage as measured in accord with ASTM E 2831.
- 6. System to accommodate, without damage to system or components, or deterioration of perimeter seal; Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.

## C. Allowable Tolerances

- 1. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.
- 2. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

#### D. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. A 164, Electrodeposited Coatings of Zinc on Steel
  - b. A 386, Zinc Coating (Hot-Dip) on Assembled Steel Products
  - c. B 221, Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
  - d. E 283, Air Performance
  - e. E 330, Structural
  - f. E 331, Water
- 2. Aluminum Association (AA): Designation for Aluminum Finishes.
- 3. American Architectural Manufacturers Association (AAMA):
  - a. 501, Water
  - b. 1503, Thermal
- **1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Samples: Submit a sample of the prefinished aluminum material illustrating the actual finish obtained in the specified anodizing.
  - B. Shop Drawings: Submit complete Shop Drawings showing all details of the fabrication and installation, including system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; door hardware requirements; and adequate provision for installation of the specified glass.
  - C. Certificates: Manufacturer's certificates that materials meet Specification requirements.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver materials in Manufacturer's packaging complete with installation instructions.

- C. Provide wrapping or strippable coating to protect prefinished aluminum surfaces.
- 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.
- **1.5 Warranty:** Provide three-year Manufacturer's warranty to cover complete system for failure to meet specified requirements.

## **PART 2 PRODUCTS**

## 2.1 Materials

- A. Extruded Aluminum: ASTM B 221, 6063 alloy, T5 temper.
- B. Touch-up primer for galvanized surfaces: FS TT-P-641.
- C. Fasteners, where exposed, shall be aluminum, stainless steel or zinc plated steel in accord with ASTM A 164.
- D. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum.
- E. Glazing gaskets shall be EPDM elastomeric extrusions.
- F. Single acting entrance frame weatherstripping shall be a non-porous, polymeric material.
- G. Fabricated Components
  - 1. General
    - a. All assemblies for this Work, unless otherwise specifically approved by the Architect, shall be the product of one Manufacturer.
    - b. All exterior frames and doors shall be of thermal break construction. Mullion and perimeter gutters shall be separated from mullion and perimeter faces by PVC members eliminating all metal to metal contact between exterior and interior of the frame so that it will perform in such a manner that condensation will first appear on the glass before the metal.
  - 2. Exterior Framing System: 4 ½" deep by 2 wide profile of Kawneer TRI-FAB-VG-451-T; extruded aluminum alloy, ASTM B 221; thermally broken with interior portion of frame section completely insulated; complete with extruded aluminum security type snap-in glass stops for sidelights and transom lights, of profile to suit frame section. Verticals to be SSG Type Exterior Butt-Glazed. Reinforced storefront framing will be acceptable for SF7. Front set glazing.
  - Exterior Frames: 4-1/2 inch deep by 1-3/4 inch wide profile Kawneer Encore; of extruded aluminum alloy; ASTM B 221 complete with extruded aluminum security type snap-in glass stops for sidelights and transom lights, of profile to suit frame section. Unit designed for front set glazing. Front set glazing.
  - 4. Interior Frames: 4-1/2 inch deep by 1-3/4 inch wide profile Kawneer Tri-Fab II 451; of extruded aluminum alloy; ASTM B 221 complete with extruded aluminum security type snap-in glass stops for sidelights and transom lights, of profile to suit frame section.

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- 5. Doors: Of extruded aluminum alloy; ASTM B 221; wide stile, Kawneer 500, 1-3/4 inches thick with 5 inch wide vertical stiles, 5 inch wide top rail and 6 ½ inch wide bottom rail; for 1 inch exterior glass and ¼ inch thick interior glass secured with snap-in glazing splines.
- 6. Door, Sidelight and Transom Light Glass: Exterior and Interior located; thickness and type same as doors as called for in these Specifications.

#### H. Finish

- All exposed framing surfaces shall be free of scratches and other serious blemishes.
   Aluminum moldings shall be given a caustic etch followed by an anodic oxide treatment to obtain;
  - a. Annodized Finish Permanodic coating conforming to Aluminum Association Standard AA-M12 C22 A44, Dark Bronze.
- 2. Concealed Steel Items: Galvanized in accord with ASTM A 386 to 2 ounces per square foot.
- 3. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

#### Hardware

- Weatherstripping, sweep strips, thresholds, hinges: Manufacturer's recommended standard type.
- 2. Hinges: Full length piano, heavy duty.
- 3. Push/Pulls: Designer style 1" offset tube each face, 12: long.
- 4. Panic Device: Panic device per Section 08 71 00 to be provided by Aluminum Entrance Contractor per hardware schedule for aluminum entrance doors.
- 5. Closer: Heavy-Duty type.
- 6. Cylinder Lock: 5 pin mortised
- 7. Security strike as shown as security on hardware schedule; wiring by Electronic Systems Contractor.
- 8. Prepare doors to meet requirements of electronic systems swipe card entry security systems.
- 9. Push bottom door opener by Aluminum Door Contractor per Section 08 71 00 2.1 P
- J. Other Materials: All other materials, not specifically described but required for a complete and proper installation shall be new, first quality of their respective kinds and subject to approval of the Architect.

## **2.2** Acceptable Manufacturers:

- A. Kawneer
- B. U. S. Aluminum
- C. EFCO
- D. CMI Architectural Products
- E. Tubelite
- F. Oldcastle Building Envelope
- G. YKK AP Storefront Systems

# 2.3 Fabrication

A. Fabricate aluminum doors and frames to allow for clearances and shim spacing around perimeter of assemblies to enable installation.

- B. Fabricate aluminum sills, head jamb, jamb closures at exposed precast, insulation as all doors and sash terminations, caps at extended sills, etc, as shown on Drawings.
- C. Provide anchorage devices to securely and rigidly fit door and frame assemblies in place.
- D. Accurately and rigidly fit together joints and corners. Match components ensuring continuity of line and design. Ensure joints and connections are flush, hairline and weatherproof.
- E. Provide for moisture entering joints and condensation occurring within frame construction to drain to exterior.
- F. Make provision for hardware and provide required internal reinforcing.
- G. Shop prefabricate all doors and frames into complete units.
- H. Fabricate in strict accord with the approved Shop Drawings and the Manufacturer's published recommendations.
- I. Weld or mechanically fasten along entire line of contact on the unexposed side.
- J. No discoloration of the face after anodizing will be acceptable.

#### **PART 3 EXECUTION**

## 3.1 Surface Conditions

#### A. Inspection

- 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that doors and frames may be installed in complete accord with the original design and the approved Shop Drawings.
- 3. Assure that frame openings correspond to dimensions of frame furnished.
- 4. Beginning of installation means acceptance of existing conditions.

### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

## 3.2 Preparation

A. Verify all measurements at the job site prior to fabrication.

#### 3.3 Installation

A. Install aluminum doors and frames in accord with Manufacturer's recommendations. Ensure assemblies are plumb, level and free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

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- B. Use sufficient anchorage devices to securely and rigidly fasten door and frame assemblies to the building.
- C. Install all members with adequate provision for settling, expanding and contracting to occur without breaking glass.
- D. Install hardware in accord with Manufacturer's recommendations, using proper templates. Adjust operating hardware.
- E. Install batt insulation in shim spaces around perimeter of door and frame assemblies, to maintain continuity of thermal barrier.
- F. Install interior and exterior perimeter sealant and related backing materials in accord with workmanship and installation requirements indicated in Section 07 92 13.

## 3.4 Adjustment and Cleaning

- A. Remove protective material from prefinished aluminum surfaces.
- B. Remove dirt from exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealants or glazing compounds from exposed surfaces by moderate use of mineral spirits or other solvent acceptable to sealant Manufacturer.
- D. Touch up marred or abraded surfaces to match original finish.
- E. Adjust moving parts for smooth operation.
- F. Remove debris from project site.

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## **SECTION 08 71 00 HARDWARE**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Acceptable Manufacturers

> 1.2 Quality Assurance 3.1 Deliveries 1.3 Submittals 3.2 Installation

1.4 Product Delivery, Storage and Handling 3.3 Inspection of Installation

3.4 Setup & Training 2.1 Materials

#### **PART 1 GENERAL**

### 1.1 Description

A. Work Included: The required hardware for doors is indicated on the Drawings in the form of a hardware schedule.

## B. Related Work Specified Elsewhere

1.	Rough Carpentry	Section 06 10 00
2.	Architectural woodwork	Section 06 40 00
3.	Installation on metal doors and frames	Section 08 11 00
4.	Installation on wood doors and frames	Section 08 14 29
5.	Aluminum Entrances and Storefronts	Section 08 41 13
6.	Communication Cable and Equipment	Section 27 00 00

## **1.2** Quality Assurance

- A. Qualification of Supplier: The finish hardware supplier will employ a hardware consultant who will prepare all submittals and be available to the Owner for consultation should any problems arise during the course of the work; this consultation will be at no additional cost to the Owner. The hardware consultant shall check all installations and report to the Architect.
- B. Quality of Hardware: All hardware will meet applicable materials and finishes standards of the Builders' Hardware Manufacturer's Assn., ANSI A156, and Underwriters' Laboratory for all hardware in fire rated assemblies.

## C. Reference Standards

- 1. American National Standards Institute (ANSI):
  - a. A115.1 Door and Frame Preparation for Mortise Door Locks for 1-3/4 inch
  - b. A115.2 Door and Frame Preparation for Bored or Cylindrical Locks for 1-3/4 inch Doors.
  - c. A115.4 Door and Frame Preparation for Lever Extension Flush Bolts.
  - d. A115.5 Frame Preparation for 181 & 190 Series Deadlock Strikes.
  - e. A115.9 Door and Frame Preparation for Closer, Offset Hung, Single Acting.
  - f. A115.13 Door and Frame Preparation for Tubular Deadlocks.
  - g. A115.14 Preparation for Standard Steel Doors for Open Back Strikes.
  - h. A156.1 Butts and Hinges.

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- i. A117.1 Accessible and Usable Buildings and Facilities.
- j. A156.2 Locks and Lock Trim.
- k. A156.3 Exit Devices.
- I. A156.4 Door Controls (Closers).
- m. A156.6 Architectural Door Trim.
- n. A156.7 Template Hinges.
- o. A156.8 Door Controls (Overhead Holders).
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

## A. Samples

- 1. Submit samples of each type of hardware required for job.
- 2. Indicate required style and finish.
- B. Shop Drawings and Product Data
  - 1. Submit Shop Drawings and product data for each style of hardware.
  - 2. Indicate locations and mounting heights of each type of hardware.
  - 3. Supply templates to door and frame manufacturers to enable proper and accurate sizing and locations of cutouts for hardware.
- C. Material List: Before any finish hardware is ordered for this work, submit to the Architect, for approval, a complete list of all finish hardware proposed to be furnished, giving Manufacturer's name, catalog number with a picture of each item.
- D. Operation and Maintenance Data: Provide Architect with Manufacturer's parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

## 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Packaging
  - 1. Furnish all finish hardware with each unit clearly marked or numbered in accord with the Hardware Schedule.
  - 2. Pack each item complete with all necessary pieces and fasteners.
  - 3. Properly wrap and cushion each item to prevent scratches during delivery and storage.
- C. Delivery: Deliver all finish hardware to the installers in a timely manner to ensure orderly progress of the total work.
- 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.

## **PART 2 PRODUCTS**

2.1 Materials: All Hardware Finish is to be Clear Aluminum.

#### A. General

- 1. Provide items as listed in this Section, complete to function as intended.
- 2. Furnish all finish hardware with all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position securely.
- Furnish fastenings where necessary with expansion shields, toggle bolts, hex bolts and other anchors approved by the Architect, according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer.
- 4. Design: All fastenings shall harmonize with the hardware as to material and finish.
- 5. Fire label approved hardware to be used on all fire rated doors.
- B. Hinges: 5 knuckle, button tip, full mortise, template type, butts with non-rising loose pins. See schedule for ball bearings. Finish 4-1/2 X 4-1/2.
- C. Closures: Closures shall be LCN 4040XP Series or equal from Norton. Size all closers in accord with the Manufacturer's recommendations and good standard practice. All surface mounted closures shall be the product of a single manufacturer. Hold opens and door stops where scheduled.
  - 1. All closures with the exception of rated openings shall include HCUSH Hold Open type arms.
  - 2. Provide Special Rust Inhibitor to door closure at the Salt Shed service door.
  - 3. Stanley Precision 2000 series is also acceptable.
- D. Door Holders: Surface mounted or integral with door closure where applicable.
- E. Panic Hardware: Cylinder bolts and latches per schedule. Panic hardware at aluminum doors by aluminum door contractor.
  - 1. For single doors scheduled as "Panic NL", supply door pull as specified below and panic hardware with night latch function. Von Duprin – #99NL-OP type, fire hardware where scheduled, finish to be 313AN Dark Bronze.
  - 2. For double doors scheduled as "Panic NL", supply door pull as specified below and panic hardware with night latch function. Surface mounted vertical rod. Von Duprin - #9927NL-OP type, fire hardware where scheduled, finish to be 313AN Dark Bronze.
  - 3. For single doors scheduled as "Panic L", supply integral panic hardware and lever. Von Duprin -- #99L-06 type, fire hardware where scheduled, finish to be 313AN Dark Bronze.
  - 4. For double doors scheduled as "Panic L", supply integral panic hardware and lever. Surface mounted vertical rod. Von Duprin -- #9927L-06 type, fire hardware where scheduled, finish to be 313AN Dark Bronze.
  - 5. EL typical at all card reader location including PS 873 -2 Power supply with EPT-2 transfer.

## F. Door stops:

- 1. Wall mounted, rubber tipped, mount level with knob. 1" projection.
- 2. Floor mounted: cast dome type, rubber cushion.
- 3. Door mounted: Rubber tipped, 3-3/4" projection, mount where shown.
- 4. Integral with closer where scheduled.

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- G. Push-pull: Designer style 1" offset tube Rockwood #107X70B with Rockwood #70B push plate.
- H. Kick-plates: Colored plastic to match Hardware.
- I. Lockset
  - 1. Best Access Systems: 9K Series, or equal function as scheduled, Lever Style 15, Rose Style D, finish to be Clear Aluminum.
- J. Soundstop: Tear drop shape, Zero #188N or equal.
- K. Door Bottoms: On schedule listed as "Drop Down Seal"; Hager #747S to isolate sound from vehicle areas.
- L. Weatherstrip:
  - 1. Head and Jamb Zero #326 aluminum to sizes, color and profiles to fit door application and hardware color.
  - 2. Sill Sweep Zero #39W aluminum to color to fit hardware color.
- M. Name Plates: ABS plastic with raised lettering. White letters; background color selected from standard palette and symbols. ADA approved signs at toilet rooms. See drawings for details.
- N. Threshold: Saddle type, aluminum 6063-T5 mill finish, aluminum color, size 4" X 1/2".
- O. Latch Protectors:
  - 1. Applications: Exterior Entrance doors Cylindrical Lockset
  - 2. Model: Rockwood 320C Latch Protector
  - 3. Material: .090" Steel, Stainless Steel'
  - 4. Fastener: 5/16" 18 carriage bolts and hex drive sex nuts
  - 5. Finish: [2C/603] [US10BE/613E] [US32D/630]
- P. Keying
  - 1. All cylinders shall be construction masterkeyed. No substitutions will be allowed.
  - 2. Master key all locks in accord with Owner's Master Key system.
  - 3. Perform all keying at the factory. Have construction Master Keys only delivered to the job site. Send all other keys, tagged and identified directly to the Owner by registered mail. Stamp all permanent keys and key blanks: "Do Not Duplicate".
  - 4. Deliver two keys for each type of lock plus two master keys.
- P. Electric strikes: compatible with scheduled frames.
  - 1. Von Duprin Model #6211 strikes for Mortise or cylindrical devices
  - 2. Von Duprin 6300 Series Surface mounted for rim exit devices
- Q. Automatic door operators and entry and exit radio controlled push plates.
  - 1. Stanley Magic Access operators including headers, control boxes and arms or equal, One (1) each per doors 100A and 100B
  - 2. 24V Radio receivers or equal; One (1) each per doors 100A and 100B.
  - 3. 4 -1/2" Radio controlled push plates; Two (2) each per 100A and 100B.
  - 4. Color Dark Bronze

5. Stanley Precision 2000 Series is also acceptable

# 2.2 Acceptable Manufacturers

A. Exit Devices Russwin, Von Duprin, Stanley Precision B. Push-Pull Brookline, Dor-Line, Russwin, Hiawatha,

Rockwood, Ives

C. Cylinder Schlage, Corbin

D. Closer LCN, Norton, Stanley Precision

E. Wall Stop Ives, Corbin Russwin F. Threshold Brookline, Reese, Zero, **National Guard Products** 

Hager, Ives G. Hinges

H. Weatherstrip Gossen, Zero, National Guard Products

I. Kickplates Brookline, Ives

Best Access Systems, Schlage J. Locksets K. Door Holders Glynn-Johnson, Russwin National Guard Products, Zero L. Soundstops M. Door Sweeps National Guard Products, Zero

## **PART 3 EXECUTION**

3.1 Deliveries: 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.

## 3.2 Installation

- A. Install all hardware securely in place, test, oil, grease, adjust for perfect operation.
- B. Maintain following mounting heights for doors, from finished floor to center line of hardware item: Conform to applicable codes for accessibility requirements.
  - 1. Hinges
    - a. Top 5 inches from head of frame to top of hinge.
    - b. Bottom 10 inches from finished floor to bottom of hinge.
    - c. Intermediate centered between top and bottom hinges.
    - d. On Dutch doors 5 inches from head of frame to top of hinge; 10 inches from finished floor to bottom of bottom hinge. 5 inches from split line to top and bottom respectively of lower and upper intermediate hinges.
  - 2. Unit and integral type locks and latches 38 inches to centerline of knob.
  - 3. Deadlocks 48 inches to centerline of cylinder.
  - 4. Panic hardware 38 inches to centerline of cross bar.
  - 5. Door pulls 42 inches to center of grip.
  - 6. Push-pull bars 42 inches to centerline of bar.
  - 7. Arm pulls 47 inches to centerline.
  - 8. Push plates 48 inches to centerline of plate.
  - 9. Roller latches 45 inches to centerline.
  - 10. Nameplates 60 inches to centerline, on wall adjacent to latch side of door.

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- 3.3 Inspection of Installation: Upon completion of the installation, and as a condition of its acceptance, deliver to the Architect a report signed by the hardware consultant stating that the consultant's inspection was made, that all adjustments recommended have been complete, and that all finish hardware furnished under this Section has been installed and is in optimum working condition.
- **3.4 Setup and Training:** Upon completion of the installation of the electronic access hardware, install software and card encoder on site. Provide on site training and one-year of telephone support.

\* \* \* \* \* \* \* \* \* \* \* \*

## **SECTION 08 80 00 GLAZING**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Acceptable Manufacturers

> 1.2 Quality Assurance 2.3 Fabrication

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage and Handling 3.2 Preparation 1.5 Job Conditions 3.3 Installation

1.6 Warranty 3.4 Protection of Completed

2.1 Materials Work 3.5 Cleaning

### **PART 1 GENERAL**

## 1.1 Description

A. Work Included: Glass and glazing required for this Work includes tempered and regular plate glass; insulating glass; wire glass and safety glass; and bronze tint insulating glass; glass mirrors; glass doors; and glass sound seal.

B. Related Work Specified Elsewhere

1. Joint sealers Section 07 92 13 2. Metal doors and frames Section 08 11 00 3. Wood doors Section 08 14 29 4. Aluminum entrances and storefronts Section 08 41 13

## 1.2 Quality Assurance

- A. Qualifications of Manufacturers
- B. Qualifications of Installers: Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the referenced standards and the requirements of this Work, and who shall personally direct all installation performed under this Section of these specifications.
- C. Requirements of Regulatory Agencies: Install glass and glazing to meet requirements of State and Federal Building Codes.
- D. Source Quality Control
- E. Reference Standards
  - 1. American National Standards Institute (ANSI):
    - a. Z 97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings
  - 2. American Society for Testing and Materials (ASTM):
    - a. E 84, Surface Burning Characteristics of Building Materials.

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- 3. Federal Specifications (FS):
  - a. DD-G-451, Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors and Other Uses).
  - b. DD-G- 1403, Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).
  - c. TT-S-230, Sealing Compound: Synthetic Rubber Base, Single Component, Chemically Curing for Caulking, Sealing and Glazing in Building Construction.
  - d. TT-S-1543, Sealing Compound: Silicone Rubber Base (for Caulking, Sealing and Glazing in Buildings and Other Structures).
- 4. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual and Glazing Sealing Systems Manual for glazing installation methods.
- 5. Sealed Insulating Glass Manufacturers Association (SIGMA):
  - a. 64-7-2, Specification for Sealed Insulating Glass Units.
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Shop Drawings: Sections and details of glass installation at framing members such as head, mullions, transoms, jambs and sills. Provide schedule of sizes, quantities, locations and mounting methods.
  - B. Manufacturer's Literature
    - Manufacturer's descriptive data of glass materials. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
    - 2. Provide data on glazing sealant identifying available colors.

## 1.4 Product Delivery, Storage and Handling

- A. Protection
  - 1. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
  - 2. Keep glass free from contamination by materials capable of staining glass.
- B. Delivery of Materials
  - 1. Deliver glass with Manufacturer's labels intact. Do not remove labels until glass has been installed.
  - 2. Deliver glazing compounds and sealants in Manufacturer's unopened, labeled containers.
- 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.

## 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Perform glazing when ambient temperature is above 40 degrees F.
  - 2. Perform glazing on dry surfaces only.

# 1.6 Warranty

- 1. The subcontract for the glass will not be approved by the Owner until the subcontractor has submitted to the Owner, for approval, the proposed warranty on the glass material to be supplied. This warranty should be supplied to the Owner on execution of the General Contract. This warranty should cover a period of 5 years.
- 2. Include coverage of sealed glass units from seal failure, interpane dusting or misting and replacement of same.
- 3. Mirror warranty to cover glass and coating against discoloration or manufacturing defects and against failure from mastic.

# **PART 2 PRODUCTS**

# 2.1 Materials

#### A. Glass

- 1. Float Glass: FS DD-G-451; Type I, Class 1, quality; 1/4" and 3/8" inch thick.
- 2. Safety Glass: FS DD-G-451 and FS DD-G-1403; Type I; All floor to ceiling glass to be 3/8 inch tempered clear or bronze tint per elevations, all other interior glass walls to be 1/4" tempered clear or tint per elevations.
- 3. Safety Glass: FS DD-G-1403; Kind HS, Condition A. Type I, 1/4 inch thick minimum clear.
- 4. Tinted Glass: Float and safety glass Bronze tint heat absorbing: FS DD-G-451 and FS dd-G-1403 Style A. Type I, Class 2 - 1/4" inch thickness.
- 5. Insulated Glass Units: Double pane units with edge seal; outer pane 1/4 inch Bronze tint, inner pane 1/4" clear, 1/2 inch interpane space purged with inert argon gas. Total unit thickness 1 inch. Low emensitivity #3 surface. Tempered pane each face where required by 1.2.C or if shown on Drawings or specified in addition to above code reference.

Insulating glass to meet the following requirements:

- a. Transmittance: average daylight 44%; solar -35%; UV 23%
- b. External reflectance: average daylight 8%; solar 7%.
- c. Winter U-Value 0.30
- d. Shading coefficient 0.53
- e. Relative heat gain 111
- 6. Exterior and interior glass edge finished for silicone butt glazing.
  - a. Silicone Sealant: FS-S-1543, Type II, Class A, single component neutral cure medium modulus silicone for butt glazing, color as selected by Owner.
  - b. Urethane Sealant: FS S-230-6, Type II, Class A, single component polymer for general glazing, color as selected by Owner.
- 7. Mirror Glass: FS DD-G-451; 1/4 inch thick, quality Q2 clear plate glass; full silver coating, copper coating and Manufacturer's standard organic coating at 7.5 grams/square foot.
- 8. Spandrel Glass: Ceramic frit type to match tinted glass.

# B. Insulated Infill Panel

- 1. Basis of Design: Mapes Architectural Insulated Infill Panel
- 2. Thickness: 1"
- 3. Insulating Core: 2.5# Density Polystyrene
- 4. Substrate: Solid Plastic (ABS)
- 5. Finish: Standard Kynar (.032"). Architect color selection from standard colors.
- 6. Finish Warranty: 20 Years

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# C. Glazing Accessories

- 1. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness; 4 inches long by 3/8 inch wide by 1/4 inch high, chemically compatible with sealant used.
- 2. Spacer Shims: Neoprene; 50 Shore A durometer hardness; 3 inches long by 1/4 inch wide by 1/4 inch thick; self adhesive one face, chemically compatible with sealant used.
- Glazing Tape: Preformed butyl compound; 10-15 Shore A durometer hardness; coiled on release paper; Size and spacers where recommended by manufacturer; black color.
- 4. Glazing Splines: Resilient polyvinylchloride extruded shape to suit glazing channel retaining slot; color as selected.
- 5. Glazing Clips: Manufacturer's standard type.
- 6. Filler Rod: Compressible synthetic rubber of foam, chemically compatible with sealant use.
- 7. Primer-Sealers and Cleaners: As recommended by glass Manufacturer.

# **2.2** Acceptable Manufacturers

- A. Glass: SIGMA Member
- B. Glazing Compound: Tremco
  - 1. Butt glazing: Silicone sealant: Spectrum 2
  - 2. Standard glazing: Dymonic
- C. Substitutions: Under provisions of Section 01 60 00.

# 2.3 Fabrication

- A. Glass: All glass shall bear labels showing strength, thickness, type and quality and shall be relatively distortion free with all distortion waves in the horizontal direction and shall be in the following qualities.
- B. Interior Glazing: Door lites all tempered; 1/4 inch clear, tint, or frosted per door schedule: fixed lites 1/4 inch clear or tint plate tempered below eye level; 3/8 inch and 1/4 inch clear or tint plate, edges for butt glazing.
  - 1. Tinting Schedule
    - a. Provide Clear Glass Interior
    - b. Provide Bronze tinted glass Exterior
- C. Exterior Glazing
  - 1. Windows: One inch Bronze tint insulating.
  - 2. Doors and sidelites: One inch insulating tempered.
  - 3. Edges for butt glazing.
- D. Tempered Glass: Where tempered insulating glass is required by code, both lites will be tempered.
- E. Insulating Glass: Exterior insulating glass construction shall be; 1/4 inch Bronze exterior, 1/2 inch air space and 1/4 inch clear interior lite. Low emensitivity #3 surface, inert argon gas, tempered where specified or required. Edges for butt glazing.

# **PART 3 EXECUTION**

# 3.1 Surface Conditions

# A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that all glazing may be performed in accord with all pertinent codes and regulations, the original design and the reference standards.
- 3. Check that glazing channels are free of burrs, irregularities and debris.
- 4. Check that glass is free of edge damage or face imperfections.
- 5. Do not proceed with installation until conditions are satisfactory.
- 6. Beginning of installation means acceptance of substrate.

# B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Owner.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

#### A. Field Measurements

- 1. Measure size of frames to receive glass.
- 2. Compute actual glass size, allowing for edge clearances.

# B. Preparation of Surfaces

- 1. Remove protective coatings from surfaces to be glazed.
- 2. Clean glass and glazing surfaces, to remove dust, oil and contaminants and wipe dry.
- 3. Seal porous glazing channels or recesses.
- 4. Prime surfaces scheduled to receive sealant.

# 3.3 Installation - Application - Erection

#### A. General

- 1. Positioning Glass
  - a. Orient pattern and draw of glass pieces in same direction.
  - b. Place glass waves parallel to floor.
  - c. Set smooth side to exterior.
- 2. Do not cut, seam, nip or abrade tempered, heat strengthened, coated or insulating glass.
- Slope exterior surfaces of gaskets, tapes and sealant beads to provide for water runoff.
- 4. All glazing materials must be compatible.
- 5. Provide weep holes to remove all water from the glazing assembly.

# B. Exterior Dry Method (Preformed Glazing)

- 1. Cut glazing tape spline to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.
- 2. Place setting blocks at 1/4 points.

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- 3. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.
- 4. Install removable stops without displacement of glazing spline. Exert pressure for full continuous contact.
- 5. Trim protruding tape edge.
- C. Interior Dry Method (Tape and Tape)
  - 1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sightline.
  - 2. Place setting blocks at 1/4 1/3 points.
  - 3. Rest glass on setting blocks and push against tape for full contact at perimeter of pane.
  - 4. Place glazing tape on free perimeter of pane in same manner described above.
  - 5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
  - 6. Knife trim protruding tape.

# 3.4 Protection of Completed Work

- A. Attach crossed streamers away from glass face.
- B. Do not apply markers to glass surface.
- C. Replace damaged glass.

# 3.5 Cleaning

- A. Remove excess glazing compound from installed glass and frames.
- B. Remove labels from glass surface as soon as installed.
- C. Wash and polish faces of glass.
- D. Remove debris from worksite.

\* \* \* \* \* \* \* \* \* \* \*

# **SECTION 09 29 00 GYPSUM WALLBOARD**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

1.1 Description 1.5 Job Conditions INDEX

> 1.2 Quality Assurance 2.1 Materials

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage 3.2 Installation and Handling 3.3 Application

3.4 Adjust and Clean

#### **PART 1 GENERAL**

#### 1.1 Description

- A. Work Included: Gypsum wallboard is required on interior wall and ceiling surfaces where so indicated on the Drawings.
  - 1. Metal Framing required for gypsum board.
  - 2. Gypsum board.
  - 3. Taped and sanded joint treatment.
- B. Related Work Specified Elsewhere

1. Stud Partition (sound batt) Section 07 21 00 2. Ceramic Tile Section 09 31 00 3. Painting Section 09 91 00

# **1.2** Quality Assurance

- A. Qualifications of Installers
  - 1. Use only skilled and experienced gypsum wallboard installers for laying up the wall board, fastening, taping and finishing.
  - 2. In the acceptance or rejection of installed gypsum wallboard, no allowance will be made for lack of skill on the part of installers.
- B. Requirements of Regulatory Agencies
  - 1. Underwriters' Laboratories, Inc.
    - a. Fire Hazard Classification (40 U8.22).
    - b. Fire Resistance Classification (40 U18).
- C. Testing: Fire resistance: ASTM E 119.
- D. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. C 36, Gypsum Wallboard
    - b. C 475, Joint Treatment for Gypsum Wallboard Construction.
    - c. C 754, Specification for Installation of Steel Framing Members to Receive Screwattached Gypsum Wallboard, Backing Board or Water-resistant Backing Board.
    - d. E 119, Standard Methods of Fire Tests of Building Construction and Materials.
  - 2. Underwriters' Laboratories, Inc. (UL)
    - a. UL U8-22, Wallboard, Gypsum
    - b. UL 40 U18, Fire Resistance Classification.

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- 3. Gypsum Association (GA)
  - a. GA-214-M-97 recommended levels of Gypsum Board Finish.
- Submittals: Within 15 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Manufacturer's Recommendations
    - Submit two copies of the Manufacturer's current recommended method of installation for each item.
    - 2. The Manufacturer's recommended methods of installation, when approved by the Architect, shall be the basis for acceptance or rejection of actual installation methods used in this Work.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery and Handling
  - 1. Deliver materials to the project site with Manufacturer's labels intact and legible.
  - 2. Handle materials with care to prevent damage.
  - 3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.

# C. Storage

- 1. Store materials inside under cover, stack flat, off floor.
- 2. Stack wallboard so that long lengths are not over short lengths.
- 3. Avoid overloading floor system.
- 4. Store adhesives in dry area, provide protection against freezing at all times.
- 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.

#### 1.5 Job Conditions

- A. Environmental Conditions: Ventilation: Provide ventilation during and following adhesives and joint treatment applications.
- B. Protection: Protect adjacent surfaces against damage and stains.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Gypsum Wallboard: Provide gypsum wallboard materials in accord with recommendations of GA 216. Fire Partitions constructed per approved UL Design Number.
  - 1. Fire-rated board
    - a. ASTM C 36, Type X
    - b. Thickness: 5/8 inch.
  - 2. Sag resistant board at ceilings

- a. ASTM C 1395/ C 1396
- b. Thickness: ½ inch
- 3. Moisture resistant board at toilet rooms.
- 4. Cement board backer at ceramic wall tile.
- 5. Vapor barrier 6 mil at all exterior walls

#### B. Fasteners

- 1. Screws
  - a. Self-drilling, self-tapping, bugle head, for use with power driven tools.
    - (1) Type S for wallboard to sheet metal application.
    - (2) Type G for wallboard to wallboard application.
  - b. Length
    - (1) Single layer or base layer application.
      - (a) Type W: 1-1/4"
    - (2) Face layer of two layer application
      - (a) Type W: 1-5/8"
    - (3) Wallboard to wallboard in multiple application: Type G, 1-1/2".
- C. Joint Treatment Materials
  - 1. General: All joint system including tape and compounds, shall be a system recommended by the manufacturer of the gypsum panels used as compatible with the gypsum panels.
  - 2. Joint Tape: ASTM C 475: Perforated tape.
  - 3. Joint compound: Ready-mixed joint compounds.
- D. Metal Cornerbead and Trim: All metal cornerbead and trim and all accessory items, shall be a system recommended by the Manufacturer of the gypsum panels used as being compatible with the gypsum panels.
- E. Water: All water used in joint system shall be clean, fresh and free from deleterious amounts of foreign material.
- F. Furring Partition Runners
  - 1. Floor and Ceiling Runners:
    - a. Cold formed galvanized steel.
    - b. Size: 3-5/8 inches.
    - c. Shape 1 1/4" base track, 3" slip track at wall head for floor/ceiling deflection.
    - d. Formed with inserts, slots, notches or perforations to hold lath or studs securely in place.
- G. Non-Loadbearing Prefabricated Steel Screw Studs
  - 1. Cold formed galvanized steel.
  - 2. Thickness: 25 gauge.
  - 3. Shape: Roll formed channel with punched openings along solid web and knurled flanges.
  - 4. Furnish floor and ceiling tracks of acceptable stud manufacturer's regular type for stud specified.
  - 5. Size: 3-5/8 inches.
- H. Furring Channel, Screw Type
  - 1. Cold formed galvanized steel.
  - 2. Minimum thickness: 26 gauge

- 3. Plain or knurled face to receive screws.
- 4. Suitable for 1-1/2 inch thick rigid insulation.
- I. Sound Seal: Manufacturer's standard, caulk type sound seal at floor and roof deck.

#### J. Metal Accessories

- 1. General:
  - a. Shapes used as grounds: Sized and dimensioned to provide for required plaster thicknesses.
  - b. Flanges:
    - (1) Designed to permit complete embedment of accessory in plaster.
    - (2) Provide for alignment and attachment to underlying surface.
- 2. Corner Beads:
  - a. Fabrication: Minimum 26 gauge galvanized steel.
  - b. Flexible type, perforated flanges.
- 3. Casing beads:
  - a. Fabrication: Minimum 24 gauge galvanized steel.
  - b. Style: Square end
- 4. Expansion Joints:
  - a. Fabrication: minimum 26 gauge galvanized steel
  - b. Provide with double stops.
  - c. Flanges: expanded
  - d. Provide adjustable opening with solid type flanges.
- 5. No plastic accessories allowed.
- K. Other Materials: All other materials, not specifically described but required for a complete and proper installation of gypsum drywall, shall be as selected by the Contractor subject to approval of the Architect.

# **PART 3 EXECUTION**

#### 3.1 Surface Conditions

#### A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- Verify that gypsum wallboard may be installed in accord with the original design, all pertinent codes and regulations, and the Manufacturer's recommendations as approved by the Architect.
- 3. Check framing for accurate spacing and alignment.
- 4. Verify that spacing of installed framing does not exceed maximum allowable for thickness of wallboard to be used.
- 5. Verify that frames are set for thickness of wallboard to be used.
- 6. Do not proceed with installation of wallboard until deficiencies are corrected and surfaces to receive wallboard are acceptable.
- 7. Protrusions of framing, twisted framing members or unaligned members must be repaired before installation of wallboard is started.

# 3.2 Installation

- A. Furring and Lathing
  - 1. Erection of Non-loadbearing Screw Studs Hollow Partitions:

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- a. Floor and ceiling Tracks
  - (1) Align floor and ceiling tracks.
  - (2) Attach to concrete with power-driven fasteners.
  - (3) Wire-tie to structural framing.
  - (4) Attach tracks to structure at maximum of 24 inches on center.
- b. Screw Studs:
  - (1) Plumb and align studs.
  - (2) Space studs 16 inches on center.
  - (3) Attach studs to floor and ceiling track by screwing
  - (4) If necessary, splice studs by nesting with minimum lap of 8 inches.
- c. Horizontal Stiffeners:
  - (1) Brace studs with steel channel stiffeners place horizontally on inside of partition.
  - (2) Spacing: Maximum 4'-6" o.c. quarter points vertically.
  - (3) Secure as recommended by stud Manufacturer.
- d. Framing Around Door Openings:
  - (1) Hollow metal door frames:
    - (a) Install stud at each jamb of hollow metal door frames continuous for full height of partition.
    - (b) Screw stud to jamb anchors of frame.
    - (c) Tack weld a second stud to stud at door jamb, nested to form box.
  - (2) Attach section of floor track horizontally to head of frame.
    - (a) Install jack studs at 16 inches on center over head of door frame.
    - (b) Attach jack studs to floor track and anchor top in same manner as provided for full studs.
- e. Form corners and intersections of partitions with three studs.
- f. Place studs forming internal corners 2 inches from point of partition intersection.
- g. Provide headers above and below framed wall openings having area of 2 square feet or more.
- B. Follow U.L. Specifications for Fire Rated Assemblies.

# 3.3 Application

#### A. General

- 1. Use wallboard of maximum lengths to minimize end joints.
- 2. Stagger end joints when they occur.
- 3. Framing and wallboard will fit tight to stems and flanges of existing precast concrete roof deck for two hour rated construction.
- 4. Support ends and edges of wallboard panels on framing members.
- 5. Perform gypsum wallboard work in accord with recommendations of ASTM C 754 and GA 216 unless otherwise specified in this Section.
- B. Joint System
  - 1. Taping and finished joints
    - a. Taping or embedding joints
      - (1) Apply compound in thin uniform layer to all joints and angles to be reinforced.
      - (2) Apply reinforcing tape immediately.
      - (3) Center tape over joint and seat tape into compound.
      - (4) Leave approximately 1/64 to 1/32 inch compound under tape to provide bond.
      - (5) Apply skim coat immediately following tape embedment but not to function as fill or second coat.

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- (6) Dry embedding coat prior to application of fill coat.
- b. Filling
  - (1) Apply joint compound over embedding coat.
  - (2) Fill taper flush with surface.
  - (3) Apply fill coat to cover tape.
  - (4) Feather out fill coat beyond tape and previous joint compound line.
  - (5) Joints with no taper: Feather out at least 4 inches on eight side of tape.
  - (6) Allow fill coat to dry prior to application of finish coat.
- c. Finishing
  - (1) Spread joint compound evenly over and beyond fill coat on all joints.
  - (2) Feather to smooth uniform finish.
  - (3) Apply finish coat to taped angles to cover tape and taping compound to provide surface ready for decoration.
- 2. Filling and finishing depressions
  - a. Apply joint compound as first coat to fastener depressions.
  - b. Apply at least two additional coats of compound after first coat is dry.
  - c. Leave filled and finished depressions level with plane of surface.
- 3. Finishing beads and trim
  - a. First fill coat
    - (1) Apply joint compound to bead and trim.
    - (2) Feather out from ground to plane of the surface.
    - (3) Dry compound prior to application of second fill coat.
  - b. Second fill coat
    - (1) Apply joint compound in same manner as first fill coat.
    - (2) Extend beyond first coat onto face of wallboard.
    - (3) Dry compound prior to application of finish coat.
  - c. Finish coat
    - (1) Apply joint compound to bead and trim.
    - (2) Extend beyond second fill coat.
    - (3) Feather finish coat from ground to plane of surface.
    - (4) Sand finish coat to provide flat surface ready for decoration.
- 4. Finish to be minimum levels according to the "recommended levels of gypsum board finish #GA-214-M-97.

# 3.4 Adjust and Clean

- A. Nail Pop
  - 1. When face paper is punctured drive new nail or screw approximately 1-1/2 inches from defective fastening and remove defective fastening.
  - 2. Fill damaged surface with compound.
- B. Fill cracks with compound and finish smooth and flush.
- C. Cleaning Up: Do not allow the accumulation of scraps and debris arising from the work of this Section but maintain the premises in a neat and orderly condition at all times; in the event of spilling or splashing compound onto other surfaces, immediately remove the spilled or splashed material and all trace of the residue to the approval of the Architect.

\* \* \* \* \* \* \* \* \* \* \* \*

# **SECTION 09 31 00 CERAMIC TILE**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage and Handling1.5 Job Conditions3.2 Installation3.3 Cleaning

# PART 1 GENERAL

# 1.1 Description

A. Work Included: Ceramic tile required for this Work is indicated on the Drawings and includes walls, floors and base.

B. Related Work Specified Elsewhere

Gypsum Wallboard
 Toilet and Bath Accessories
 Plumbing Systems
 Section 09 29 00
 Section 10 28 13
 Division 22

C. Work Installed but Furnished by Others

1. Toilet and Bath Accessories Section 10 28 13

# 1.2 Quality Assurance

#### A. Qualifications of Installers

- 1. For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this Work and the recommendations contained in the referenced Standards.
- 2. In acceptance or rejection of installed ceramic tile, no allowance will be made for lack of skill on the part of tile setters.

# B. Reference Standards

- 1. American National Standards Institute (ANSI):
  - a. A 108.1 Installation of Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile with Portland Cement Mortar.
  - b. A 108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar on Latex-Portland Cement Mortar.
  - c. A 118.1, Dry-Set Portland Cement Mortar.
  - d. A 136.1, Organic Adhesives for Installation of Ceramic Tile.
- 2. American Society for Testing and Materials (ASTM):
  - a. A 185, Welded Steel Wire Fabric for Concrete.
  - b. C 144, Aggregate for Masonry Mortar.
  - c. C 150, Portland Cement.
- 3. Tile Council of America, Inc. (TCA)
  - a. 137, Recommended Specification for Ceramic Tile.
- 4. Set all tile in accord with the "Handbook for Ceramic Tile Installation" of the Tile Council of American, Inc.

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Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

#### A. Samples

- 1. Glazed wall tile: Panel for each color and type.
- 2. Paver Tile: Two tiles per sample for each color and type.
- 3. Accessories: Each color, type and style.
- 4. Edging Strips:
  - a. Length: 12 inches.
  - b. Show type and finish.
- 5. Grout color chips.
- B. Manufacturer's Instructions: Furnish manufacturer's instructions for use of mortars, adhesives and grouts.
- C. Extra Stock: Provide 1/4 cartons of each tile.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery and Storage of Materials
  - 1. Deliver materials in manufacturer's original sealed containers.
    - a. Labels legible and intact identifying brand name and contents.
    - b. Tile cartons grade-sealed by manufacturer in accord with TCA 137.
    - c. Grade-seals unbroken.
    - d. Manufactured mortars and grouts to contain hallmarks certifying compliance with referenced standards and be types recommended by tile Manufacturer for application.
    - e. Adhesives in containers labeled with hallmarks certifying compliance with reference standards.
  - 2. Deliver dry-set mortar in sealed, moisture-proof containers.
  - 3. Store materials under cover in manner to prevent damage or contamination.
- 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.

#### 1.5 Job Conditions

A. Environmental Requirements: Set and grout tile when ambient temperature is at least 50 degrees F. and rising.

#### **PART 2 PRODUCTS**

# 2.1 Materials

- A. Tile
  - 1. Conforming to TCA 137.1.

#### a. Grade: Standard

#### A. Paver Tile:

- 1. Floor Tile (CFT-1): See Plan for locations.
  - a. Product: "NeoSpeck" by American Olean
  - b. Construction: Flooring
  - c. Thickness: 5/16"
  - d. Finish: Matte
  - e. Water Absorption: ASTM C373 (<0.5%)
  - f. Break Strength: ASTM C648 (>275 lbs.)
  - g. Scratch Hardness: ASTM MOHS (8.0)
  - h. Chemical Resistance: ASTM C650 (Resistant)
  - i. Standard Size: 12" x 24" approx. (30.00 cm x 60.48 cm)
  - i. Color: Architect Selection

# B. Wall Tile:

- 1. Wall Tile (CWT-1): See Plan for locations.
  - a. Product: "NeoConcrete" by American Olean
  - b. Construction: Wall Cover
  - c. Thickness: 5/16"
  - d. Finish: Matte
  - e. Water Absorption: ASTM C373 (<0.5%)
  - f. Break Strength: ASTM C648 (>275 lbs.)
  - g. Scratch Hardness: ASTM MOHS (8.0)
  - h. Chemical Resistance: ASTM C650 (Resistant)
  - i. Standard Size: 3" Mosaic 12" x 24" approx. (30.00 cm x 60.48 cm)
  - j. Color: Architect Selection

#### C. Wall Base

- a. TCA 137.a Designation
- b. Construction: Floor Tile (CFT-1).
- c. Installation: Align all jointing with floor tile (CFT-1) and wall tile (CWT-1).

# B. Setting Materials

- 1. Portland Cement Mortar:
  - a. Portland cement: ASTM C 150, Type I.
  - b. Sand ASTM C 144.
  - c. Water: Clean and potable.
  - d. Mortar bed reinforcement.
    - (1) Welded wire fabric:
      - (a) Conforming to ASTM A 185.
      - (b) Size: 2" x 2" mesh 16/16 wire
- 2. Dry-set Mortar: Conforming to ANSI A 118.1.

# C. Grouting Materials

- 1. Commercial portland cement grout:
  - a. As manufactured by
  - b. Color: As selected
- 2. Sand-portland cement grout:
  - a. Portland cement: ASTM C 150, Type 1.
  - b. Sand: ASTM C 144.

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- c. Hydrated lime: ASTM C 206, or ASTM C 207, Type S.
- d. Water: Clean and potable.
- e. Mixes:
  - (1) For pavers: mix 1 part portland cement to 2 parts fine graded sand, and up to 1/5 part hydrated lime by volume. Color as selected.
- 3. Dry-Set Grout:
  - a. Dry-set grout as manufactured for ceramic wall tile.
  - b. Color: White
  - c. Porcelain tile: Follow tile manufacturer's recommendations for grout and mixing.
- 4. Latex-portland cement grout: Special latex emulsions with dry-set grout, replacing all or part of water according to directions.

#### D. Accessories

- 1. Metal termination bars and control joints Required at all terminations
  - a. Blanke or Schluter

# **2.2** Acceptable Manufacturers

- A. Tile Work:
  - 1. American-Olean
  - 2. U.S. Ceramic
  - 3. Dal-Tile
  - 4. Graniti Fiandre
  - 5. Crossville

#### **PART 3 EXECUTION**

# 3.1 Surface Conditions

- A. Inspection
  - 1. Examine surfaces to receive ceramic tile, setting, beds, or accessories before tile installation begins for:
    - a. Defects or conditions adversely affecting quality and execution of tile installation.
  - 2. Do not proceed with installation work until unsatisfactory conditions are corrected.
- B. Condition of Surfaces to Receive Tile
  - 1. Surfaces to be firm, dry, clean and free of oily or waxy films.
  - 2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile to be installed prior to proceeding the tile work.
- C. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Architect.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

#### 3.2 Installation

- A. Ceramic Tile
  - 1. Conventional portland cement mortar: ANSI A 108.1.
  - 2. Dry-set portland cement mortar: ANSI A 108.5.
  - 3. Methods:

- a. Floor Tile and Pavers: Install tile in accord with TCA Method. F-113-03
- b. Wall and Base Tile: Install tile in accord with TCA Method W-244-03 over plaster base or cement board per details.
- B. Install Edge Strips
  - 1. At openings without thresholds and similar discontinuous edges of thin-set tile floors.
  - 2. Where ceramic tile floors are adjacent to other flooring material at the same level.
  - 3. Where ceramic tile cove base is combined with other types of flooring.
- C. Color Patterns
  - 1. See drawings for wall and floor accent stripes and patterns.
- 3.3 Cleaning Up: Upon completion of all ceramic tile installation and grouting, thoroughly clean and polish the exposed surfaces of all ceramic tile.

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# **SECTION 09 51 00 ACOUSTICAL CEILINGS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage and Handling 3.2 Preparation

1.5 Job Conditions
3.3 Installation
3.4 Adjustments and Cleaning

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: The suspended acoustical ceiling systems required for this work are indicated on the Drawings and consist of suspended exposed metal grid with acoustical board panels. See "Ceiling" on Room Finish Schedule in the Drawings.

# B. Related Work Specified Elsewhere

1.	Precast Concrete	Section 03 41 00	
2.	Masonry	Section 04 20 00	
3.	Gypsum Wallboard	Section 09 29 00	
4.	Sprinkler System	Division 22	
5.	Air distribution grilles	Division 22	
6.	Electrical Fixtures	Division 26	

C. Work Furnished but Not Installed: Furnish hanger inserts in time to be installed in precast decking.

# 1.2 Quality Assurance

#### A. Qualification of Installers

- The suspended ceiling subcontractor shall have a record of successful installations
  of similar ceilings acceptable to the Architect and shall be currently approved by the
  Manufacturer of the ceiling suspension system.
- 2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

#### B. Allowable Tolerances

- 1. Deflection:
  - a. Suspension system components, hangers and fastening devices supporting light fixtures, ceiling grilles and acoustical units: Maximum deflection of 1/360 of the span.
  - b. Deflection test: ASTM C 635. Allowable tolerance of finished acoustical ceiling system: level within 1/8 inch in 10 feet.
- 2. Accessibility percentage: full

#### C. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. C 635, Metal Suspension Systems for Acoustical Tile and Lay-in Panel Systems.
  - b. C 636, Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
  - c. D 1779, Adhesive for Acoustical Materials.
- 2. Federal Specifications (FS)
  - a. SS-S-118, Sound Controlling Blocks and Boards (Acoustical Tiles and Panels, Prefabricated).
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

#### A. Samples

- 1. Submit one full size samples of each type of acoustical material to illustrate color and range of appearance.
- 2. Submit one full size sample of each suspension system member, moldings and hangers.
- B. Manufacturer's Recommendations: Submit for review of Architect the Manufacturer's recommendation for installation of suspension system.

# C. Maintenance Materials

- 1. Furnish extra materials equal to 2 percent of each type of acoustical material supplied.
- 2. Furnish suspension system components in amount sufficient to install extra ceiling
- Securely wrap and identify all extra materials.

# 1.4 Product Delivery, Storage and Handling

- A. Delivery of Materials: Deliver materials in original, unopened, protective packaging, with Manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.
- B. Store materials in original protective packaging to prevent soiling, warpage, physical damage or wetting.
- C. Do not begin installation until sufficient materials to complete a room are received.
- D. 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.

# 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Installation of acoustical treatment shall not begin until all wet work, such as plastering, concrete and terrazzo work, is completely dry.
  - 2. Maintain relative humidity of not more than 70 percent in area where acoustical materials are to be installed, 25 hours before, during and 25 hours after installation.

3. Maintain a uniform temperature in the space of 60 to 85 degrees F. prior to and during installation of materials.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Suspension Materials
  - 1. Suspension Systems:
    - a. Suspension Systems:
      - (1) ASTM C 635.
      - (2) Structural classification: 1-1/2" Intermediate duty systems for 3/4" panels.
      - (3) All components of system from one Manufacturer.
    - b. Main, cross and concealed members:
      - (1) Web design: Double
      - (2) Cold-rolled steel, minimum thickness of 0.020 inch, electrozinc coated and factory painted low sheen satin white finish.
    - c. Edge molding, minimum 0.020 inch steel channel or angle shaped, with minimum flange width of 15/16 inch.
    - d. Rough Suspension:
      - (1) Hanger wire: Minimum 12 gage, galvanized, soft-annealed, mild steel wire.
      - (2) Wire ties: 18 gage, galvanized annealed steel wire.
  - 2. Adhesive: ASTM D 1779.
  - Caulking: Non-staining type
- B. Acoustical Unit Materials (Acoustical Tile ACT-1 on Schedule)
  - 1. Acoustic Tiles: USG Astro Climaplus Performance: Conforming to the following:
    - a. Size: 24 inches by 24 inches. Foil backed.
    - b. Thickness: 5/8 inches.
    - c. Composition: Mineral fiber
    - d. Sound Absorption: 0.55 NRC (or greater).
    - e. Sound Attenuation: 35 CAC
    - f. Light Reflectance: ASTM C 523 (0.86).
    - g. Performance: Mold and Mildew Resistance
    - h. Edge: Shadowline Tapered
    - i. Surface Color: White, factory applied
- C. Acoustical Unit Materials (Acoustical Tile ACT-2 on Room Finish Schedule in Drawings)
  - 1. Acoustic Tiles: ClimaPlus Vinyl: Conforming to the following:
    - a. Size: 24 inches by 24 inches. Paper backed.
    - b. Thickness: 1/2 inches.
    - c. Composition: Sheet Rock
    - d. Light Reflectance: ASTM C 523, LR-1 (0.77 or more).
    - e. Edge: Square
    - f. Surface Color: White, factory applied

# 2.2 Acceptable Manufacturers

- A. Suspension Systems
  - 1. Armstrong
  - 2. Chicago Metallic Corporation

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- 3. Donn Corporation
- B. Acoustical Units
  - 1. Armstrong
  - 2. Celotex
  - 3. United States Gypsum

# **PART 3 EXECUTION**

#### 3.1 Surface Conditions

# A. Inspection

- Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that suspended ceiling systems may be installed in strict accord with all pertinent codes and regulations, the approved Shop Drawings and the Manufacturer's recommendations. Verify that layout of hangers will not interfere with other work.
- 2. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of Work.
- 3. Mark access provisions as to size and location before beginning installation
- 4. Areas to which acoustical units will be cemented. Must be free of oils from residue or materials that will affect bond capabilities of adhesive.
- 5. Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.
- 6. Beginning of installation means acceptance of existing conditions.

#### 3.2 Installation

#### A. General

- Installation of products in this Section shall occur after all components in the ceiling plenum are installed. The building shall be in proper condition to receive the acoustical materials and suspension system before any of the material shall be installed. The acoustical materials shall be installed under conditions of normal occupancy. All wet work shall be completely dry, and the building fully enclosed.
- B. Suspension Systems: ASTM C 636.

# C. Rough Suspension

- 1. Hangers:
  - a. Attach secure to structure/joist/deck/etc. thru plaster ceilings or metal pan ceilings hangers inserts installed as recommended by Manufacturer.
  - b. Space hanger wire 4'-0" on center.
  - c. Install additional hangers at ends of each suspension member and at light fixtures, 6 inches from vertical surfaces.
  - d. Do not splay wires more than 5 inches in a 4 foot vertical drops.
  - e. Wrap wire a minimum of three times horizontally, turning ends upward.
  - f. Provide lateral bracing with wire at 45 degree angles as required. Secure lateral bracing to structure above ceiling.

- 2. Install carrying channels with leveling clips to main structure for indirect hung suspension system.
- 3. Main and cross runners:
  - a. Space main runners at 4 feet on center, at right angle to carrying channel.
    - (1) Level and square to adjacent walls.
    - (2) Wire clip to channels at all intersections.
  - b. Space cross runners at 2 feet on center.
  - c. Install at height shown on Room Finish Schedule.
- D. Acoustical Units
  - 1. Install in level plane in straight line courses, free from twist, warp and dents.
  - 2. Cut out tile face at walls attached to grid for flat tile insertion.
  - 3. Place materials to bear all around on suspension members.
  - 4. Minimum width of border tiles: One-half unit dimension.
  - 5. Sound barrier: Install fiberflas pads with foil face up.

# 3.4 Adjustments and Cleaning

- A. Clean soiled or discolored unit surfaces after installation.
- B. Touch up scratches, abrasions, voids and other defects in painted surfaces. At the Owner's discretion, remove and replace any repaired units that still do not have a like new appearance.
- C. Remove and replace damaged or improperly installed units.

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# **SECTION 09 65 00 RESILIENT FLOORING**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

1.1 Description INDEX 2.1 Materials

> 1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage 3.2 Preparation and Handling 3.3 Application 3.4 Installation 1.5 Job Conditions

1.6 Warranty 3.5 Finishing and Cleaning

# **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Resilient flooring required for this Work is indicated on the Room Finish Schedule in the Drawings and includes:
  - 1. Vinyl composition tile flooring
  - 2. Vinyl base cove
- B. Related Work Specified Elsewhere

1.	Cleaning	Section 01 77 16
2.	Finishes for concrete slabs and topping substrates	Section 03 30 00
3.	Ceramic Tile	Section 09 31 00
4.	Carpeting	Section 09 68 00

# 1.2 Quality Assurance

- A. Qualifications of Installers
  - 1. Use only skilled and experienced resilient flooring installers for preparation of substrate and actual installation of resilient flooring.
  - 2. In the acceptance or rejection of installed resilient flooring, no allowance will be made for lack of skill on the part of installers.
- B. Manufacturer's Recommendations: The Manufacturer's recommended methods of installation, when approved by the Architect, shall be the basis for acceptance or rejection of actual installation methods used on this Work.
- C. Reference Standards
  - American Society for Testing and Materials (ASTM):
    - a. E 84 Surface Burning Characteristics of Building Materials
    - b. F 1913
  - 2. Federal Specifications (FS):
    - a. SS-T-312, Tile, Floor: Vinyl Composition
    - b. SS-W-40, Wall Base: Vinyl Plastic
    - c. MMM-A-115, Adhesive, Asphalt, Water Emulsion Type (For Vinyl Emulsion Tile).
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

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# A. Samples

- 1. Submit minimum of 1 sample of each type and color or pattern of resilient flooring and base material.
- 2. Submit two inch long sample of base material for each color specified.
- B. Manufacturer's Recommendations: Accompanying the samples, submit two copies of the Manufacturer's current recommended method of installation for each item.
- C. Maintenance Data and Instructions: Upon completion and prior to acceptance of the Work, furnish 2 copies of a list of recommended maintenance products and recommended maintenance methods and procedures. Include suggested schedule for cleaning, stripping and re-waxing.

#### D. Maintenance Materials

- 1. Furnish additional floor covering materials for replacement and maintenance.
- 2. Furnish materials of each size, color, pattern and type of material included in the Work.
- 3. Furnish materials at the rate of one carton per 1000 square feet of each color and style. One carton minimum.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect resilient flooring materials before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns and quality designations legible and intact.
- C. Do not open containers or remove markings until materials are inspected and accepted.
- D. Store and protect accepted materials in accord with Manufacturer's directions and recommendations.
- E. Unless otherwise directed, store materials in original containers at not less than 70 degrees F. for not less than 3 days immediately before installation.
- F. 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.

# 1.5 Job Conditions

- A. Environmental Requirements:
  - 1. Maintain temperature in space to receive tile between 70 and 90 degrees F. for not less than 24 hours before and 48 hours after installation.
  - 2. Maintain minimum temperature of 55 degrees F. after flooring is installed except as specified in paragraph 1.5.A.1.

1.6 Warranty: Warranty installation against defects in material and workmanship for one year from acceptance of installation by the Architect. Warranty will cover all cost for labor and materials required for replacement.

#### **PART 2 PRODUCTS**

# 2.1 Materials

#### A. General

- 1. All resilient floor tile and base of each type shall be the product of one Manufacturer and shall, to the maximum extent possible, be of a single batch number.
- 2. Colors and Patterns: All colors and patterns shall be as selected by the Architect for the standard range of colors and patterns of the selected Manufacturer; colors and patterns will be limited to not more than one field color per room or space and not more than a total of four field colors in the total Work. Patterns as shown on drawings.

# B. Floor Covering Materials

- 1. General:
  - a. Uniform in thickness and size.
  - b. Edges cut accurately and square.
  - c. Uniform color with variations in variegated patterns kept to a minimum.
- 2. LVT-1 Luxury Vinyl Tile (as noted on drawings).
  - a. Product: Brushed Lines
  - b. Manufacturer Interface or Architect Approved Equal
  - c. Size: 25 cm x 1 m (9.845 in x 39.38 in)
  - d. Product Number: A016
  - e. Product Construction: High Performance Luxury Vinyl Tile
  - f. Class / ASTM F1700: Class III Printed Vinyl Plank
  - g. Wear Laver Thickness: 22 MIL
  - h. Total Thickness: 4.5 mm
  - i. Backing Class: Commercial Grade
  - j. Finish: Ceramor
  - k. Full Life Cycle Carbon Emissions: Carbon Neutral Floors™
  - I. Color: Architect Selection

#### C. Base Materials

- 1. General:
  - a. Uniform in thickness.
  - b. As long lengths as practicable to suit conditions of installation.
- 2. Standard vinyl base (marked '4" Vinyl' on Schedule):
  - a. FS SS-W-40 a Type II.
  - b. 4 inches high: style per schedule.

#### D. Application Materials

1. General: Provide type and brands of adhesive as recommended by Manufacturer of covering material for the conditions of the installation.

# 2.2 Acceptable Manufacturers

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# A. Tile

- 1. LVT
  - a. Interface
  - b. J+J Flooring
  - c. Mannington

# B. Base, Risers and Treads

- 1. Johnsonite
- 2. Roppe
- 3. VPI

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

# A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that resilient flooring may be installed in accord with the original design and the Manufacturer's recommendations.
- B. Examine substrate for excessive moisture content (7% maximum) and uneveness which would prevent execution and quality of resilient flooring as specified. Concrete floor slabs to be at least 6 weeks old at time of tile installation. Maximum variation of 1/8 inch in 10 feet.
- Beginning of installation means acceptance of existing substrate and site conditions.

#### D. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

#### 3.2 Preparation

#### A. Subfloor

- 1. Do not begin Work until Work of other trades is complete.
- 2. Sub-floor will be delivered to this Contractor broom clean.
- 3. Remove dirt, oil, grease, non-compatible curing compounds or other foreign matter from surfaces to receive floor covering materials.
- 4. Fill cracks less than 1/16 inch wide and depression less than 1/8 inch deep with crack filler.
- 5. Apply, trowel and float filler to leave a smooth, flat, hard surface.
- 6. Prohibit traffic from area until filler is cured.
- 7. Prime surfaces other than wood if recommended by floor covering Manufacturer.
- 8. Vacuum subfloor clean.

#### 3.3 Application

A. Adhesives

- 1. Mix and apply adhesives in accord with Manufacturer's instructions.
- 2. Provide safety precautions during mixing and applications as recommended by adhesive Manufacturer.
- 3. Apply uniformly over surfaces.
  - a. Cover only that amount of area which can be covered by flooring material within the recommended working time of the adhesive.
  - b. Remove any adhesive which dries or films over.
  - c. Do not soil walls, bases or adjacent areas with adhesives.
  - d. Promptly remove any spillage.
- 4. Apply adhesives with notched trowel or other suitable tool.
- 5. Clean trowel and re-work notches as necessary to insure proper application of adhesive.

# 3.4 Installation

#### A. General

- 1. Install in accord with Manufacturer's instructions.
- 2. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- 3. Install edge strips at unprotected or exposed edges and where flooring terminates.
- 4. Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to produce tight joints.
- 5. Install feature strips, letter, numbers, shapes, and floor markings where indicated. Fit ioints tightly.
- 6. Prohibit traffic on floor finish for 48 hours after installation.

#### B. Tile Materials

- 1. Mix tile from container to ensure shade variations are consistent.
- 2. Lay tile to center of room or space.
- 3. Work toward perimeter.
- 4. Do not lay tile less than 1/2 the width of a field tile except where accepted by the Architect for irregularly shaped rooms or spaces.
- 5. Cut border tile neatly and accurately to fit within 1/64 inch of abutting surfaces.
- 6. Fit flooring material nearly and tightly into breaks and recesses, against bases, around pipes and penetrations, and around permanent cabinets and equipment.
- 7. Install tile aligned with pattern grain parallel for all units and parallel to width of room. Allow minimum 1/2 full size tile width at room or area perimeter.
- 8. Feature strips and inserts:
  - a. Cut to shapes, sizes and profiles as shown on Drawings.
  - b. Carefully scribe into positions on field.
- 9. Properly roll all tiled areas to eliminate bubbles, ripples and uneven areas.

# 3.5 Finish and Cleaning

- A. Upon completion of the installation of floor covering, adjacent work and after materials have set, clean surfaces with a neutral cleaner as recommended by the Manufacturer for the type of floor covering material installed.
- B. Apply non-slip wax or other finish as recommended by the floor covering manufacturer and buff to a sheen.

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- C. Protect completed work from traffic and damage until acceptance by the Owner.
- D. Provide a non-staining paper pathway taped to the resilient Flooring in direction of foot traffic throughout the Work. Prohibit traffic in other areas.

\* \* \* \* \* \* \* \* \* \* \* \*

# **SECTION 09 68 00 CARPET**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description

1.2 Quality Assurance

1.3 Submittals

1.4 Product Delivery, Storage

and Handling 1.5 Job Conditions 1.6 Warranty

2.1 Materials

2.2 Acceptable Manufacturers

and Projects

3.1 Surface Conditions

3.2 Preparation 3.3 Installation 3.4 Cleaning

3.5 Protection

#### **PART 1 GENERAL**

#### 1.1 Description

A. Work Included: Glue-down carpeting required as indicated on the Room Finish Schedule and Floor Finish Plan on the Drawings and is limited to one type of carpeting. One color maximum to be used. Include as detailed returns and all accessories.

# B. Related Work Specified Elsewhere

1.	Cleaning	Section 01 77 16
2.	Concrete	Section 03 30 00
3.	Finish Carpentry	Section 06 10 00
4.	Gypsum Wallboard	Section 09 29 00
5.	Ceramic Tile	Section 09 31 00
6.	Resilient Flooring	Section 09 65 00

# 1.2 Quality Assurance

A. Manufacturer: Company specializing in tufted carpet with 3 years minimum experience.

#### B. Installer Qualifications

- 1. Installer of at least ten projects equal in yardage to work specified.
- 2. Minimum five years experience.
- 3. For cutting, laying and trimming of carpet, use only workmen completely familiar with the materials specified, the Manufacturer's recommended methods of installation, and the requirements of this Work.

# C. Requirements of Regulatory Agencies

- 1. Conform to applicable code for carpet and cushion flammable requirements in accord with ASTM E 84.
- 2. Conform to ASTM E 648.

#### D. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. C 423, Test for Sound Absorption of Acoustical Materials in Reverberation Rooms.

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- b. D 1335, Test for Tuft Bind of Pile Floor Coverings.
- c. E84, Test for Surface Burning Characteristics of Building.
- 2. Federal Specifications (FS):
  - a. DDD-C-0095, Carpet and Rugs, Wool Nylon, Acrylic, Modacrylic, Polyester, Polypropylene
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Samples: Carpet: Two pieces 18 inches by 27 inches of each type, color and pattern.
  - B. Product Data: Provide product data on specified products, describing physical and performance characteristics; sizes, patterns, colors available and method of installation.
  - C. Manufacturer's Recommendations
    - 1. Accompanying the Samples submittal, include two copies of the Manufacturer's currently recommended:
      - a. Installation instructions, including allowable temperature range.
      - b. Maintenance and cleaning instructions: Include maintenance procedures, recommended maintenance materials and suggested schedule for cleaning and shampooing.
    - 2. The Manufacturer's recommended methods of installation, when approved by the Owner, shall be the basis for acceptance or rejection of actual methods of installation used in this Work.
  - D. Maintenance Material
    - 1. Provide 3 pieces of each color of carpet.
    - 2. Store where directed by Owner.

# 1.4 Product Delivery, Storage and Handling

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

#### 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Store materials for three days prior to installation in area of installation to achieve temperature stability.
  - 2. Maintain minimum 70 degrees F. ambient temperature three days prior to, during and 24 hours after installation of materials.

# 1.6 Warranty

A. Adjustment: During warranty period and within 15 days written notice, restretch carpet,

repair seams and edges.

- B. Static Electricity: Manufacturer's five year warranty that carpet will maintain specified levels of static control.
- C. Materials: 10 year warranty.
- D. Installation: 2 year warranty.

# **PART 2 PRODUCTS**

# 2.1 Materials

- A. WM-1 Walk-Off Mat (as noted on drawings)
  - a. Product: "Catwalk II" 7268 by J&J Flooring
  - b. Construction: Textured Patterned Loop
  - c. Backing: Nexus Modular
  - d. Dve Method: Solution Dved
  - e. Fiber Type: Encore® SD (with recycled content)
  - f. Face Weight: 34 oz./sy.
  - g. Pile Density: 7443 oz./y3
  - h. Gauge: 1/10 (3.94 rows/cm)
  - i. Soil Release: Yes
  - j. Stain/Bleach Resistance: No
  - k. Optional Treatments: No
  - I. Standard Size: 24" x 24"approx. (60.96cm x 60.96cm)
  - m. Color: "Spotlight" (1427)
- B. CPT-1 Carpet Tile (as noted on drawings)
  - a. Product: "Elemental" 7683 by J&J Flooring
  - b. Color: Steel
  - c. Installation: Quarter Turn
  - d. Construction: Tip Sheared Patterned Loop
  - e. Backing: Nexus Modular
  - f. Dye Method: Solution Dyed
  - g. Fiber Type: Encore® SD (with recycled content)
  - h. Face Weight: 18 oz./sy.
  - i. Pile Density: 7417 oz./y3
  - j. Gauge: 1/12 (7.72 rows/cm)
  - k. Soil Release: Yes
  - I. Stain/Bleach Resistance: No
  - m. Optional Treatments: No
  - n. Adhesive: Commercialon Premium Modular Adhesive
  - o. Standard Size: 24" x 24"approx. (60.96cm x 60.96cm)
  - p. Color: Architect Selection
- C. CPT-1 Carpet Tile (as noted on drawings)
  - a. Product: "Elemental" 7683 by J&J Flooring
  - b. Color: Draftsman
  - c. Install: Brick
  - d. Construction: Tip Sheared Patterned Loop

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- e. Backing: Nexus Modular
- f. Dye Method: Solution Dyed
- g. Fiber Type: Encore® SD (with recycled content)
- h. Face Weight: 18 oz./sy.i. Pile Density: 7417 oz./y3j. Gauge: 1/12 (7.72 rows/cm)
- k. Soil Release: Yes
- I. Stain/Bleach Resistance: Nom. Optional Treatments: No
- n. Adhesive: Commercialon Premium Modular Adhesive o. Standard Size: 24" x 24"approx. (60.96cm x 60.96cm)
- p. Color: Architect Selection
- 7. Adhesive: Floor and seam adhesive as recommended by carpet Manufacturer.
- B. Edge Strip: Steel edge strip as detailed on drawings.

# **2.2** Acceptable Manufacturers

- A. Carpet Squares
  - 1. J & J Commercial as listed or
  - 2. Equals from Lees and Shaw
  - 3. Interface

#### **PART 3 EXECUTION**

# 3.1 Surface Conditions

#### A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that carpeting may be installed in accord with the original design and the Manufacturer's recommendations.
- B. Examination: Examine surfaces scheduled to receive carpeting for:
  - 1. Holes, debris or other defects that will adversely effect the execution and quality of work.
  - 2. Deviations beyond allowable tolerances for carpet substrates.
  - 3. Verify that substrate surfaces are smooth and flat with maximum variation of 1/8 inch in ten feet and are ready to receive work.
  - 4. Beginning of installation means acceptance of existing substrate and site conditions.
- C. Condition of Surfaces
  - 1. Do not start work until unsatisfactory conditions are corrected.
  - Do not install carpet or cushion over concrete substrate until concrete has cured 30
    days minimum. Verify concrete floors are dry to a maximum moisture content of
    seven percent; and exhibit negative alkalinity, carbonization or dusting.
  - 3. Do not install carpet until masonry and plastering is completed.
  - 4. Install carpeting prior to installation of movable partitions, fixtures and telephone and electrical pedestal floor outlets or work with same.

5. Install carpet within allowable temperature range stated by Manufacturer.

# 3.2 Preparation

- Α. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- B. Apply, trowel and float filler to leave smooth, flat, hard surface.
- C. Prohibit traffic until filler is cured.
- D. Vacuum floor surface.

# 3.3 Installation

#### Α. Carpet

- 1. Inspect each piece of carpeting before installation and do not install material which is imperfect in any way.
- 2. Verify carpet match before cutting to ensure minimal variation between dye lots.
- 3. Install carpet with pile inclination in one direction.
- 4. Fit carpet neatly into breaks and recesses, against bases, around pipes and penetrations, under saddles and thresholds and around permanent cabinets and equipment.
- 5. Install all carpeting according to Manufacturer's recommendations.
- 6. Lay carpet on floors with run of pile in same direction as anticipated traffic.
- 7. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.
- 8. Seaming:
  - a. Tape seams.
  - b. Trim seams.
  - c. Coat cut edges with seam adhesive.
  - d. Match carpet pattern at seams. Make all seams as inconspicuous as possible, flat, unpuckered, completely free from glue on the exposed surface. Locate in areas of least traffic.
  - e. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true and unfrayed. Edge seam carpet at public areas.
- 9. Adhesive:
  - a. Apply adhesives in accord with Manufacturer's instructions.
  - b. Apply adhesive uniformly:
    - (1) Cover only that amount of area that can be covered by carpet with the recommended working time of adhesive.
    - (2) Do not soil walls, bases or adjacent areas with adhesives.
    - (3) Promptly remove spillage.
  - c. Apply adhesives with notched trowel.
  - d. Clean trowel and rework patches to assure even applications.
- 10. Broom or roll carpet to remove air bubbles and insure bond.

# 3.4 Cleaning

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- A. Remove spots and smears of cement from carpet immediately with solvent.
- B. Remove rubbish, wrapping paper, selvages and scraps less than 2 feet square or less than 8 inches in least dimension.
- C. Upon completion, vacuum with a commercial beater bar type vacuum cleaner.
- D. After each area of carpet has been installed, protect from soiling and damage.
- **3.5 Protection:** In all public areas, provide a temporary non-staining paper pathway in the direction of traffic. Prohibit traffic from carpet areas for 24 hours after installation.

\* \* \* \* \* \* \* \* \* \* \* \*

# **SECTION 09 91 00 PAINTING**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

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1.2 Quality Assurance

1.3 Submittals

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and Handling 1.5 Job Conditions

2.1 Materials

2.2 Acceptable Manufacturers

2.3 Mixing and Tinting

3.1 Surface Conditions

3.2 Preparation of Surfaces

3.3 Paint Application

3.4 Reinstallation of

Removed Items

3.5 Cleaning Items

3.6 Painting Schedules

#### **PART 1 GENERAL**

# 1.1 Description

#### A. Work Included

- 1. The Painting Contractor shall furnish all material, labor and equipment required to complete all painting and finishing as shown on the Drawings, Plans and Specifications.
- 2. The Painting Contractor shall examine the Specifications for the various other trades and shall thoroughly become familiar with all provisions regarding painting. All surfaces that are left unfinished by the requirements of other Specifications shall be painted or finished as a part of this Work.
- 3. In general, paint all wood, metal surfaces, doors, frames, masonry; omit acoustic tile, aluminum and prefinished wood doors.
- 4. Following Specifications cover complete painting, finishing of wood and other surfaces throughout interior and exterior of building, unless otherwise noted.
- 5. Painting Contractor will include in his Bid the Painting of all cabinetwork and millwork supplies as part of the Millwork Contractor's Bid.
- 6. The types of paint to be used and the number of coats to be applied are listed in the Painting Schedule in Part 3.7 of this Section of these Specifications.
- 7. Furnish tools, ladders, scaffolding, other equipment necessary for work completion.

# B. Related Work Specified Elsewhere

- 1. Prefinishing: Shop priming and factory prefinishing are required on some, but not all of the items described in other Sections of these Specifications.
- 2. Structural Steel, Miscellaneous Metals and Metal Doors and Frames; one shop coat and touching up in field.

3. Cabinetwork Section 06 40 00 4. Sealants and Caulking Section 07 92 13 5. Gypsum Board Section 09 29 00 6. Painting of Exterior Roof Vents/Louvers Division 23

# C. Definitions

1. The term "Paint", as used herein, includes enamels, paints, sealers, fillers, emulsions, and other coatings, whether used as prime, intermediate of finish coats.

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- "Coats" described later are based on roller, brush or spray application. Above does not refer to processes that require spraying only for their application or where specifically specified to be sprayed.
- 3. Conform to ASTM D16 for interpretation of terms used in this Section.

# **1.2** Quality Assurance

#### A. Qualifications of Painters

- 1. Maintain a crew of painters throughout the duration of the work who shall be qualified to fully satisfy the requirements of this Specification.
- 2. Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Apprentices may be employed to work under the direction of qualified journeymen, in accord with trade regulations. In the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.

# B. Requirements of Regulatory Agencies

- 1. Occupational Safety and Health and pollution Regulations: Conform to the Federal and State requirements for painting work applicable to this Project.
- 2. Permits: Obtain and pay for any special permits required by local governmental agencies.

#### C. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. D 16, Definitions of Terms Relating to Painting, Varnish, Lacquer and Related Products.
- 2. In addition to complying with all pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their "Modern Guide to Paint Specifications", current Edition.
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Samples: Accompanying the materials list, submit to the Owner two copies of the full range of colors, textures and finishes available in each of the proposed products.
  - B. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these Specifications, submit for the Owner's review the current Manufacturer of the proposed material.

#### C. Material List

- 1. A complete list of all materials proposed to be furnished and installed under this portion of the Work.
- 2. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Owner.
- D. Color Charts: Include color charts for selection by Owner.

E. Extra Stock: Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint equaling approximately 10% of each color used in each coating material used, with all such extra stock tightly sealed in clearly labeled containers. Extra stock to be from batch mix furnished for Work.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.

#### C. Storage of Materials

- 1. Store only the approved materials at the job site, and store only in suitable and designated area restricted to the storage of paint materials and related equipment.
- 2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
- 3. Store paint materials at minimum ambient temperature of 45 degrees F. and a maximum of 90 degrees F., in well ventilated area, unless required otherwise by Manufacturer's instructions.

# D. Handling Materials and Equipment

- 1. Take precautionary measures to prevent fire hazards and spontaneous combustion.
- 2. All soiled or used rags, waste and trash must be removed from the building each night and every precaution taken to avoid the danger of fire.
- 3. Toxic Materials:
  - a. Where toxic materials, including both toxic and explosive solvents are used, take appropriate precautions as a regular procedure, conforming to the Manufacturer's recommendations and to the requirements of the applicable safety regulatory agencies.
  - b. In applying acid etch coating or solutions and toxic materials, provide ventilation and take protective measures to conform to the requirements of regulatory agencies.
- E. Replacements: The painting trade is responsible for making repairs of their own Work when due to defective workmanship or materials. Repair of damaged paint finish caused by other trades will be done by this Contractor but paid for by the contractor causing such damage. See Section 01 70 00.

#### 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Comply with Manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
  - 2. Do not apply finish in areas where dust is being generated.

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- 3. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F. for 24 hours before, during and for 48 hours after application of finishes, unless required otherwise by Manufacturer's instructions.
- 4. Do not apply exterior coatings during rain or snow or when relative humidity is above 50 percent, unless required otherwise by Manufacturer's instructions.
- 5. Minimum Application Temperatures for Latex Paints: 45 degrees F. for interiors; 50 degrees F. for exteriors; unless required otherwise by Manufacturer's instructions.
- 6. Minimum Application Temperature for Varnish Finishes: 65 degrees F. for interior, unless required otherwise by Manufacturer's instructions.
- 7. Provide lighting level of 80 foot candles measured mid-height at substrate surface.
- 8. Do not do exterior work on unprotected surfaces if it is raining or moisture from any other source is present or expected before applied materials can dry or attain proper cure.
- 9. Allow surfaces wetted by rain or other moisture source to dry and to attain temperatures and conditions specified before proceeding or continuing with coating application.

#### B. Protection

- 1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.
- 2. The Painting Contractor shall protect surfaces and objects inside and outside the building, as well as the grounds, lawns, shrubbery and adjacent properties against damage. The Painting Contractor shall be held responsible for damage to adjacent furnishings.
- 3. Drop Cloths: Provide sufficient drop cloths, shields and protective equipment to prevent spray or drippings from fouling surfaces not being painted including surfaces within the paint storage and preparation areas.
- 4. Exposed Concrete Floors: Floor slabs that will not be covered by other finishes will be protected against staining or damage by the work of the Painting Contractor. Repair of such damage may include replacement of the slab if so determined by the Architect or Owner.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Select primary products of the coating system from products of a single manufacturer.
- B. Secondary products not specified by name and required for the job such as oils, thinners, patching, compounds, putty, shall be "best grade" or "first line" products of a reputable manufacturer.

### C. Compatibility

- All paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.
- 2. Thinners, when used, shall be only those thinners recommended for that purpose by the Manufacturer of the material to be thinned.
- 3. All shop primers are required to be approved by finish coat paint manufacturer.

- D. Colors and glosses: All colors shall be as selected by the Owner and will be limited to not more than six paint colors in the total Work.
  - 1. Colors of paints and stains match color chips submitted to the Owner.

# 2.2 Acceptable Manufacturers

- A. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.
- B. Sherwin Williams Macropoxy 646 Fast Cure Epoxy or approved equal.

# 2.3 Mixing and Tinting

- A. Deliver paints and enamels ready-mixed to job site.
- B. Accomplish job mixing and job tinting only when acceptable to the Owner.
- C. Fungicidal agent shall be incorporated into the paint by the Manufacturer.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

#### A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that paint finishes may be applied in strict accord with all pertinent codes and regulations and the requirements of these Specifications.
- 3. Examine surfaces schedules to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Article 3.2 Preparation.
- 4. If woodwork, metal or any other surface to be finished cannot be put in proper condition for finishing by customary cleaning, filling, sanding, dusting, puttying operation, notify Owner immediately for clarification.
- 5. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.
- 6. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums or as required by paint materials manufacturer: (submit written documentation by paint manufacturer).
  - a. Plaster and Gypsum Wallboard: 12 percent.
  - b. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
  - c. Interior Located Wood: 15 percent, measured in accord with ASTM D 2016.
- 7. Beginning of installation means acceptance of existing surfaces or substrate.

# 3.2 Preparation

#### A. General

1. Protection: Prior to all surface preparation and painting operation, completely mask, remove or otherwise adequately protect all hardware, accessories, machined

February 6, 2024 09 91 00-5 surfaces, plates, lighting fixtures and similar items in contact with painted surfaces, but not scheduled to receive paint.

# 2. Priming:

- a. Spot prime all exposed nails and other metals which are to be painted with emulsion paints using a primer recommended by the Manufacturer of the coating system.
- b. Back prime interior trim before installation, with interior trim primer.

# 3. Cleaning:

- a. Before applying paint or other surface treatment, thoroughly clean all surfaces involved.
- b. Previously Painted Surfaces:
  - (1) Remove all blistered, peeling and scaling paint to bare substrate. Remove heavy chalk by scrubbing with seal and water. Sand or etch any glossy areas and dust clean. Clean and spot prime any failed areas. Rinse clean and let dry. Any existing mildew on the surface must be completely killed and remove before applying paint.
  - (2) Efflorescence should be removed from masonry surfaces. Rusted or abraded areas on painted metal should be thoroughly hand or power toll cleaned and spot primed. For optimum performance in more corrosive areas, entire metal surface should be abrasive blast cleaned. In all cases if the old paint shows poor adhesion, it shall all be removed and the entire surface primed.
  - (3) Where new work joints existing work, prepare existing surfaces extending to the nearest break in the plane.
  - (4) Wash surfaces with detergent and water or other solution as required to remove any accumulated dirt, oil, grease or other foreign matter which would impair bond or bleed through new finishes. After washing, rinse with water and allow to dry thoroughly.
- c. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- d. Work will be received broom clean only from General Contractor. Note protection and cleaning required by Painting Contractor.

#### B. Wood Surfaces

- Cleaning: Clean all wood surfaces until they are free from dirt, oil and other foreign substances. Remove all pencil marks and grade stamps, sanding when a semitransparent finish is to be applied. All loose wood fibers or dust should be removed by brushing.
- 2. Smoothing:
  - a. Unless specifically noted to be left rough, smooth all finished wood surfaces exposed to view, using the proper sandpaper, the dust off.
  - b. Where so required, use varying degrees of coarseness in sandpaper to produce uniformly smooth and unmarred wood surfaces.
- 3. Dryness: Unless specifically approved by the Owner, do not proceed with the painting of wood surfaces

### C. Plaster Surfaces and Gypsum Wallboard

- 1. Allow plaster to dry thoroughly for as least 30 days before painting. Sand smooth any irregularities.
- 2. Fill narrow, shallow cracks and small holes with spackling compound.
- 3. Allow to dry.
- 4. Sand smooth. Do not raise nap of paper on wallboard.

# D. Masonry and Precast Concrete

- 1. Fill cracks and irregularities with portland cement grout to provide uniform surface
- 2. Fill concrete masonry unit surfaces with block filler.

### E. Ferrous Metal Surfaces

- 1. Thoroughly clean all surfaces until they are completely free from dirt, oil, rust, scale or grease. When heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Spot prime paint after repairs.
- 2. Allow to dry thoroughly before application of paint.
- 3. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

# 3.3 Paint Application

#### A. General

- 1. Workmanship: Very best, spread materials evenly, glow on smoothly without runs, sags, employ skilled mechanics.
- 2. Use materials only as specified by Manufacturer's direction label on container.
- 3. Where interior or exterior wood and metal are primed in the mill or ship, use material in every case same as the specified for such surfaces; use as per Manufacturer's directions for first or priming coat.
- 4. Finish door tops, bottoms, edges, same as balance of doors after they are fitted.
- 5. Cover surfaced to be stained with uniform stain coat; wipe off as required.
- 6. Sand smoothly woodwork to be finished with stain. Clean surface before proceeding with first coat application. Use fine sand paper between coats. Finish wood or metal to produce even, smooth finish.
- 7. Do not apply finishes to surfaces that are not dry.
- 8. Each coat shall cover preceding coat, so that preceding coat shall not show through. Each coat of paint shall be slightly darker than preceding coat unless otherwise directed. Undercoats shall be tinted similar to finish coats. Color of priming shall be lighter than body coat. Body coat shall be same color but lighter than finish coat.
- 9. Paint all surfaces, except glass, flat concrete and similar items, not pre-finished and not called out as unfinished.
- 10. Apply paint enamel stain and varnish with suitable brushes, or rollers, or spraying equipment.
  - a. Rate of application shall not exceed that as recommended by paint Manufacturer for the surface involved.
  - b. Keep brushes, and rollers, and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
  - c. Apply stain by brush.
- 11. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas.
  - a. Finished metal surfaces shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector. Test required on first application.
- 12. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
- 13. Apply primer on all work before glazing.

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- 14. Refinish whole wall where portion of finish has been damaged or is not acceptable.
- 15. Finish metal doors and frames to be Manufacturer's standard primed (not finish coated); finish coats by Painting Contractor.
- 16. No overhead doors or rolling steel doors should be painted. Rolling steel door track and all tube steel door jambs are scheduled to be painted.
- 17. All ceilings to be painted except acoustical tile ceilings. See schedules.

### B. Drying

- 1. Allow sufficient drying time between coats.
- 2. Modify the period as recommended by the material Manufacturer to suit adverse weather conditions.

#### C. Environmental Conditions

- Comply with the Manufacturer's recommendations as to environmental conditions under which the coating system may be applied. No painting allowed when temperatures are below 50 degrees F., above 120 degrees F. or with 90% or above relative humidity.
- 2. Do not apply paint in areas where dust is being generated.
- D. Defects: Sand and dust between coats to remove all defects visible to the unaided eye from a distance of five feet.

#### E. Dry Mil Thickness

 General: Apply all coatings to the dry mil thickness indicated in the "Painting Schedule". In general all painted surfaces to have a DFT as listed unless noted otherwise.

# F. Recoating

- 1. Whenever possible, notify Architect between coats.
- 3.4 Reinstallation of Removed Items: Following completion of painting, in each space, promptly reinstall all items removed for painting or wall covering using only workmen skilled in the particular trade.

# 3.5 Cleaning Up

#### A. General

- 1. During profess of the Work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for the purpose.
- 2. Prevent accidental spilling of paint materials and in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill, and wash the surfaces to their original undamaged condition, all at no additional cost to the Owner.
- 3. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- 4. Touch up and restore finish where damaged.
- 5. Do not mar surface finish of item being cleaned.
- 6. Leave storage space clean and in condition required for equivalent spaces in project.
- B. Prior to Final Inspection: Upon completion of this portion of the Work visually inspect all surfaces and remove all paint and traces of paint from surfaces not scheduled to be painted.

# 3.6 Painting Schedule

- A. Surfaces Not to be Painted.
  - 1. Pre-finished wall, ceiling and floor coverings.
  - 2. Items with factory applied final finish.
  - 3. Concealed ducts, pipes and conduit.
  - 4. Glass, flat concrete and similar items, not pre-finished.
  - 5. Ceramic tile, acoustical tile and plastic laminate.
- B. Exterior Work (use only exterior quality materials)
  - 1. Exterior Ferrous Metals:
    - a. Touch-up: Rust-inhibitive waterborne acrylic primer, free of heavy metals;

Min. DFT: 2.5 - 5.0 mils

Min. Volume Solids: 44%

- b. 2nd Coat: Non-blocking, 100% acrylic gloss coating
- 3rd Coat: Non-blocking, 100% acrylic gloss coating; Min. DFT: 1.3 mils per coat;

Min. Volume Solids: 31%;

Sheen: 70-90 units at 60 degrees.

#### C. Interior Work

- 1. Interior Wood transparent finish:
  - a. First Coat: VOC compliant wiping stain; spreading rate: as needed to match Owner's sample.
  - b. 2nd Coat: Polyurethane satin varnish
  - c. 3rd Coat: Polyurethane satin varnish:

Min DFT: 1.7 mils per coat;

Min. Volume Solids: 41%;

Sheen: 20-35 units at 60 degrees.

- 2. Interior Wood painted
  - a. First Coat: 100% acrylic primer;

Min. DFT: 1.6 mils; Min. Volume Solids: 39%

- b. 2nd Coat: Non-blocking, acrylic semi-gloss
- c. 3rd Coat: Non-blocking, acrylic semi-gloss Pencil Hardness

(ASTM D3363): H or harder;

Min. DFT: 1.3 mils per coat;

Min. Volume Solids: 33%;

Sheen: 35-45 units at 60 degrees.

- 3. Concrete and Precast wall panels (inside face) (scheduled for epoxy)
  - a. First Coat: 100% acrylic, alkali resistant primer;

Min DFT: 3.0 mils;

Min Volume Solids: 37%;

Alkali Resistance: tolerance of PH levels up to 13.

- b. 2nd Coat: 2-component water based catalyzed epoxy
- c. 3rd Coat: 2-component water based catalyzed epoxy

DFT: 2.5 - 3.0 mils per coat

Min Volume Solids: 38% (catalyzed)

Sheen: 20 - 30 units at 60 degrees.

- 4. Concrete Masonry Units:
  - a. First Coat: Vinyl acrylic blockfiller

Min DFT: 8.0 mils; (50-90 sq.ft./gal)

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Min Volume Solids: 53.5%

b. 2nd Coat: 2-component water based catalyzed epoxy

c. 3rd Coat: 2-component water based catalyzed epoxy

Min DFT: 2.5 - 3.0 per coat;

Min Volume Solids: 38% (catalyzed) Sheen: 20-30 units at 60 degrees.

- 5. Concrete and precast wall panels (inside face) (scheduled for Latex E)
  - a. First Coat: 100% acrylic, alkali resistant primer

Min. DFT: 3.0 mils per coat Min.

Volume Solids: 37%

Alkali Resistance: tolerance of PH levels up to 13

- b. Second Coat: Vinyl acrylic finish
- c. Third Coat: Vinyl acrylic eggshell finish

Min. DFT: 1.6 mils per coat Min.

Volume Solids: 37%

Sheen: 10 - 20 units at 85 degrees

- 6. Concrete and precast wall panels (inside face) (scheduled for Latex S)
  - a. First Coat: 100% acrylic, alkali resistant primer

Min. DFT: 3.0 mils per coat Min.

Volume Solids: 37%

Alkali Resistance: tolerance of PH levels up to 13

- b. Second Coat: Vinyl acrylic semi-gloss finish
- c. Third Coat: Vinyl acrylic semi-gloss finish

Min. DFT: 1.6 mils per coat Min.

Volume Solids: 37%

Sheen: 25 - 35 units at 60 degrees

- 7. Concrete masonry units (scheduled for Latex E)
  - a. First Coat: Vinyl acrylic blockfiller

Min. DFT: 8.0 mils (75-125 sq.ft./gallon

Min. Volume Solids: 48%

- b. Second Coat: Vinyl acrylic eggshell finish
- c. Third Coat: Vinyl acrylic eggshell finish

Min. DFT: 1.6 mils per coat

Min. Volume Solids: 37%

Sheen: 10 - 20 units at 85 degrees

- 8. Concrete masonry units (scheduled for Latex S)
  - a. First Coat: Vinyl acrylic blockfiller

Min. DFT: 8.0 mils (75-125 sq.ft./gallon)

Min. Volume Solids: 48%

- b. Second Coat: Vinyl acrylic semi-gloss finish
- c. Third Coat: Vinyl acrylic semi-gloss finish

Min. DFT: 1.6 mils per coat

Min. Volume Solids: 37%

Sheen: 25 - 35 units at 60 degrees

- 9. Gypsum Drywall walls (scheduled for Latex E)
  - a. First Coat: 100% acrylic primer

Min. DFT: 1.6 mils per coat

Min. Volume Solids: 39%

- b. Second Coat: Vinyl acrylic eggshell finish
- c. Third Coat: Vinyl acrylic eggshell finish

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Min. DFT: 1.6 mils per coat Min. Volume Solids: 37%

Sheen: 10 - 20 units at 85 degrees

10. Gypsum Drywall - walls (scheduled for Latex - S)

a. First Coat: 100% acrylic primer Min. DFT: 1.6 mils per coat Min.

Volume Solids: 39%

b. Second Coat: Vinyl acrylic Semi-gloss finish

c. Third Coat: Vinyl acrylic Semi-gloss finish

Min. DFT: 1.6 mils per coat Min.

Volume Solids: 37%

Sheen: 25 - 35 units at 60 degrees

- 11. Interior Ferrous Metal:
  - a. Touch-up: Rust-inhibitive waterborne acrylic primer,

free of heavy metals: Min. DFT:

2.5 - 5.0 mils Min. Volume Solids:

44%

- b. 2nd Coat: Non-blocking, acrylic semi-gloss
- c. 3rd Coat: Non-blocking, acrylic semi-gloss coating; Pencil Hardness

(ASTM D3363): H or harder Min. DFT: 1.3 mils per coat; Min.

Volume Solids: 33%;

Sheen: 35-45 units at 60 degrees.

- 12. Interior Zinc-coated metal:
  - a. First Coat: Rust-inhibitive waterborne acrylic primer.

free of heavy metals; Min. DFT: 2.5 - 5.0 mils Min. Volume Solids: 44%

- b. 2nd Coat: Non-blocking, acrylic semi-gloss
- c. 3rd Coat: Non-blocking, acrylic semi-gloss Pencil Hardness (ASTM D3363): H or harder

Min. DFT: 1.3 mils per coat; Min.

Volume Solids: 33%

Sheen: 35-45 units at 60 degrees.

- 13. Exposed Overhead Work:
  - a. Touch-up Rust-inhibitive Oil- Based acrylic primer, free of heavy metals.
  - b. DFT: 2.5 5.0 mils
  - c. Min. volume solids: 44%
  - d. 2nd Coat: Oil- Based flat dryfall
  - e. DFT: 3.0 5.0 mils
  - f. Min. volume Solids: 40%
  - g. Sheen: 0-5 at 80 degrees.
- D. Finishing Mechanical and Electrical Equipment
  - 1. Paint in finished areas only and on exterior of building, exposed or visible galvanized metal ducts, hangers, sheet metal work, conduit boxes, brackets, collars, supports, exposed covered and uncovered plumbing, heating and other piping and conduit. See Mechanical and Electrical Drawings for extent of such work. Do not include painting of pipes, ducts, conduit, etc. in mechanical rooms and other unfinished areas unless specifically noted.
  - 2. Piping or ducts to be hidden above ceilings or in pipe chases will not be painted.

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- 3. Paint plumbing, heating, ventilating and electrical equipment not furnished with factory finish e.g. grilles, louvers, covers and access panels. Equipment furnished with a prime coat shall receive 2 coats of enamel in colors as selected.
- 4. Paint bright metal portion and interior surfaces of ductwork convectors and baseboard heating cabinets that is visible through grilles and louvers with one coat of flat black paint to the limits of sight lines. Paint dampers exposed behind louvers, grilles and convectors and baseboard cabinets to match face panels.
- 5. Remove oil or grease from piping and ductwork and apply one coat of primer compatible with surface being finished and with painting material being used for finished coats.
- 6. In general, exposed covered or uncovered piping and ductwork will be finished with the same materials, number or finish coats of paint and color as the surface to which they are attached.
- 7. Replace identification markings on mechanical or electrical equipment when painted accidentally.
- 8. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

\* \* \* \* \* \* \* \* \* \* \*

### **SECTION 10 11 00 VISUAL DISPLAY UNITS**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

1.1 Description INDEX 1.6 Warranty 1.2 Quality Assurance 2.1 Materials

> 1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage 3.2 Installation and Handling 3.3 Cleaning

1.5 Job Conditions

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included
  - 1. Display case
  - 2. Track Boards and Marker Boards
- B. Related Work Specified Elsewhere

1. Finish Carpentry Section 06 40 00 2. Gypsum Drywall Section 09 29 00 3. Acoustical Tile Section 09 51 00

C. Work Furnished but Installed Under Other Sections: Furnish special concealed supports for installation in wall or ceiling construction.

#### 1.2 Quality Assurance

- A. Qualifications of Manufacturers: Five years experience in producing Display Systems.
- B. Requirements of Regulatory Agencies
  - 1. Provide tack boards with fire hazard classifications for all materials equal to or lower than:
    - a. Flame spread:
    - b. Fuel contributed:
    - c. Smoke developed:
  - 2. Determine fire hazard classification by ASTM E 84.
- C. Reference Standards
  - 1. Porcelain Enamel Institute: Performance Specifications for Porcelain Enamel Chalkboards.
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Shop Drawings: Submit Shop Drawings for all Display Systems work.

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- 1. Include type, dimensions, arrangement and material.
- 2. Indicate joints, backing anchor, mounting details, trim and accessories.
- 3. Projection Screen including recessed ceiling installation.
- B. Manufacturer's Literature
  - 1. Printed technical specifications, catalog data and details of products.
  - 2. Recommend installation and maintenance instructions.
  - 3. Furnish Manufacturer's printed instructions for adhesive applications.
- C. Color Chart: Submit color charts for display case and tack board.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Store in a clean, dry storage area, as packaged by Manufacturer, with Manufacturer's seals and labels intact.
- 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.

#### 1.5 Job Conditions

- A. Environmental Requirements
  - 1. Store materials in dry area at not less than 55 degrees F. for at least 24 hours before installation.
  - 2. Maintain temperature of at least 55 degrees F. in area receiving installation for 24 hours prior to, during and for 24 hours after installation is completed.
  - 3. Provide adequate ventilation when using contact adhesives.
- **1.6 Warranty:** Provide Owner with a two year warranty against defects in workmanship and a lifetime warranty for the facing material from discoloration due to cleaning, crazing, cracking or staining.

#### **PART 2 PRODUCTS**

#### 2.1 Materials

- A. Display case: Aluminum extruded 4' x 6'-0" with press on letters; glass front; doors lockable; (2 reg). Verify location with Architect.
- B. Architectural Tackboard: (Corridor 101) / Hall 103 (Qty. 2).
  - 1. Manufacturer: EGAN or Architects Approved Equal
  - 2. Product: "BoxCore" Tackboard
  - 3. Size: 48" x 36"
  - 4. Thickness: 34mm Boxcore (EcoTack).
  - 5. Frame: Clear Anodized Aluminum (29 mm)
  - 6. Mounting: Cleat Mounted (concealed)

7. Locations: Final Locations TBD by Architect.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

- A. Inspection
  - 1. Prior to installation, inspect supporting construction and grounds to assure reinforcement is sufficient for installation of display systems.
  - 2. Check surface conditions to receive display systems to assure they are:
    - a. Free from dust, grease or scally paint.
    - b. Free from projections or depressions that will affect smooth finished surface.
    - c. Dry and free of substance that might impair bond between board and wall.
    - d. Roughen slick or smooth substrate to provide a satisfactory bond.
  - 3. Surface to receive trim: True and even to allow trim member to lie flat against the wall surface.
  - 4. Do not proceed with installation until deficiencies are corrected.
- **3.2 Installation:** By manufacturer's qualified installers.
- 3.3 Cleaning: leave installation and site in a neat and clean condition. Instruct the Owner in product use and maintenance.

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### **SECTION 10 14 19 FLAT CUT LETTERS AND LOGOS**

SCOPE Applicable provisions of the General and Supplementary Conditions and

Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Materials

1.2 Quality Assurance 2.3 Finishes

1.3 Submittals 2.4 Mounting Hardware

1.4 Warranty 2.5 Fabrication 2.1 Acceptable Manufacturers 3.1 Installation

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Furnish letters and hardware necessary to install flat cut letters shown on drawings and herein specified.

B. Related Work Specified Elsewhere

1. Precast Concrete Wall Panels Section 03 41 00

# 1.2 Quality Assurance

- A. Manufacturer to have a minimum of 20 years experience in manufacturing letters.
- B. All letters to be manufactured by one manufacturer.

### 1.3 Submittals

- A. Manufacturer's illustrated product literature and specifications.
- B. Installation instructions

# 1.4 Warranty

A. Letters should be guaranteed for the life of the business against defects.

# **PART 2 PRODUCTS**

### 2.1 Acceptable Manufacturer or Manufacturer's Representative

A. Gemini Incorporated 103 Mensing Way

Cannon Falls, MN 55009

Phone: 800-538-8377 or 507-263-3957 Fax: 800-421-1256 or 507-263-4887 Web: www.signletters.com Email: sales@signletters.com

B. Other manufacturers meeting these specifications in accord with the General Conditions.

**2.2 Materials** (Metal Alloys)

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- A. Aluminum 5052 Alloy
- B. Stainless Steel 304 Alloy

### 2.3 Finishes

- A. Aluminum
  - 1. Dark bronze anodized, bead-blasted return.

# **2.4** Mounting Hardware

- A. All aluminum letters under 18" use aluminum studs
- B. All other letters use stainless steel studs.

# 2.5 Fabrication

- A. All letters shall be made of ½" thick aluminum. ¾" cast aluminum is also acceptable.
- B. Letters and Logos:
  - 1. Overhead Door Opening: Arial or Equal letter style and shall be 12 inches high, as indicated on the drawings.
  - 2. City Logo: Flat Cut sign size per elevation. Proprietary logo to be provided by owner.
- C. Finish on letters and logo shall be Dark Bronze.
- D. Mounting shall be stud mounted, ¾"offset and a mounting template designating stud locations is required for mounting on an exposed aggregate precast concrete panel surface.

#### PART 3 EXECUTION

### 3.1 Installation

A. A qualified installer shall install precision cut letters per the manufacturer's instructions.

\* \* \* \* \* \* \* \* \* \* \* \* \*

# SECTION 10 21 13 SOLID PHENOLIC CORE PLASTIC LAMINATE-CLAD TOILET COMPARTMENTS

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

2.2 Acceptable Manufacturers

2.3 Fabrication

1.1 Description
1.2 Quality Assurance
1.3 Submittals
1.4 Product Delivery, Storage 3.1 Surface Conditions

and Handling 3.2 Installation

1.5 Warranty 3.3 Adjust and Clean

# **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Solid Phenolic toilet and urinal screens, and accessories indicated on the Drawings.

# B. Related Work Specified Elsewhere

1.	Miscellaneous Metals	Section 05 50 00
2.	Blocking within stud walls	Section 06 10 00
3.	Toilet and Bath Accessories	Section 10 28 13

C. Work Furnished but Not Installed

1. Wall reinforcement for concealed in-wall construction Section 06 10 00

#### 1.2 Quality Assurance

- A. Qualifications of Manufacturers: Regularly engaged in manufacture of solid plastic toilet partitions.
- B. Qualifications of Installers: For actual installation of toilet partitions, use only personnel who are skilled in the Work required, completely familiar with the Manufacturer's recommended methods of installation, and thoroughly familiar with the requirements of this Work.
- C. Requirements of Regulatory Agencies: Conform to ANSI A 117.1 and applicable State and Federal codes for provisions for the physically handicapped.
- D. Erection Tolerances
  - 1. Maximum Variation from Plumb or Level: 1/8 inch.
  - 2. Maximum Misplacement from Intended Position: 1/8 inch.

### E. Reference Standards

- 1. American National Standards Institute (ANSI):
  - a. A 117.1, Specifications for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped.
- 2. American Society for Testing and Materials (ASTM):
  - a. A 167, Corrosion-Resisting Chrominum-Nickel Steel Plate

- 3. Federal Specifications (FS):
  - a. FF-B-588, Bolt, Toggle; and Expansion Sleeve, Screw
  - b. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
  - c. MMM-A-188, Adhesives; Urea-Resin-Type (Liquid and Powder)
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

# A. Shop Drawings

- 1. Indicate partition layout and dimensions, panel and door sizes, door swings and elevations.
- 2. Show fabrication and erection of partition assemblies, to extent not fully described by Manufacturer's data sheets.
- 3. Show anchorage, accessory items and finishes.
- 4. Provide location template drawings for bolt hole locations in supporting members for attachment of partitions.
- B. Color Chips: Accompanying the Shop Drawings, submit color chips representing the full range of standard colors available from the selected Manufacturer in the quality of partition specified.
- C. Installation Methods: Accompanying the Shop Drawings, submit two copies of the Manufacturer's currently recommended installation methods, showing all required blocking and bracing.

#### 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect toilet partitions, urinal screens, and shower partitions, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver items in Manufacturer's original unopened protective packaging.
- C. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.
- 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.
- **1.5 Warranty:** Warranty all defects in workmanship and materials for fifteen years from date of acceptance of Owner.

### **PART 2 PRODUCTS**

## 2.1 Materials

- A. Type and Style
  - 1. Solid Phenolic plastic toilet compartments shall be ceiling hung. Doors and pilasters shall have a finish thickness of 3/4" Panels shall be 1/2".
  - 2. Pilasters to be anchored to overhead member (which member is to be supplied by others) with standard 3/8" threaded rod, hex nuts, and washers to provide vertical adjustment and necessary strength.
- B. Partitions. Pilaster, Screens and Doors: Solid Phenolic Core:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ASI Global Partitions, an ASI Group company; Black Core Phenolic Partitions.
  - 2. Toilet-Enclosure Style: Ceiling hung reference plans and details.
  - 3. Entrance-Screen Style: Ceiling Hung.
  - 4. Urinal-Screen Style: Wall hung
  - 5. Door Width: 24-inch Standard / 36-inch ADA.
  - 6. Door and Panel Height: As Indicated on the drawings.
  - 7. Door Height Above Floor: 9 inches.
  - 8. Pilaster Height: As indicated on Drawings
  - 9. Door Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4" thick doors. Provide door with factory predrilled hinge locations for barrel hinges.
  - 10. Screen and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide nominal 1/2-inch- (13-mm-) thick panels.
  - 11. Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide nominal 3/4-inch- (19-mm-) thick pilasters. Provide pilaster with factory predrilled hinge locations for barrel hinges.
  - 12. Brackets (Fittings):
    - a. Stirrup Type: Ear or U-brackets, stainless steel.
    - b. Continuous Type: Manufacturer's standard design; Stainless Steel.
  - 13. Phenolic-Panel Finish:
    - a. Facing Sheet Finish: One color and pattern in each room.
    - b. Color and Pattern: As selected by Architect from manufacturer's full range
    - c. Edge Color: Through-color matching facing sheet color.
- C. Adhesive: Manufacturer's Standard.
- D. Hardware and Fittings:
  - 1. All exposed door hardware shall be of die cast aluminum and shall be as noted:
    - a. Heavy-duty "Bank Vault" hinge shall have gravity-acting cams and are fabricated from a die cast aluminum alloy with a brushed polish chrome-plated finish and wraparound flanges. The cam is constructed from a ¾" diameter nylon rod and a 3/8" stainless steel pin. Hinges are through bolted onto doors and pilasters using stainless steel, tamper-resistant through bolts. Hinges are easily adjusted at the job site to a full close or partially open position, as required.

- b. Hardware includes coat hook, bumper, stop and keeper, and all necessary fasteners for installation.
- c. Fasteners shall be of stainless steal; door hinges and latches will be mounted with theft-proof barrel nuts and machine screws; hooks and handles will be mounted with theft-proof full-thread screws.
- d. All slide latches shall be mounted at mid-point of the door, 29" up from the bottom of the door. Keepers shall be designed and installed permitting emergency access to the compartment by lifting the door until the latch bolt is clear of the keeper. Install keeper on pilaster.
- 2. Headrail shall be installed between end pilaster and wall secured by stirrup brackets above end panel to inner surface of headrail and on the opposing wall surface.
- 3. Wall brackets shall be secured to walls with anchoring and/or expansion shields. Brackets to be type 304 stainless steel 1 ear or 2 ear connections.
- 4. Pilaster shoes shall be of type 304 stainless steel having a #4 finish.
- 5. All mounting brackets shall be cast stainless steel. All material shall be through bolted with stainless steel tamper resistant fasteners.

#### E. Fasteners:

- 1. Toggle bolts: FS FF-B-588.
- 2. Masonry anchors: FS FF-S-325.
- 3. Exposed bolts and screws: Theft resistant, one-way heads, finished to match hardware.
- F. Accessories: Provide stainless coat hook at each door. Toilet paper holders and grab bars as shown on Drawings are specified in Section 10 28 13.
- G. Color: All toilet partitions shall be factory pre-finished in the colors selected by the Architect from the Manufacturer's standard range of colors.

### H. HARDWARE AND ACCESSORIES

- 1. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
- 2. Material: Stainless steel
- 3. Hinges: Manufacturer's standard paired, self-closing vault-type that can be adjusted to hold doors open at any angle up to 90 degrees emergency access by lifting door.
- 4. Latch and Keeper: Manufacturer's standard surface-mounted latch unit on door for outswinging doors and pilaster for in-swinging doors designed for occupancy indication and emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- 5. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
- 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- I. Overhead Bracing: Manufacturer's standard continuous, stainless steel head rail with "antigrip" profile and in manufacturer's standard finish.
- J. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sextype bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

# 2.2 Acceptable Manufacturers

- A. Embassy Phenolic Partitions manufactured by Global Steel Products, Deer Park, New York.
- B. Equivalent partitions from following manufacturers are acceptable:
  - 1. Bobrick Duraline series solid phenolic.
  - 2. Metpar Forum solid phenolic.
  - 3. Scranton Products
  - 4. ASI Global Partitions

#### 4.3 Fabrication

- A. Partitions, Pilasters, Screens and Doors
  - 1. No splices or joints in faces.
  - 2. All edges sealed against moisture and edged with plastic laminate.
  - Reinforce with steel plate reinforcement sandwiched within particle core at attachment points, hardware and fittings. Router cut openings as required.
  - 4. Notch recesses and drill holes for hardware and fittings.
- B. Pilasters, Supports and Hangers: Equipped with leveling devices, anchor studs and locking nuts.
- C. Pilaster Shoes: Plinths, one piece hemmed top and bottom, formed to fit pilaster, equipped with concealed clips.
- D. Wall Brackets: Panel brackets, two ear, "T" style, 1 inch stock.
- E. Panel to Pilaster Brackets: Stirrup style brackets.
- F. Door Hardware
  - 1. Hinge: Self-lubricating, inward and outward, surface mounted, cut out insert, gravity, spring action cam, torsion rod type, return movement, adjustable to hold door open at any angle up to 90 degrees. Nylon bearings.
  - 2. Latch: Combination rubber faced door strike and keeper, equipped for emergency access.
  - 3. Coat Hook: Combination unit with hook and rubber tipped pin.
  - 4. Door Pull: Outswing door type.

### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

- A. Inspection
  - 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  - Verify that toilet partitions and urinal screens may be installed in complete accord with the original design, the approved Shop Drawings and the Manufacturer's recommendations.

- Check areas scheduled to receive partitions for correct dimensions, plumbness of walls and soundness of wall surfaces that would affect the installation of holding brackets.
- 4. Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.
- 5. Verify correct location of built-in framing, anchorage and bracing.
- 6. Beginning of installation means installer accepts existing conditions.

#### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Installation

#### A. General

- 1. Install all toilet partitions and urinal screens where indicated on the Drawings and as indicated on the approved Shop Drawings in accord with Manufacturer's instructions.
- 2. Install partition rigidly, straight, plumb and level.
- 3. Provide clearances of not more than 1/2 inch between pilasters and panels.
- 4. Provide clearances of not more than one inch between panels and walls.
- 5. Secure panels to walls with not less than two stirrup brackets, attached near top and bottom of panel.
- 6. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints where applicable.
- 7. Conceal evidence of drilling, cutting and fitting to room finish.

### B. Ceiling-Hung Partitions

- 1. Secure pilasters to supporting structural framing using pilaster hangers.
- 2. Assure pilaster hangers do not transmit load to finished ceiling.
- 3. Level, plumb and tighten installation with leveling device.
- 4. Secure pilaster shoe in position.
- 5. Set bottoms of doors level with bottom of pilasters when doors are in closed position.

# 3.3 Adjust and Clean

- A. Adjust and lubricate hardware for proper operation after installation.
- B. Adjust and align door hardware to uniform clearance at vertical edges of doors. Clearance space not to exceed 3/16 inch.
- C. Set hinges on inward swing doors to hold doors open approximately 30 degrees from closed position when unlatched.
- D. Set hinges on outward swing doors to hold doors open approximately 10 degrees from closed position when unlatched.
- E. Perform final adjustments to leveling devices and hardware.
- F. Touch-up all scratches and abrasions to be completely invisible.
- G. Remove protective coverings.

\* \* \* \* \* \* \* \* \* \* \* \*

### **SECTION 10 28 13 TOILET ACCESSORIES**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.2 Washroom Accessories 1.2 Quality Assurance 2.3 Acceptable Manufacturers

> 1.3 Submittals 2.4 Fabrication

1.4 Product Delivery, Storage 3.1 Surface Conditions

and Handling 3.2 Preparation 2.1 Materials 3.3 Installation

3.4 Adjust and Clean

# **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Washroom accessories required are described in these Specifications and shown on the Drawings.

B. Related Work Specified Elsewhere

1.	Miscellaneous Metal	Section 05 50 00
2.	Gypsum Wallboard	Section 09 29 00
3.	Ceramic Tile	Section 09 31 00
4.	Plumbing Fixtures	Division 22
5.	Electrical	Division 26

C. Work Furnished but Installed by Others:

1. Wall anchors for grab bars Section 05 50 00 2. Wood blocking for accessories Section 06 10 00

### 1.2 Quality Assurance

- A. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. A 123, Zinc (Hot Galvanized) Coating on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
    - b. A 167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and
    - c. A 366, Specifications for Cold Rolled Carbon Steel Sheets, Commercial Quality.
    - d. A 386, Zinc Coating (Hot-Drip on Assembled Steel Products.
  - 2. Federal Specifications (FS):
    - a. WW-P-541, Plumbing Fixtures (Land Use).
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Material Lists: Manufacturer's catalog cuts and data sheets, complete parts list, and installation requirements for each accessory item specified.

February 6, 2024 10 28 13-1 **TOILET ACCESSORIES**  B. Maintenance data, operating instructions and keys required for each type of equipment and lock.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Delivery of Materials: Deliver items in Manufacturer's original unopened protective packaging.
- C. Storage of Materials, Equipment and Fixtures: Store materials in original protective packaging to prevent soiling, physical damage, or wetting.
- D. Handling Materials and Equipment
  - 1. Handle so as to prevent damage to finished surfaces.
  - 2. Protection:
    - a. Maintain protective covers on all units until installation is complete.
    - b. Remove protective covers at final clean-up of installation.
- E. 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 2 PRODUCTS**

# 2.1 Materials

#### 2.1 Materials

- A. Stainless Steel:
  - 1. Type: 302/304, ASTM A 167.
  - 2. Finish: No.4, satin
- B. Mounting Devices: Galvanized steel, ASTM A 386.

### 2.2 Washroom Accessories:

- A. As scheduled on drawings. Includes but is not necessarily limited to the following:
  - 1. Surface c-fold towel dispenser
    - a. Bay West #53270 Elegance Series or
    - b. Kimberley Clark #09905
    - c. Locations: (1) per restroom.
  - 2. Surface mounted soap dispenser
    - a. Bay West #9200 Silhouette
    - b. Kimberley Clark #92145
    - c. Locations: As shown on plans.
  - 3. Jumbo roll toilet paper dispenser
    - a. Bay West #72600 Silhouette Dubl-Serv

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- b. Kimberly Clark #09604
- c. Locations: (1) per toilet fixture.
- 4. Semi-recessed waste receptacle
  - a. Bobrick #B-3644
  - b. Bradley #344
  - c. Locations: As noted on plans.
- 5. Recessed Napkin/Tampon Disposal
  - a. Bobrick #B-353
  - b. Bradley #4731
  - c. Locations: (1) per restroom.
- 6. Shower curtain rod with curtain
  - a. Bobrick #B-207
  - b. Bradley #9538
  - c. Locations: (1) per shower unit.
- 7. Towel hooks
  - a. Bobrick #B-207
  - b. Bradlev #9118
  - c. Locations: (1) per shower location.
- 8. Mirrors 24" x 48" / 18" x 48" Frameless
  - a. Bobrick #B-1556 or approved equal
  - c. Locations: Per Elevations
- B. Grab Bars
  - 1. Material: Stainless steel, 1-1/4" diameter, satin finish.
  - 2. Strength Requirements: Material and anchorage capabilities to withstand downward force of 800 pounds.
  - 3. Flanges: Match bars and material and finish.
  - 4. Mounting plate: Concealed type, minimum 13 gauge, stainless steel.
- C. Diaper Changing Station- One (1): Wall-mounted folding diaper changing station of r use in commercial toilet facilities, meeting or exceeding ASTM F 2285.
  - 1. Style: Horizontal.
  - 2. Material: Stainless Steel.
  - 3. Mounting: Surface.
  - 4. Minimum Rated Load: 250 pounds.
  - 5. Basis-of-Design: Koala Kare KB200-01.
  - 6. Refer to Drawings for locations.
  - 7. ADA-Compliant mounting requirements.
  - 8. Locations: RR 109

# **2.3** Acceptable Manufacturers

- A. Washroom Accessories
  - 1. Bobrick
  - 2. Bradley

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#### 2.4 Fabrication

- A. Fabricate recessed units with seamless one piece flange on exposed face.
- B. Locked dispensing units: Key alike for all accessories.
- C. Coin operated dispensing units: Key coin boxes separately from dispensing unit.
- D. Weld corners, leaving no open miters.

#### PART 3 EXECUTION

#### 3.1 Surface Conditions

- A. Inspection
  - Check opening scheduled to receive recessed units for correct dimensions, plumbness of blocking or frames, preparation that would affect installation of accessories.
  - 2. Check areas to receive surface mounted units for conditions that would affect quality and execution of work.
  - Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.
  - 4. Do not begin installation of washroom accessories until openings and surfaces are acceptable.

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# 3.2 Preparation

- A. Coordinate work and cooperate with other trades to avoid delays in Work.
- B. Furnish items to be built into other Work to trades concerned and locate items for installation.

### 3.3 Installation

- A. Drill holes to correct size and application that is concealed by item, with 1/4 inch tolerance.
- B. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking, or sheet metal screws into metal frames.
- C. Mount surface mounted accessories to back up with toggle bolts, plumb and align.
- D. Lock grab bars to concealed mounting plate installed in wall.
- E. Accessories shall be located as indicated on Drawings. The exact type of fastening devices for each type of accessory shall be approved by Architect.
- F. Where accessories are set with screws, provide the necessary grounds, insert, screws and bolts as required to provide suitable anchorage.

# 3.4 Adjust and Clean

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Deliver keys and instruction sheets to Owner.

\* \* \* \* \* \* \* \* \* \* \* \*

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### **SECTION 10 51 13 METAL LOCKERS**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

1.2 Quality Assurance 2.2 Acceptable Manufacturers

1.3 Submittals 2.3 Fabrication

1.4 Product Delivery, Storage

3.1 Surface Conditions

and Handling 3.2 Preparation 1.5 Warranty 3.3 Installation

3.4 Adjust and Clean

### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Slope-top steel lockers and accessories as indicated on Drawings.

B. Related Work Specified Elsewhere

1.	Concrete	Section 03 30 00
2.	Masonry	Section 04 20 00
3.	Carpentry	Section 06 10 00
4.	Gypsum Wallboard	Section 09 29 00
5.	Ceramic Tile	Section 09 31 00

# **1.2** Quality Assurance

- A. Qualifications of Manufacturers: Regularly engaged in manufacture of steel lockers.
- B. Qualifications of Installers: For actual installation of lockers, use only personnel who are skilled in the Work required, completely familiar with the Manufacturer's recommended methods of installation and thoroughly familiar with the requirements of this Work.
- C. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. A 446, Steel Sheet, (Galvanized) by the Hot-Dip Process, Structural Quality
  - 2. Federal Specifications (FS):
    - a. AA-L-486, Lockers, Clothing, Steel.
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Shop Drawings
    - 1. Show locker types, sizes, configuration, fabrication and erection of locker assemblies, to extent not fully described by Manufacturer's data sheets.
    - 2. Show anchorage, accessory items, numbering and finishes.
    - 3. Provide location template drawings for bolthole locations in supporting members for attachment of partitions.
    - 4. Provide dimensions for base layout to Concrete Contractor.

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- B. Manufacturer's Data
  - 1. Data sheets
  - 2. Parts list
  - 3. Installation instructions
  - 4. Maintenance procedures
- C. Color Chips: Accompanying the Shop Drawings, submit color chips representing the full range of standard colors available from the selected Manufacturer in the quality of locker specified.
- D. Installation Methods: Accompanying the Shop Drawings, submit two copies of the Manufacturer's currently recommended installation methods, showing all required blocking and bracing.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
- B. Deliver items in Manufacturer's original unopened protective packaging.
- C. Store materials in original protective packaging to prevent soiling, physical damage or wetting.
- D. 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.
- **1.5 Warranty:** Warranty all defects in workmanship and materials for two year from date of acceptance by Owner.

#### PART 2 PRODUCTS

#### 2.1 Materials

- A. Sizes (Type 1) 18" x 24" x 72" and (Type 2) 12" x 18" x 72". 16" deep; slope top; recessed padlock device. (Filler Plates at all open gaps between lockers)
- B. Material: All parts shall be made of mild cold rolled sheet steel. All steel to be free from imperfections and capable of taking a high grade enamel finish. (Doors and body may be different color). Assembly fasteners to be zinc plated low round head slot less machine with screws with hex nuts or 3/16" steel rivets.
- C. Locker benches and pedestal; select hardwood with clear lacquer finish; 9-1/2" deep x 1-1/4" thick x 6'-0" long; (Two tubular steel pedestals per bench; color to match lockers). ADA Bench per Drawings

# 2.2 Acceptable Manufacturers

- Α. Products from the following manufacturers meeting or exceeding the specifications are approved:
  - 1. Art Metal Products
  - 2. Lyon Metal Products
  - 3. Olympus Lockers
  - 4. Penco Products
  - 5. Republic Storage Systems
  - 6. ASI Locker
  - 7. Elite Storage Products ESP
  - 8. Scranton Products
- **2.3 Fabrication:** Lockers shall be standard quiet type constructed as follows.
  - A. Construction: Lockers shall have flat, smooth metal surfaces without warp, dents or distortion. Assembled units shall be rigid and square. Bolt or rivet heads shall not be exposed on face of lockers.
  - B. Door Frames: Uprights shall not be less than 16 ga. steel. Cross members shall be provided between all doors and shall not be less than 16 ga. Exposed front frame edge shall be 1" width. The depth of the frame side shall be 1-1/2" and the frame must have a minimum 3/8" vertical door strike width on the hinge and latch side. Door frame shall also be MIG weld reinforced on the inside corners to assure rigid and square construction.
  - C. Doors: Locker door shall be 16 ga. cold rolled steel reinforced with right angle bends at top and bottom and a channel formation at the sides.
  - D. Quiet Latching Mechanism: Shall be quiet, positive, and operated by means of a spring actuated slide latch enclosed on four sides in a zinc plated steel, boxed receptacle in the lock bar channel, and engaging latch hooks on the frame. The device shall be prelocking, permitting latching without manipulating the door latch lifter. The lock bar shall be securely contained in the door channel by self-lubricating high density polyethylene guides that isolate the lock bar from metal-to-metal contact with the door.
  - E. Latching: There shall be three latching points on single tier lockers and two latching points for each door on double tier and triple tier lockers.
  - F. Frame Hooks: Frame hooks to accept latching shall be of 12 ga. steel, set completely within the 3/8" vertical door strike and welded to the door frame and vertical door strike.
  - G. Handles: Standard flush type
    - 1. Provide a stainless steel, recessed door handle that has to parts protruding from the surface of the locker door. Incorporate a lifting feature for actuating the lock bar when opening the door. The recessed door handle pocket shall be formed of 20 ga. stainless steel that is securely assembled to the door with a pop rivet. This pocket also provides a recessed area for accommodating the various lock types.

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- The lifting trigger integral with the recess packet shall be 11 ga. zinc plated steel, shall have a provision for a padlock centered in the depth of the pan, and shall be mechanically riveted to the lock bar in a location which is inaccessible from the outside.
- H. Door Silencers: The impact caused by the door closing shall be absorbed by an injected molded thermal plastic silencer securely fastened to each door.
- Hinges: Shall be at least 2" high, 5-knuckle, full loop, tight pin style, securely welded to frame and riveted to the inside of the door flange. Hinges shall be attached to the door with a minimum of two rivets.
- J. Body: Locker bodies shall consist of 24 ga. side sheets, backs, tops, and shelves. Locker bottoms shall be of 20 ga. zinc coated steel - no exceptions will be allowed. Tops, bottom and shelves shall be flanged on all four sides, backs shall be flanged on two sides.
- K. Interior Equipment: Units shall feature three single pronged wall hooks and one double pronged ceiling hook.
- L. Number Plates: Each locker shall have a polished aluminum number plate with black numerals not less than 3/8" high. Plates to be riveted to recessed handle or the upper center of door, depending on locker model and style.
- M. Finish: Exposed steel parts shall be thoroughly cleaned, given bonding and rust-inhibitive phosphate treatment, and electrostatically sprayed with powder coat. Bakedon finish.
- N. Colors: Doors and exposed body parts shall be finished in colors selected from manufacturer's 18 designer colors. Non-exposed body parts shall be finished in #05 Desert Beige or equal. Provide Two-Tone door and frame color combinations.
- O. Accessible Lockers: Provide handicap accessible units in quantity required by code or as shown on drawings. Include accessible shelf, hardware and label depicting International Accessible Symbol.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

#### A. Inspection

- 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that lockers may be installed in complete accord with the original design, the approved Shop Drawings and the Manufacturer's recommendations.
- 3. Check areas scheduled to receive lockers for correct dimensions, plumbness of walls and soundness of wall surfaces that would affect the installation of holding brackets.
- 4. Lockers may need to be cut to fit around obstructions.

- B. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Owner.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- **3.2 Preparation:** Take site dimensions affecting this work.
- 3.3 Installation: Lockers must be installed in accordance with manufacturer's approved drawings. Installation shall be level and plumb with flush surfaces and rigid attachment to anchoring surfaces.
  - A. Install all lockers where indicated on the Drawings and as indicated on the approved Shop Drawings.
  - B. Install lockers rigidly, straight, plumb and level.

# 3.4 Adjust and Clean

- A. Adjust and lubricate hardware for proper operation after installation.
- B. Perform final adjustments to leveling devices and hardware.
- C. Touch-up all scratches and abrasions to be completely invisible.
- D. Clean exposed surfaces and partitions, hardware fittings and accessories.

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### **SECTION 10 75 00 FLAGPOLE**

SCOPE Applicable provisions of the General and Supplementary Conditions, Supplementary Conditions for City of Oshkosh, City Specifications and Division 1 govern work under

this Section.

INDEX 1.1 Description 2.2 Acceptable Manufacturers

1.2 Quality Assurance and Products1.3 Submittals 3.1 Surface Conditions

1.4 Product Delivery, Storage 3.2 Preparation and Handling 3.3 Installation

1.5 Warranty 3.4 Adjust and Clean

2.1 Materials 3.5 Instructions

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Flagpoles required for this Work is indicated on the Drawings and includes One (1) aluminum system(s) complete with foundations.

B. Related Work Specified Elsewhere

Concrete
 Painting
 Electrical hookup
 Earthwork
 Section 03 30 00
 Section 09 91 00
 Division 26
 Division 31

C. Work Furnished but Not Installed: Furnish to concrete Contractor curb angles and other mounting hardware to be cast into concrete.

### 1.2 Quality Assurance

- A. Qualifications of Installers: For installation of flagpoles, use only personnel who are thoroughly familiar with the Manufacturer's recommended methods of installation and who are completely trained in the required skills.
- B. Installation methods: The recommended installation methods of the Manufacturer of the approved flagpoles, when those methods have been approved by the Owner, shall become the basis for acceptance or rejection of actual installation methods used in the Work.
- C. Design Criteria
  - 1. Wind Loading: Flagpoles, bases and anchorage devices shall be designed to withstand these wind velocities, unflagged:
    - a. Extra Heavy Duty Line: 120 mph
- D. Reference Standards
  - 1. American Society for Testing and Materials (ASTM):
    - a. A 53

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- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Shop Drawings: Include all details on construction, operation, equipment and foundation requirements.
  - B. Manufacturer's Installation Instruction: Submit for review by Owner.
- 1.4 Product Delivery, Storage and Handling
  - A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the 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.
- 1.5 Warranty: Manufacturer to fully warranty all equipment supplied for a period of two years from date of acceptance by Owner. Warranty shall cover all defects in materials and workmanship with replacements made at no additional cost to the Owner.

#### **PART 2 PRODUCTS**

- 2.1 Materials
  - A. Materials
    - 1. Aluminum: 6063 T6 alloy, seamless
  - B. Type of Taper
    - 1. Cone Tapered:
      - a. Uniform straight line with rate of taper:
        - (1) Standard line: 1 inch to every 5.5 feet of length.
        - (2) Extra heavy duty line: 1 inch to every 7.14 feet of length.
  - C. Classification
    - 1. Ground Set: Cone tapered aluminum tube flagpole.
  - D. Dimensions;
    - 1. One (1) flagpole required ground set
      - a. Exposed pole heights: 30'
      - b. Bottom diameter: 6"
      - c. Wall thickness: .188"
  - E. Finishes
    - 1. Aluminum flagpole: Clear finish anodized Aluminum.
  - F. Mountings
    - 1. Site
      - a. Ground set: Refer to foundation and installation details.

- G. Fittings
  - 1. Finial:
    - a. Ball: Satin aluminum
  - 2. Truck:
    - a. Concealed halyard revolving truck with 3/8" stainless steel ball bearings and 1/16" diameter stainless steel aircraft cable.
    - b. Flag arrangement of 1/8" stainless steel aircraft cable and quick links for one flag per pole.
  - 3. Halyard: #10 multi-filament braided polypropylene.
  - 4. Snap Hooks: two bronze snap hooks for each halyard.
  - 5. Snap hooks covers: neoprene
  - 6. Cleats: 9 inch aluminum, bronze or bronze-nickel plated.
  - 7. Internal Halyard cylinder; lock at cover.
  - 8. Mounting hardware:
    - a. Ground set:
      - (1) Flash collar of aluminum, bronze or stainless steel compatible with flagpole material.
      - (2) Foundation sleeve: 16 gauge corrugated galvanized steel.
  - 9. Lightning rod or spike:
  - 10. Flag: nylon American
    - a. 6' x 10'
    - b. State 5' x 8'
  - 11. Patriot light system LED Light Assembly
    - a. LED system including a 1,400 lumen 12 watt LED all-weather 110v spot light.
    - b. Mounting: Pole mounting with flag pole brackets.
    - c. The light must be compatible with the internal flag pole operation.
- H. Foundations: Design and construct concrete foundations as required for the approved flagpoles, securing necessary permits and approvals and providing suitable lightning arrestor system in accord with the recommendations of the flagpole Manufacturer.
- I. Operation: Internal halyard
- J. Other Materials: All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be as selected by the Contractor subject to the approval of the Owner.
- 2.2 Acceptable Manufacturers
  - A. Eder
  - B. American Flagpole
  - C. Concord Industries
  - D. John Ewing and Company
  - E. Morgan Francis

#### **PART 3 EXECUTION**

- 3.1 Surface Conditions
  - A. Inspection

- 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such Work is complete to the point where this installation may properly commence.
- Verify that flagpoles may be installed in strict accord with the original design and the Manufacturer's recommendations. Verify Pole spacing is adequate, relative to flag size.

# B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Owner.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

A. Shop Drawings: Transmit to the concrete contractor drawings to be used in the construction of the foundations.

# 3.3 Installation

- A. Foundations: Install all foundations in strict accord with the approved Shop Drawings.
- B. Flagpoles: Install all flagpoles in strict accord with the original design, all pertinent codes and regulations, the approved Shop Drawings and the Manufacturer's recommendations, anchoring all components securely for long life under hard use.

# 3.4 Adjust and Clean

- A. Make adjustments for efficient operation of flagpole equipment.
- B. Upon completion of installation, restore finish surface to original condition by touching up any marred or abraded surfaces.
- 3.5 Instructions: At a time designated by the Owner, thoroughly demonstrate to the Owner's maintenance personnel the operation and maintenance of all items installed under the work of this Section.

# **SECTION 10 80 00 MISCELLANEOUS SPECIALTIES**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

> 1.2 Submittals 2.2 Acceptable Manufacturer

1.3 Product Delivery, Storage and Handling 3.1 Surface Conditions

3.2 Preparation

1.4 Job Conditions 3.3 Installation

# **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Specialties under this Section will include:
  - 1. Semi-recessed fire extinguisher cabinets.
  - 2. Roof Tie back post
  - 3. Pipe Bollard Covers
  - 4. Bike Rack
  - 5. Knox Box
- B. Related Work Specified Elsewhere

1.	Concrete	Section 03 30 00
2.	Masonry	Section 04 20 00
3.	Carpentry	Section 06 10 00
4.	Gypsum Wallboard	Section 09 29 00

- 1.2 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
  - A. Shop Drawings

# 1.3 Product Delivery, Storage and Handling

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

# 1.4 Job Conditions

 A. Existing Conditions: Before any work of this Section is fabricated verify all existing field conditions. Take necessary field measurement. This Contractor has sole responsibility for the fit of this Work.

# **PART 2 PRODUCTS**

# 2.1 Materials

- A. Fire Extinguisher Cabinets: (See Drawings for locations)
  - 1. Box: Semi-recessed (2-1/2" or 4-1/2" projection per wall type), constructed of heavy duty cold-rolled steel. Finish to be white polyester powder coating.
  - 2. Door and Frame: bronze aluminum finish with radius edges. Door to have full break glass panel with break device and lock.
  - 3. Size: 12" W x 27" H x 8" D (inside dimensions must fit a 10lb unit)
  - 4. Glass: Smoke tempered safety glass.
  - 5. Cabinet to be ADA compliant.
  - 6. Fire extinguisher by Owner.
  - 7. Surface mount hooks at all parking, shop, and repair areas. G.C. responsible for hook mounting. Owner provided extinguishers.
- B. Pipe Bollard Covers (Size and Quantity per Drawings)
  - 1. Material: 1/4" Plastic
  - 2. Shape: Rounded top
  - 3. Reflective Tape: Two bands in recessed groove.
  - 4. Color: As selected from standard range.
  - 5. Accessories: Provide all mounting accessories needed for installation
- D. Tie Back Post Four (See Drawings for locations)
  - 1. Post 14.5"
  - 2. Strength 7,000 lbs.
  - Backer Plate 14" x 14" x 1/2" A36 galvanized plate with (4) 5/8" holes (bolt to column top plate)
  - 4. Welded direct to steel bar joist
- E. Bike Rack (1) required
  - 1. 3- Loop wave style bike rack 5 bike capacity
  - 2. Color: Black
  - 3. 10-gauge steel powder coated
  - 4. 2 3/8" diameter bar
  - 5. Model: H-2543BL
- F. Knox Box (1) required
  - 1. Knox Rapid Access System Model 3200 Verify with Fire Department
  - 2. Color: Black
  - 3. Knoxbox.com
- G. Desktop Partition Panel
  - 1. Product: Wellguard Separation Panels, Humanscale
  - 2. Mounting Style: Desk top direct, top mount.
  - 3. Material: FPETG Frosted
  - 4. Thickness: 1/4" thickness (6 mm)
  - 5. Removable Panel Option
  - 6. Side Panels: 24" depth / 24" Height

# 2.2 Acceptable Manufacturers

- A. Fire Extinguisher Cabinets
  - 1. J. L. Industries
  - 2. Larsens Manufacturing Company
  - 3. Potter Roemer
- B. Tie Back Post
  - Hy-Safe Technology
     Union Grove, WI
     Victor Busalacchi
  - 2. Other equal products as approved.
- C. Bike Rack
  - 1. Supplier Uline

# **PART 3 EXECUTION**

# 3.1 Surface Conditions

- A. Inspection: Prior to all Work of this Section, verify that the equipment may be installed in accord with Manufacturer's recommendations and the original design. In the event of discrepancy, immediately notify the Owner for clarification. Do not proceed until all such discrepancies have been fully resolved.
- **3.2 Preparation:** This Contractor will be responsible to supply other trades with the proper information to ensure that surfaces to receive the work of this Section are correctly fabricated.
- 3.3 Installation: Install equipment to Manufacturer's recommendations. Secure properly to supporting structures. Check for sound tightness. Install all hardware and check its operation. Clean all exposed surfaces.

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City of Huber Heights - New Public Works Facility

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# SECTION 11 11 19 LUBRICATION SYSTEMS

#### **PART 1 GENERAL**

#### 1.01 SCOPE

A. Applicable provisions of the General and Supplementary Conditions and Division I govern work under this Section.

#### 1.02 RELATED WORK

- A. 11 11 28 Vehicle Fueling
- B. 11 11 30 Card Activated management System

#### 1.03 DESCRIPTION

- A. Furnish and install a complete inside "lubrication system" as herein described and shown on drawings. This shall include all items necessary to complete the installation and as usually included in similar work whether specifically mentioned in the Contract Documents or not, including:
  - 1. Lubrication reels
  - 2. Piping, fittings and valves
  - 3. Pipe support
  - 4. Equipment mounting and support
  - 5. Lube pumps
  - 6. Lube tanks
  - 7. Installation
  - 8. Adapters
  - 9. Emergency Shut Off
  - 10. Vehicle Oil Pump (Waste Oil System)
  - 11. Low voltage wiring and components for controls/alarms.
- B. The entire project shall be designed, fabricated and installed by a contractor with not less than five years of installation experience with projects of this type and size.
- C. This Contractor shall hire all other trades as required to complete this project.
- D. All piping in building to run as high as possible, verify locations of all HVAC, electrical, plumbing, piping, ductwork and fire protection piping.
- E. Component and coordination of this system with fluid control system.

#### 1.04 MISCELLANEOUS EQUIPMENT AND INSTALLATION SPECIFICATIONS

- A. This system shall be bid on an installed basis by a qualified and experienced contractor with five years experience in the installation of centralized lubrication systems.
- B. Lubrication system piping shall be of size required for proper function of systems, piping shall be annealed steel tubing and matching fittings.
- C. All reels and pumps shall have shut-off valves and union connections.
- D. The piping shall be installed as per the manufacturer's installation instructions and good practice as noted on the plans. The manufacturers' installation procedure shall be completely followed by the contractor.
- E. The reels shall be mounted and secured to a heavy duty mounting assembly attached directly to the wall, structure, or column and extending down to 8' above the floor in the repair shop and on the supports in the vehicle parking area.
- F. One portion of the procedure is being emphasized as follows, but in no way minimizes the remaining manufacturers' installation instructions.
  - 1. Blow all air lines clean before making final equipment connections.
  - 2. Flush lubricant lines with non-flammable cleaner to remove foreign materials.
  - 3. Do not install control valves before flushing.

- 4. Each line shall be flushed with the pump to be used on the line.
- 5. After the lines are flushed, install control valves and pressure test with line under pressure. Check all connections and fittings for leakage.
- 6. Adjust the hose ball stops so valves hang 7' from floor.

#### 1.05 **DRAWINGS**

- A. Contractor shall design a system based on equipment locations shown on drawings. Contractors shall use Architectural and Mechanical drawings to do so, coordinate locations with all other contractors, verify equipment, duct, electrical and plumbing locations.
- B. Intent: It is the intent and the requirement of these Contract Documents, including Specifications, to provide finished work, complete in all respects and ready for operation by the Owner.
- C. It is the Contractor's responsibility to review all materials and equipment hereinafter specified or indicated on the Architectural drawings with regard to their proper operation and compliance with all governing Codes and then include in his bid proposal all materials required to provide the Owner with a completely approved and operating system whether or not all items have been specifically mentioned herein.
- D. Any dimensions given in figures on the drawings and details regarding the locations and configuration of any part of this work shall take precedence over dimensions and locations obtained by scaling the drawings. All dimensions, whether given in figures or scaled from the drawings, shall be field verified by the Contractor prior to fabricating any materials or ordering any equipment.
- E. The contractor shall design working shop drawings for review and coordination.

#### 1.06 **CODES AND APPROVALS**

- A. Comply with all codes, laws and ordinances of all governing bodies having jurisdiction over this work. In the event that the requirements of any of the codes, laws or ordinances conflict with these Contract Documents the more stringent requirements shall govern the Contractor.
- B. This entire installation shall be in complete compliance with guidelines set forth in:
  - 1. NFPA. latest edition and all other applicable N.F.P.A. Standards.
  - 2. Applicable Local Codes.
  - 3. Fire insurance requirements. (Rating Bureau and Owners)
  - 4. State Codes.
  - 5. Local Codes.
- C. Secure all required permits and pay all fees.
- D. Include permitting for waste oil tanks on waste oil heaters. Waste oil tanks are provided by HVAC contractor.

#### 1.07 **SUBMITTALS**

- A. Submit to the Engineer, preliminary layout and detail drawings with pipe locations and sizes, as specified hereinafter, for approval as to compliance with contract intent.
- B. Submit layout drawings, details and calculations of the system design to Engineer. Engineer shall approve these submittals prior to fabrication or installation of any materials by the contractor and proof of such approval shall be submitted to the Architect.
- C. The above mentioned submittal shall be submitted in triplicate and shall include catalog cut sheets on the following:
  - 1. All equipment, fittings, pipe, hangers, etc.

#### **MATERIALS AND WORKMANSHIP** 1.08

- A. All materials furnished for this work shall be suitable for use on this type of installation.
- B. All work shall be guaranteed for one year from the date of final acceptance by the Owner against defective materials and careless workmanship.
- C. Contractor shall patch the holes made necessary by this work and provide sleeves and waterproof members for any protrusions of the exterior building walls.

#### 1.09 RECORD DRAWINGS

- A. Upon completion of the project the Contractor shall provide the Owner with three (3) sets of Record Drawings updated to reflect any field changes that may have been made to the shop drawings.
- B. Contractor shall review the system installation with the Owner or his representative and instruct him as to the proper care and maintenance procedures. This instruction should include providing all instruction charts describing operation and proper maintenance.

#### **PART 2 PRODUCTS**

# 2.01 EQUIPMENT

#### A. General

- 1. All hose reels located in the lube reel banks, Lube dispensing Station, control valves and pumps shall be matched to a single source manufacturer.
- 2. Pumps, tanks and controllers to be installed in Oil Room 162
- B. Equipment by Lincoln, Graco, Sampson or pre-approved equal shall be used.

#### C. Reels

- Reels shall be rated "heavy duty" with single pedestal and hose roller arms, permanently lubricated bearings, extra large ratchet latch, fully ported swivel, be capable of retracting a minimum of 50' x 1/2" hose, carry a minimum one year limited parts and labor warranty, and have metal product identification tags.
- 2. Oil Reels 1-4 install at 7 stations in Repair 164 see plans for locations
  - (a) Designed to handle the following products 90W, 5W20, 5W30, and Grease (GREASE).
  - (b) 50' x 1/2" 2250 psi WP hose
  - (c) Hose Inlet Kit
  - (d) Control valve
  - (e) Solenoid valve with ready light
  - (f) Medium pressure inlet hose kit (comes with hose Reel)
  - (g) Lubricant Filter
  - (h) 2,000 psi shut-off ball valve
  - (i) Non-metered dispensing valve
  - (j) Oil, hydraulic, transmission fluids, metering control valve, 60 quart, preset countdown
- 3. Oil Reels 1-7 install at 1 station in Repair 164 see plans for locations
  - (a) Designed to handle the following products 90W, 5W20, 5W30, 15W40, Transmission (ATF), Hydraulic(HYD), and Grease (GREASE).
  - (b) 50' x 1/2" 2250 psi WP hose
  - (c) Hose Inlet Kit
  - (d) Control valve
  - (e) Solenoid valve with ready light
  - (f) Medium pressure inlet hose kit (comes with hose Reel)
  - (g) Lubricant Filter
  - (h) 2,000 psi shut-off ball valve
  - (i) Non-metered dispensing valve
  - (j) Oil, hydraulic, transmission fluids, metering control valve, 60 quart, preset countdown
- D. Provide and install a 24 HR/7 day programmable timer (this is a simple HVAC type) and normally closed 2" air solenoid valve with valved bypass at air Main that supplies all Lube air pumps.
  - (a) Install a 2" air valve before solenoid valve at 4' above floor.
  - (b) This contractor shall add normally closed air solenoid valve, panic push button for shut off and wiring from push button to solenoid valves to shut off supply air to air pumps.
  - (c) System shall operate by closing air solenoid valves at air pump inlets when panic button is pushed.
  - (d) Include sign indicating "emergency shut off for lubrication reels."
  - (e) Equipment: Similar to BJ Enterprises air solenoid valve

(f) Locations: Mount panic button on wall or support at 4' above floor at east wall of Repair area RM 130, outside of oil 131, wired and installed by this contractor.

# E. Pumps

- 1. All pumps shall have a minimum 4" diameter air motor size and the lubrication pumps shall have a limited parts and labor warranty.
- 2. General Lubrication:, , 5W30, 15W40, Transmission and (ATF), Hydraulic(HYD),

Quantity	Part #	Description
4		Powermaster 3, 8:1 ratio stub pump with 4" diameter air motor and 6" stroke and built-in air muffler with remote wall mount brackets/supports
4		2' air connect hose
4		5' x 3/4" product hose
4		Bung adapter
4		low-level cut off
4		Thermal relief valves
4		Suction tubes for between pump and low level cutoff High pressure valves

- (a) As needed: suction and pressure hosed for remote location of pumps
- (b) Other miscellaneous items for proper system function.
- 3. Miscellaneous Pump Accessories

Quantity	Part #	Description
4		1/2" air regulator and gauge
4		3/4" product shut off ball valve
4		1/2" pump air shut off ball valve
4		3/4" airline filter
4		3/4" airline lubricator
4		3/4" shut-off ball valve for main airline

#### F. Above Ground Tanks

- 1. Shall be stackable Poly tanks made for stackable installation or Double wall Steel tanks approved for use with Lubrication fluids will be allowed.
- 2. Include Base frame supports, openings as needed, opening plugs, fasteners, secondary containment pans and all other misc. items as needed for complete system. Venting and double float gauges are to be included. Fluidall or equal.
- 3. Provide 1 tank per pump and a waste oil tank for a total of 5 tanks. The tanks shall be 240gallon capacity each. Include a 500gallon tank for the waste oil
- G. Vehicle Waste Oil Pump (Waste Oil pump), total of 2 stations, 1 Station in Repair Bay 130 on north wall and 1 station in Repair Bay 130 on the south.
  - 1. A UL listed evacuation pump is to be mounted on wall 48" above the floor and include air filter, regulator, oiler, 6' x 3/4" suction hose, quick disconnect couplers, shut off valves and back check valves. All piping for system is to be provided by this contractor.

Quantity	Part #	Description	
2		UL evacuation kit. Includes: a 1" inlet UL double	
		diaphragm pump	
2		1/4" air valve	
2		overfill warning and auto-shutoff valve or approved	
		alternative system for Overflow protection	
2		5' air connecting hose	
2		Local Y-strainer	
2		I" fluid coupler	

2	portable waste oil receiver
2	16 gallon drum with threaded hole base
2	20 gallon portable waste oil truck cart
2	1" fluid nipple
2	Air shut off valves

- (a) Other miscellaneous items required for proper system function
- (b) provide and install an auto shut off of air pumps at each station when waste oil tank is full.

#### H. Piping:

- 1 All piping shall be as required for intended use and per industry standards.
- 1. Piping:
  - (a) Oil, Hyd, Trans, etc.: 1" OD steel tubing with a wall thickness of 0.049" with matching joint systems, 2200PSI minimum.
  - (b) Waste oil piping (from waste oil pump to storage tank): ASTM A53, Type E or S, standard weight, SCH40 black steel with ASTM A 197/ANSI B16.3 Class 150 black iron threaded Fittings.
  - (c) Air Piping (at Lube Pumps)
    ASTM A53, Type E or S, standard weight, SCH40 black steel with ASTM A 197/ANSI B16.3 Class 150 black iron threaded Fittings.
- I. Wall Mount Industrial Vacuum Cleaner:
  - 1. Provide JE Adams model 9235-3DH-Wall Dual hose industrial vacuum cleaner
  - 2. Unit has 3 1.6HP motors, 120/1/60, 30breaker, 2 sets of 15'-0" 2" vacuum hose
  - 3. Include push button kit with timer
  - 4. Install vacuum on column at intersection of 1-14 / 1-H in the vehicle parking area, see architectural plans for locations

#### **PART 3 EXECUTION**

# 3.01 SURFACE CONDITIONS

- A. Inspection: Prior to all work of this Section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence. Verify that lubrication systems shall be installed in strict accord with all pertinent codes and regulations and the approved Shop Drawings.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect for clarification and await his decision before proceeding.

#### 3.02 INSTALLATION

- A. Openings, Cutting, Sleeves and Repairing
  - The Contractor shall do all necessary openings, required to install all piping, fixtures and equipment. Only sawcutting or core drilling will be allowed. All piping shall be concealed wherever possible.
  - 2. All openings or holes shall be sleeved.
  - 3. Provide as necessary to permit installation of piping or any other part of the Work under this Section. Cooperate with other trades and adjust with them, subject to Architect's review, all questions of interference, right-of-way for piping, etc. Make all arrangements with various Contractors for any special framing or chases.
  - 4. All openings or holes thru new walls, floors, ceiling or footings shall be sawcut or core drilled.
  - 5. Openings around pipes penetrating required fire resistance rated floor, wall and roof assemblies shall be filled solidly with material of fire-resistance rating equal to the required rating of assembly penetrated. On all pipes passing through floors, walls and ceilings, provide chrome plated brass escutcheons of approved design and finish having outside diameter to cover sleeved openings and inside diameter to fit pipe. Securely fasten in place to floors, walls and ceilings.
  - 6. Holes through exterior walls shall be waterproofed and made watertight.

- 7. Plumber shall patch and return to original condition all areas damaged, sawcut, core drilled, etc. on this project and site.
- 8. All holes, openings, etc. cut through any reinforced concrete must be drilled with care so as to avoid spalling and unnecessary damage or weakening of the structural members. Chopping or breaking out will not be permitted. BEFORE cutting or drilling, permission must be obtained from Architect and any damage shall be repaired to Architect's satisfaction. Holes for piping through floors and walls already in place will be by means of core drilling.
- 9. Provisions for openings, holes, chases and clearances through walls, floors, ceilings, etc. in new construction shall be made in advance of construction of such parts of the building. The openings shall be provided by others during construction of the building, but it shall be the responsibility of the Contractor to furnish the applicable Contractor with all openings, dimensions and sleeves where required for installing this Work. These dimensions shall size and locate the opening sites. If the Contractor neglects to inform the other Contractors of opening requirements before that portion of the building has been constructed, the Contractor shall, at his own expense, cut his own opening and provide framing and lintels as required and approved by the Architect.
- 10. Sleeves shall be SCH 40 galvanized iron, except pipes passing through floors shall have steel sleeves extended one inch above finished floors. Sleeve shall be 1/2 inch larger than piping. Seal in open space around sleeve with caulking rope and finish with caulking to level of sleeve. Sleeves in outside wall shall be galvanized steel pipe, Schedule 40. 1 inch larger than piping, seal with oakum and finish with caulking to level of sleeve. Take special care in core drilling thru concrete floors so as not to spill water below and cause damage.
- 11. This contractor shall protect existing/New building, structure, drives, walks, equipment, etc. and furnishings when sawcutting, core drilling or installing this work.

#### B. Electrical Work:

- Contractor shall see that starters are properly located allowing for easy access and where ambient temperatures do not exceed normal room temperatures. Starters should not be secured to equipment, but instead to walls in close proximity to equipment. Where walls are not available, provide steel sandwich panels mounted on pipe legs and floor flange.
- 2. Contractor shall furnish: All motors in connections with this work, starters for all motors, overload protection for all motors and wiring diagrams, mercury float switches with 20' wire.
- This Contractor shall provide: All conduit, wiring and connectors of all requirements for all
  equipment requiring electrical service, all remote control devices including starters and final
  wiring connections.

# C. Painting and Finishes:

- 1. Painting will be done by others.
- 2. Structural iron, iron pipe supports, platforms exposed pipe hangers, etc.,provided by this Contractor and any equipment which is not furnished with an enamel finish shall be wire brushed free of rust, scale, etc., and given one coat of aluminum colored "Rustoleum" paint by a Journeyman Painter under the employ of the Contractor.
- Any surfaces of equipment in these areas where finish has been rusted or destroyed shall be refinished.

# D. General Pipe Work:

1. All piping shall be cleaned before installation by blowing out with compressed air or by other approved method. Provide temporary plugs or cap for all open ends of pipe and fixture when work is not being carried on to completion.

#### E. Lubrication System Layout:

- 1. General:
  - (a) Layout the lubrication system in careful coordination with the approved Shop Drawings, determining proper elevation for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
  - (b) Diagrammatic layouts for water, soil and vent piping are intended as a guide only and do not relieve the Contractor of any and all requirements of the State and Local Codes.

- 2. Information given herein and on Drawings is as exact as could be secured. Size and location shown are taken from the field survey. This Contractor must, therefore, examine location carefully and verify all measurements, distances, levels, etc. before starting work.
- Wherever the location of piping of equipment is governed by architectural features, this
  Contractor shall establish their location by referring to the General Drawings; he shall not
  scale the Drawings for exact dimensions.
- 4. Services: Locations of services are approximate and Contractor shall:
- Check existing locations, elevations and pitches of present piping before making connections to same;
- Report immediately to Architect in writing any existing conditions which will prohibit the installation of new work;
- Await Architect's decision on approximate adjustment of line locations and elevations before proceeding.
- 8. In event Drawings and Specifications are not in full accord and alterations, additions or deductions are necessary or exception in regard to size of equipment, notify Architect immediately, in writing and await his decision.
- 9. These Specifications and the accompanying Drawings are intended to provide for a finished and complete lubrication system.

# 3.03 FIELD QUALITY CONTROL

#### A. Tests

- 1. General:
  - (a) All tests and trials requested or directed by the Architect must be made by the Contractor without additional cost before acceptance of the Work.
  - (b) Furnish all test pumps, gauges, equipment and personnel required and test as necessary to demonstrate the integrity of the finished lubrication installation to the approval of all pertinent authorities and the Architect.
- The contractor shall conduct tests of systems as required by codes, regulatory agencies and
  this specification. Tests shall be made with the medium and under pressure as stated in the
  test requirements. Notify the Engineer and regulatory agencies prior to conducting tests.
  Contractor shall complete the attached certification form and submit to the Engineer when
  tests have been completed.

Type of System	Gauge Pressure	Medium
Lube Piping	150% of Normal	Air
	Static Pressure	

- 3. The pressure in pounds per square inch, gauge, are given as an initial pressure to be applied to lines being tested, together with test medium. Tests are to be applied for a minimum period of four (4) hours and until tests are complete. Final pressures at the end of test period may vary only by that caused by expansion of the test medium due to temperature changes.
- 4. Check of systems during application of test pressures should include visual check for water medium leakage, soap bubble or similar for air and nitrogen medium.
- 5. This Contractor shall include all temporary caps, plugs, valves, fittings, air bleeds, etc. as required for tests.
- 6. Architect's Right to Retesting
  - (a) Should the Contractor refuse or neglect to make any tests necessary to demonstration of the integrity of the completed system, the Architect may retain the services of an outside consultant to make all such tests and their resulting adjustments and balance.
  - (b) The cost for such tests shall be deducted from amounts owing to the Contractor and shall not be borne by the Owner.

- A. As completion of the Work, remove protective material from all lubrication equipment and piping, all paint and plaster spatterings and clean the fixtures and equipment. They are to be left and ready for use.
- B. Make good and pay for glass breakage, plaster patching and repairs to all other finished Work caused by this installation. Contractor shall patch and return to original condition all floors, walls, ceiling, etc., damaged as a result of his work.
- C. Rubbish removal as directed by Architect during progress of Work and at time of completion. Leave building and premises in clean, orderly condition.

#### 3.05 HOLES THRU FIRE WALLS

A. Comply with all State and Local Codes with regard to all pipe types passing thru fire walls and rated rooms.

#### 3.06 PIPE IDENTIFICATION

- A. Identify all mechanical equipment with nameplate bearing equipment name and number, using 1 1/2" white Bakelite with 1/2" black letters permanently mounted in a conspicuous place. Use mechanical fasteners instead of adhesive to mount nameplates wherever possible.
- B. Markings. Each piping system furnished and installed shall be identified. The direction of flow shall be indicated by means of stenciled legends and flow arrows. The marking shall be applied after all painting and cleaning of the piping and insulation is completed.
- C. Location. The legend and flow arrow shall be applied at all valve locations at all points where piping enters or leaves a wall, partition, bulkhead, cluster of piping, or similar obstruction and at approximately 30 feet intervals on pipe runs with at least one in each space or room. Color shall be verified with owner with stencils sized as follows: Over 2" 1" high; 2" and under 1/2" high. The marking shall be located so as to be conspicuous and legible at all times from any reasonable point.
- D. Valve Charts and Tags. Valve charts will be provided for each piping system. They shall consist of schematic drawings of piping layouts, which show and identify each valve and describes its function. Upon completion of the work, two copies of each chart, sealed to rigid backboard with clear lacquer under glass and framed, shall be mounted in the mechanical room where directed by the Owner. Valve lists shall be furnished as required. Provide 1 1/4" plastic or brass tags with 1/4" letters for all valves. Attach tags to valve handles by chrome plated "S" hooks. Furnish printed lists showing valve number, service, and location in each copy of Owner's Service Manual. Tags equal to Seton #2960 are acceptable.
- E. Identification Symbol types and colors shall be verified with Owner.

#### 3.07 PIPE HANGERS AND SUPPORTS

A. This Contractor shall be responsible to support and hang this work in a proper manner as per all codes and jobsite requirements.

**END OF SECTION** 

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# SECTION 11 11 28 VEHICLE FUEL EQUIPMENT AND CANOPY FOOTING DESIGN (Fuel Island Alternate Bid #1)

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

**INDEX** 1.1 Description

2.1 Materials

3.1 Surface Conditions

3.2 Testing, Guarantee and Training

3.3 Purpose of Fuel Monitoring System

3.4 General System Description

3.5 Fueling Procedure

3.6 System components and

**Specifications** 

3.7 Communication Lines

# **PART 1 GENERAL**

# 1.1 Description

- A. Furnish, deliver, unload, store, protect and install all equipment and piping so as to provide a complete operating system. This will include:
  - 1. All excavation and backfilling for the proper installation of buried tanks, related piping and monitoring well systems.
  - 2. Installation of concrete hold down anchors for the tanks.
  - 3. Installation of tank leak detection/monitoring system with associated electrical signal panel and wiring work to supplied power panel/source.
  - 4. Installation of automated fuel control system/key control, including electrical.
  - 5. Installation of canopy, including lighting, footings electrical and necessary permits.
  - 6. Concrete work and electrical work described under part 3 execution herein shall be installed in accordance with respective division/sections of the project manual.
- B. Or Equal: The Owner will accept bids on materials other than those herein after specified if they are equal to or better than specified. "Or equal" bidders must submit specifications and other data to Owner eight (8) days prior to closing of bids. The Owner will make a final determination on "or equal" bids. Such "or equal" bids shall be submitted in an alternate bid proposal.
- C. Shop drawings: Submittals are required for storage tanks including, tank accessory fittings, underground flexible double wall piping, fittings, flexible piping connector system, spill containment boxes tank and dispenser sumps and manholes. Information on the fuel management / control system, tank inventory level gauging, tank and electronic line leak detection monitoring system, remote high level alarm, dispensers, submersible turbine pumps, canopy and lighting.
- D. This contractor will be responsible to relocate the existing county owner CNG station. Existing station is located at the land fill to the west

# **PART 2 PRODUCTS**

# 2.1 Materials

A. Storage Tanks: The contractor shall provide State Approved ACT 100 TM or Permatank TM U.L. labeled steel tank with exterior surface fiberglass coating to provide a double wall configuration. This tank must be capable of withstanding 14 inches of vacuum on the interstice for a minimum of 1 hour. Sizes and fittings should be in according to the current installation instruction two (2) 8,000 gallon tanks required – one for gasoline, and one diesel. OR Xerxes or Containment Solutions double wall, fiberglass reinforced plastic tanks meeting or exceeding the specifications will be acceptable. Provide all required tank manufactured engineered and supplied tank tie-downs.

# 1. Tank Accessories:

- a. Anchor straps: Number and location per tank manufacturer's recommendations.
- b. Manways: Provide 24" access manways with 42" sealing turbine enclosures complete with U.L. approved gaskets, bolts on, and epoxy-coated steel covers, including 42" diameter bolt down sealing steel manholes at finish grade. Capable of withstanding heavy truck traffic, H-20 traffic loads. (32,000 pounds weight and be water tight).
- c. Threaded fittings: NPT and labeled construction.
- d. Lifting lugs: Integrally manufactured onto the tank by the manufacturer.
- e. Automatic Tank Gauging and Tank Leak Detection System: OPW **non**-discriminating interstitial sensor or equal for monitoring the interstitial space between the two walls of the tanks and monitor electronic line leak detection system.
- f. Turbine Gauging System: OPW Model #Q2000 environmental management console with printer, tank module, sensor module, line detector module with software, probes, appropriate 4" water and fuel floats, riser cap and ring assemblies or approved equal. (Tank probes to be installed under 18" diameter minimum bolt down sealing manholes).
- a. Submerged Turbine Fuel Pumps Shall be Red Jacket, Franklin Fueling or FE Petro 1.5 H.P. submerged turbine pumps with appropriate pump started/control boxes. and appropriate electronic line leak detectors to connect with the above automatic tank gauging system. The electronic line leak can be part of the tank gauging system.
- B. Fuel Island Located Diesel/Gasoline Dispensers Wayne Electronic Dispenser Model # 3/G7242D/2GHJK/HJ two product / two hose enhanced capacity 22 GPM with pulse out, external high those masts hangers. Diesel side (2) 1" x 17' hoses, (2) 1" dual 360 degree swivels, (2) 1" reconnectable breakaways, (2) 1" x 9" (whip) spacer hoses and (2) 1" high flow automatic nozzles and Gasoline side (2) 3/4" x 17' hoses, (2) 3/4" dual 360 degree swivels, (2) 3/4" breakaways, (2) 3/4" x 9" (whip) spacer hoses and (2) 3/4" standard flow automatic nozzles (two (2) total dispensers and four total hose hardware sets required at the Fuel Island) Gasboy, Wayne and Bennett are all approved equals.
- C. Underground Product Supply Piping: OPW FlexWorks/Pisces 1.5" double wall primary pipe inside 4" secondary conduit duct style piping. Both the primary and secondary piping systems shall be installed and integrity tested in accordance with the manufacturer's published installation instructions. The primary pipe must be removable for inspection and be capable of reinstallation without concrete breaking and excavation.

- D. Dispenser Sump: Shall be OPW FlexWorks /deep sumps model #DSW-1630 with OPW SBK-1100J stabilizer bars. The dispenser sump model and stabilizer bar models should be compatible to the dispenser.
- E. Underground Vent Piping: 2" NOV Ameron Dualoy 3000/L single wall fiberglass piping is used.
- F. Dispensers: To be connected to product lines with OPW 1.5" 10P-0152 10PLUS double poppet emergency impact valves and "Fire Safe" 1.5" stainless steel flex connectors.
- G. Submerged turbine pumps: To be connected to product lines with 2" stainless steel flex connectors "Fire Safe 2" ball valve should also be installed between the line and the submerged pump for isolation of the product line. Flex connectors should meet Industry standards.
- H. Vent lines: Should be connected to extractor assemblies at the tank with necessary stainless steel flex connector inside shrink wrap boot for corrosion protection and vent line tank isolation fitting connection to each tank. Transition vent lines above grade a minimum of 12 feet with 2" galvanized vent stacks, appropriate vent stands and 2" open vent for diesel and 8 oz. pressure / 2 in. vacuum vent cap for gasoline. If the fiberglass pipe connects directly to the extractor fitting then it does not require a boot covering.
- I. Fill Assemblies: Shall have 4" pipe risers to thread below grade OPW Model 101BG-2115 15 gallon spill container with drain back valve with (CAPD) and 18" round manhole lid and related 4" fill adapter and 4" fill caps. Coated galvanized steel or wrapped carbon steel 4" riser pipe is acceptable. Note: Gasoline fill to incorporate Stage I Vapor Recovery system with separate 18" V/R manhole, swivel adaptor and cap. (No coaxial fill drop tube method for Stage I Vapor Recovery method.) A 4" fiberglass risers is acceptable.
- J. 95% Overfill Protection: Shall either be Emco Wheaton Model #A-1100 "Guardian" shut-off valve assembly with Model #A20-004 Droep Tube or OPW 71SO-400EVR shut off valve with 4" aluminum Drop Tube assemblies.
- K. Extractable Vent Valve Assemblies: Shall be manufactured by either Morrison Model #562 or OPW #233-4420 TEE with associated adaptor and cap fittings.
- L. Provide a 30' (width) 60' (length) TFC Canopy Fashion Inc., B & M Canopies and King Mfg. Steel canopies with (20). 2 lights wired to stay on dusk from dawn rest of the lights on motion eye. Cree Lighting CPY250. See canopy specifications this section and plan layout.
- M. Provide OPW FIT500 Fuel Management System Card system or Gasboy or FuelMaster Card systems or equal. See specifications and plan layout.
- N. Leak Detection, tank monitoring system, pumps, dispensing equipment including fuel management system and canopy lighting should include the following: all electrical to be installed in metal rigid conduit, appropriate explosion and fire rated wiring as specified by the appropriate manufacturer, and final connection to each system. Installation to meet all NEC, NFPA 70, and all other codes which may apply or super cede class one, division one areas.

- O. Provide stainless steel island forms that are 13" (height) x 5' (width) x 43' (length). The island forms are to made of no less than 12 gauge steel with 1 ½" full-length return flange for added strength and continuous rolled edges that are 1 7/8" (wide) x 7/8" (deep). The island forms to be installed will be Riverside Model #200, Morgan Brothers or equal.
- P. Provide stainless steel bumper guard sets for the end of each island. Should be a 'U' shape. The pipe should be 4" diameter, 4'-0" high, 4'-0" wide.
- Q. Provide Concrete Island, drive area and concrete area over tanks as shown on plans per the standard specification, Ohio Department of Transportation current edition, shall apply to construction work on the project, plus current special provisions and supplemental specifications. Per the plan concrete pad is 8" type 'C' see detail on sheet 1S100.
- R. OPW and Franklin Fueling Systems components are acceptable provided they meet or exceed the specifications, including the following:

1½ hp Fixed Speed Submersible Turbine Pumps. Defender Series Overfill Prevention Valve TS-550 evo Full Feature Compliance Consoles

T. The following components are acceptable provided they meet or exceed the specifications.

Bennett Electronic Commercial Series 3722-SNR Series dispensers. OPW, Veeder Root, Franklin Fueling Systems and Pneumercator.

#### **PART 3 EXECUTION**

# 3.1 Surface Conditions

- A. Modifications to the tank system must be done by State of Ohio certified tank installer. The installation must conform to manufacturer's installation instruction and the PEI RP100 installation guide.
- B. Provide necessary local and state permits.
- C. Furnish all excavation, (excavation to meet OSHA specifications), trucking and backfilling. Use clean washed stone or pea gravel for backfill. Installer should follow all industry standards using all product manufactures approved backfill guidelines.
- D. Protect all underground steel pipe tank risers, such as fill pipe, monitor pipe risers, etc. with state approved epoxy coating or use galvanized pipe.
- E. Install all products in accordance with the manufacturer's written instructions.
- F. Clean and paint canopy columns and manholes with two coats of enamel paint. (Consult owner on preferred colors). (stainless steel ballards & island forms)
- G. Install no smoking, instruction and warning signs as required by law.

- H. Communications Lines: The communication lines will link the system components together and allow information to flow between them. Phone lines will not be utilized. The communication lines should be installed with the product manufactures approved cabling. See plan sheets for conduit run locations. Lines will dead-end in Library 129 cabling lines to be transitioned at both the beginning and ends of the run and crimped to CAT6 cable or equipment required.
- 120/208 v. 3 phase, 4 wire, is provided at the main facility; fuel systems contractor responsible for the necessary electric to provide power to complete system. See plans for panel location.

# 3.2 Testing, Guarantee and Training

- A. Test all equipment of system for compliance with the requirements of local, state and federal regulations.
- B. <u>In addition to required tests</u>, provide a final hydrostatic state approved test by an <u>independent</u> state approved testing firm.
- C. Guarantee all labor and materials for a period of one year.
- D. Training: Contractor must provide on site technical training for the Owner's operating personnel on the overall fuel handling system installed. Training to include thorough descriptions of the safety devices, the environmental monitoring well function, operational procedures, etc. This training must be provided by authorized representatives of the tank and equipment manufacturers. The contractor should provide a minimum of 8 hours of training.

#### 3.3 Fuel Monitoring System: Purpose of the System

A. The acceptable system will gather all employee-vehicle fueling data while controlling access to fuel on a 24 hour basis. (OPW FIT500 Fuel Management Card System, Phoenix Fuel Management, FuelMaster and Gasboy systems or equal.

# 3.4 General System Description

- A. The equipment provided shall be of fuel control and data collection design, no adapted systems will be allowed.
- A. The system will create a real time listing of all fuel product activity and store this information for batch transmission to an on site Personal Computer located in office 140. The system will include menu driven PC software to accomplish automatic polling, downloading, transaction storage, reporting, and transaction.
- C. The system will use a declining balance inventory for each tank in the system. The inventory will be automatically updated upon completion of each fueling transaction. Fuel receipt entries shall be make via the on site PC.
- D. The system shall have UL approval.

E. The Fuel Dispensing contractor shall provide the key reader units listed for Fuel Dispensing System including the card reader control unit at office 140.

# 3.5 Fueling Procedure

- A. The driver will position the vehicle near the reader within reach of the hose to be used. The drive should then note the vehicle's odometer reading and proceed to the Card Reader Control Unit with the required card (s) in hand. Following the instructions displayed on the Card Reader Control Unit display, the employee of vehicle key is inserted. The Card Reader Control Unit will then prompt for the second key followed by the current odometer reading the employee. The odometer entry is made via the keypad, then the hose number is selected.
  - The transaction is processed and, providing all parameters are met, an authorization to use the selected hose is received.
- B. The Fuel Dispensing System will require One (1) Master Card reader located at the fuel island,

# 3.6 System Components and Specifications

A. The proposed system will be an integrated set of components consisting of One (1) Master Reader Control Unit, one Real Time Printer, Communication Lines, 250 Cards, Computer, Report printer and Software/Phoenix. (OPW)

#### 3.7 Communication Lines

A. The Communication Lines will link the system components together and allow information to flow. Phone lines will not be utilized. (All lines and connections are the responsibility of this contractor and should be lines from the building to the island) This contractor must follow all the required manufactures requirements.

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# **SECTION 12 21 00 WINDOW BLINDS AND SHADES**

SCOPE Applicable provisions of the General and Supplementary Conditions, Supplementary Conditions for City of Oshkosh, City Specifications and Division 1 govern work under this Section.

INDEX 1.1 Submittals 3.1 Inspection

1.2 Extent of Work 3.2 Installation 2.1 Acceptable Manufacturers 3.3 Adjustment

3.4 Cleaning

#### **PART 1 GENERAL**

# 1.1 Submittals

A. Samples: One (1) complete, returnable, blind or shade of each type utilized.

# B. Shop Drawings

- Dimensions of openings scheduled to receive blinds or shades, based on field measurements.
- 2. Illustrations of special components not detailed on manufacturer's data sheets.
- 3. Details of divisions between adjacent units, abutments at corners, head and sill.
- C. Manufacturers Literature: Manufacturers descriptive literature and installation instructions for each type of unit utilized.

#### 1.2 Extent of Work

A. It is the intent of this document that all glazed openings with Venetian Blinds - see areas listed on plans. (see rooms finish plan for locations)

# **PART 2 PRODUCTS**

# 2.1 Acceptable Manufacturers

A. Roller Shades - SheerWeave by Phifer or approved equal.

#### **PART 3 EXECUTION**

#### 3.1 Inspection

- A. Check that surfaces to which work will be secured are sound and free of irregularities interfering with installation.
- B. Do not begin installation until unsatisfactory conditions have been corrected.

#### 3.2 Installation

- A. Install blinds and shades in accordance with manufacturer's installation procedures, and accepted shop drawings.
- B. Assure adequate clearance to permit unencumbered operation. February 6, 2024

C. Position units plumb and true, and securely anchor in place with brackets, clips, and fasteners.

# 3.3 Adjustment

- A. Adjust clearances and overlaps to insure free operation.
- B. Replace damaged items with new material.
- C. Repair surfaces damaged by improper installation.

# 3.4 Cleaning

- A. Remove protective coverings and devices.
- B. Clean soiled components and leave work site free of debris.

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# SECTION 14 40 00 LIFTS (HOISTS) Alternate #4

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description

1.2 Submittals

1.3 Product Delivery, Storage and Handling

1.4 Quality Assurance

1.5 Certification Requirements

1.6 Applicable Standards

2.1 Two Post Inground Lift

2.2 Construction Features

2.3 Capacities

2.4 Design Requirements

2.5 Controls

2.6 Saddle and Adapter Kit

2.7 Two Post Surface Mounted Lifts

2.8 General Specifications

2.9 Description of Installed Equipment

2.10 Arm/Adapter Assemblies

2.11 Wheel Spotting Dish

2.12 Power Unit

2.13 Equalization System

2.14 Overhead Limit Switch Assembly

2.15 Clear Floor3.1 Preparation

3.2 Fabrication

3.3 Installation

3.4 Start-Up Demonstration

3.5 Training

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: The Following are specifications for five (5) vehicle lifts: two (2) 60,000 lb. inground, one (1) 16,000 lb. surface mounted, and two (2) 12,000 lb. surface mounted. Power as specified on electrical drawings.

B. Related Work Specified Elsewhere

Cast-In Place Concrete
 Plumbing Systems
 Electrical
 Section 03 30 00
 Division 23
 Division 26

- 1.2 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:
- 1.3 Product Delivery, Storage and Handling
  - A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
  - B. Delivery and Storage of Materials
    - 1. Deliver materials in manufacturer's original sealed containers.
  - 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.

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# 1.4 QUALITY ASSURANCE

- A. Manufacturer shall be a reputable manufacturing firm, regularly engaged in the design and manufacture of lifts. All similar items shall be the product of a single manufacturer.
- B. A manufacturer's field service representative shall install; the equipment, conduct acceptance testing and train the Owner's personnel in the proper operation and maintenance of the equipment.
- C. The following information shall be provided with the bid documents regarding the manufacturer's experience and qualifications:
  - 1. Provide a minimum of three locations where similar equipment has been provided/installed including the date placed in service.
  - 2. Provide the name and telephone number of individuals at above locations who are familiar with the operation and maintenance of the lift equipment.

# 1.5 CERTIFICATION REQUIREMENTS

- A. Materials shall comply with ISO, E.N. and meet or exceed 9000 quality standards.
- B. The lift installer shall be certified as a factory authorized installer, trained and authorized by the manufacturer supplying the lift equipment. Certification shall be provided with the bid documents.
- C. The lift manufacturer shall comply with all applicable requirements of the "Buy America" provisions of the Surface Transportation Act as outlined by the Federal Transit Administration and U.S. Department of Transportation.
- D. The Lift Manufacturer shall be a held in good standings with the Automobile Lift Institute (ALI).
- E. The lift or lifts, shall be labeled and listed by a Nationally Recognized Testing Laboratory as established by OSHA for conformance to ANSI/ALI ALCTV-1998 Automotive Lifts, "Safety Requirements for the Construction, Care and Use of Automotive Lifts," as published by the American National Standards Institute. The lifts shall be Gold labeled certified with the ALI/ETL certification. The lift company's Quality Management System shall be ISO9001. The lift manufacturer shall comply with all applicable requirements of the Buy America Act.

# 1.6 APPLICABLE STANDARDS

In addition to the requirements outlined herein, the lift or lifts shall comply with all applicable requirements of Automotive Lift Institute (ALI), American National Standards Institute (ANSI), and "Safety Requirements for the Construction, Care and Use of Automobile Lifts", as published by the American National Standards Institute. All electrical apparatus shall be UL Listed.

#### **PART 2 PRODUCTS**

# 2.1 TWO POST INGROUND LIFT

A. Basis of Design – Stertil Koni DIAMONDLIFT 64

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# 2.2 CONSTRUCTION FEATURES:

Lifting Units Lift shall basically consist of two individual modular lifting assemblies in line with the longitudinal axis of the vehicle, each lifting cylinder so equipped as to engage the axle, suspension, as specified herein. Each modular lifting assembly shall be housed in a totally contained environmentally safe housing. The movable post shall be equipped with shutter plate covers that move with the post so as to keep the trench opening covered at all times. The modular lifting system shall be VEC™ equalized and controlled. The operation of the lift shall be electro-hydraulic.

# 2.3 CAPACITIES

Total Capacity – 64,000 pounds Lifting capacity front cylinder – 32,000 pounds Lifting capacity rear cylinder – 32,000 pounds Lift rise – 70 inches

#### 2.4 DESIGN REQUIREMENTS

#### FRONT POST MODULAR shall include:

- A. The front movable post shall be equipped with a carriage assembly with permanently lubricated bearing wheels for smooth and proper movement in the structural channel track. The casing of the movable post shall be coated with EnviroGuard™ coating for ultimate durability and maximum protection against deterioration due to electrolysis and/or harsh contaminates.
- B. Recessed track properly sized for movable post to provide proper engagement for vehicles ranging in wheel bases from 114 inches minimum to 228 inches maximum. The track shall have a recessed pocket location approximately 51 inches wide to house the saddle and adapter assembly when lift is in the lowered position providing and unobstructed clear floor. The track shall be equipped with a shutter plate style cover that shall move with the carriage so as to keep the trench opening covered at all times.
- C. Wheelbase adjustment shall be accomplished by a 2 HP explosion proof electric motor and chain drive assembly. Adjustment control shall be located on the control console.
- D. Lift locks: The lift lock shall be rated at same capacity as the corresponding jacking unit. The lock leg shall be a two stage telescoping type constructed of rectangular tubing. The lock leg shall be equipped with 18 locking positions on 3" increments. The locking latch shall be spring loaded to the lock position and shall be released at the control console. The lift locking leg shall be attached to the saddle to prevent rotation ensuring proper location of releases at all times. The locking leg shall prevent rotation of the piston assembly.
- E. Electro-Hydraulic Power Unit: The front modular unit shall be equipped with a 20 gallon power unit assembly, with 5 HP, explosion proof motor, 3 phase. The power unit system shall supply ample pressure for operation of lift system. The power unit shall be housed with in the modular housing.
- F. Modular Housing: The modular housing shall be a steel enclosure 5'-7" in depth, appropriately sized in length to accommodate specified wheelbase range. The housing shall be coated internally and externally with EnviroGuard coating for ultimate durability and maximum protection against deterioration due to electrolysis and/or harsh contaminates. The housing shall be designed to prevent the release of any contaminants into the surrounding soil. The housing shall be equipped with a Liquid Detection System that shall relay visual

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notification to the lift control LCD screen upon detection of 5 inches of liquid accumulation in the housing. The housing shall be equipped with a fitting located on a floor cover plate connected to a 1 ½" PVC tube routed to the bottom of the housing, which permits the removal of any liquid accumulation from the surface level without removing any cover plates from housing.

# REAR POST MODULAR shall include:

- G. The rear stationary post shall be of the same design construction, diameter and rise as the front post.
- H. Rear Frame: The rear frame unit will provide integral wheel chocks at floor level in order to accurately locate vehicle axles over the lifting saddle and adapters. The frame assembly shall also provide a recess beneath the floor for the rear saddle and base adapters when the plunger is in the down position. The recess area shall be 48 or 50 inches wide and have cover doors to close over the opening when lift is not in use.
- I. Lift locks: The lift locks shall be of the same design and construction as the front post.
- J. Power Unit: The power unit shall be of the same construction and design as the front post.
- K. Modular Housing: The modular housing shall be a steel enclosure 6' in depth, appropriately sized to house stationary post assembly and power unit. The housing shall be coated internally and externally with EnviroGuard coating for ultimate durability and maximum protection against deterioration due to electrolysis and/or harsh contaminates. The housing shall be designed to preventing the release of any contaminants into the surrounding soil.
- 2.5. CONTROLS (Reference Model Number MC2-480/277 Volts):

The VEC™ equalized controls shall be in a surface mounted console 4'-3 7/32" high X 2' wide. The control shall include the following features and functions.

- a. The control panel shall be equipped with a joystick type control for fore/aft movement of the piston and up/down operation of the lift. The joystick control shall be equipped with a locking ring to prevent accidental engagement of the control when not in use.
- b. The VEC™ equalization shall monitor all jack assemblies in relation to each other. The equalization shall be accomplished through variable motor rotation without the use of flow metering valves.
- c. The lift control panel shall be equipped with Inbay Technology allowing system communication through the use of an LCD Screen. The LCD screen shall provide onboard: Operation Training, Operation Manual, Preventative Maintenance Reminders, Fault Codes, and Site Specific Presets.
- d. The system shall provide the ability for the following facility required settings:
  - 1. Up to (10) memorized wheelbase locations as required by fleet.
  - 2. Up to (4) memorized height requirements as required by facility.
- e. The control system shall be compliant with the requirements of ANSI, ALI, UL201 and all other applicable NEC requirements.
- f. Verify supplied power per plans.
- 2.6 SADDLE AND ADAPTER KIT: The lift shall include a Saddle and Adapter Kit designed to properly engage and lift various maintenance vehicles, including Heavy Duty Trucks.

#### 2.7 TWO POST SURFACE MOUNTED LIFTS:

- A. Basis of Design
  - 1. 20,000 lb lift: Stertil Koni SK 2.20
  - 2. 12,000 lb lift: Rotary SPO12

#### 2.8 General Specifications

- A. Rise: 78" (from floor level to top of high step adapter)
- B. Overall Height: 11'8"
  - 1. Overall Height reflects standard setting. Alternative setting may be available, refer to Installation Instructions or consult factory for details.
- C. Overall Width: 11' 5 3/8"
  - 1. Overall Width reflects standard setting. Alternative setting may be available, refer to Installation Instructions or consult factory for details.
- D. Drive-Through Clearance at Tires: 95"
- E. Floor to Overhead Switch Bar: 11' 4"
- F. Front Arm/Adapter length (each): 23 3/4" min, 40 3/4" max
- G. Rear Arm/Adapter length (each): 41 3/8" min, 61" max
- H. Standard adapter heights: 4" (floor level to top of adapter)
- I. Standard adapter heights: 6 1/8" (floor level to top of adapter)
- J. Standard adapter heights: 10" (floor level to top of adapter)
- K. Distance Between Columns: 106 1/4"
- L. Cylinder Height at Full Rise: 11' 11"
- M. Capacity: Per Plans
- P. Power Unit: 2hp 208-230v (3) phase motor -~
- Q. Two column/carriage/cylinder assemblies
- R. Ceiling Height Required: 12'
- S. Single point release
- T. Standards:
  - The lift manufacturer shall be IS09001 certified. The lift shall be third party certified by ETL testing laboratory and labeled with the ETL/Automotive Lift Institute (ALI) label that affirms the lifts conformance to all applicable provisions of American National Standard ANSI/ALI ALCTV-1998.

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# 2.9 Description of Installed Equipment

- A. Column: Each column shall be manufactured of one-piece formed steel having a thickness of not less than 1/4". Column design shall place the carriage bearing surfaces to the back of the column
  - 1. Each column shall contain one carriage having 4 bearing slider blocks manufactured from a Tivar 1000 Ultra High Molecular Weight polyethylene. Each bearing block shall have a bearing area of a minimum of 22 square inches each and spaced at a minimum of 34 3/8".
  - Each column shall be factory rotated 30<sup>0</sup> to produce a genuine asymmetrical design in order to maintain proper balance between the centerline of the lifting columns and vehicle center of gravity.
- B. Locking Latches/Single Point Release: Each of the two assemblies shall contain a locking latch mechanism, external of the assemblies, for ease of service, which automatically sets at 4 1/4" increments after the first 18" of travel, continuing through full rise. The dual locking latch system shall have a single point release located near the power unit controls for operator convenience. The latches shall be spring actuated to automatically reset when the latch handle is released. There shall be no less than 13 locking positions per assembly.
- C. Cylinder: Each column shall contain one 68" stroke hydraulic cylinder with manual air bleeder at the upper end of the cylinder. The rod diameter of the cylinder shall not be less than 1 7/8" with a cylinder casing of not less than 2 3/8". Each hydraulic cylinder shall be designed with a restrictor orifice to regulate the lowering speed so as not to exceed 20 feet per minute at rated capacity. Cylinder will be installed in such a way that all lifting force is applied directly to column base and is not attached to carriage. Cylinder replacement can be achieved without any disassembly of columns, column extensions or overhead assembly.
- D. Column base plate and anchor orientation shall be designed to maximize the effectiveness of each anchor.

# 2.10 Arm/Adapter Assemblies:

- A. Shall consist of four telescoping swing arm assemblies.
- B. Each arm assembly shall have an adapter base which is laterally adjustable and equipped with a 360° rotating, 3-height position vehicle contact adapter.
- C. The vehicle contact adapter shall be capable of accommodating optional adapters for special lifting applications. Optional adapters must fit over the standard adapter and be fitted in place with a detent pin.
- D. Each arm shall be equipped with an arm restraint feature capable of withstanding 150 lbs. of horizontal force. The restraint shall be designed to engage when the carriage has been raised 1" and automatically release when fully lowered.
- 2.11 Wheel Spotting Dish: Floor-mounted three-position wheel spotting dish shall be supplied to facilitate proper vehicle positioning and load distribution on the arms:
- 2.12 Power Unit: The power unit shall be self contained with 2hp, 208-230v (1) phase 60hz motor. Fluid system shall have a capacity of 16 quarts. Controls shall be "dead man" type push button "up" and lowering lever for descent. Requires 25 amp. Service. Verify supplied power per plans.

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- 2.13 Equalization System: The lift shall be equipped with a mechanical equalization system to keep the two lifting carriages reasonably level at all stages of travel. The equalization shall consist of adjustable cables and sheaves with self lubricating bearings. The equalizer cables are used to laterally synchronize the load. They are not used as suspension cables to raise or support the load (this is accomplished by the two (2) full rise hydraulic cylinders).
- 2.14 Overhead Limit Switch Assembly: The lift shall be equipped with a padded overhead trip bar which actuates a limit switch wired to interrupt the power to the power unit should a vehicle contact the trip bar.
- 2.15 Clear Floor: The equalization cables and hydraulic hoses shall be routed overhead to provide a clear floor work area under the vehicle.

General Warranty: Manufacturer shall warrant the lift to be manufactured from sound materials in a workmanlike manner and warrant lift against failure due to defective materials and workmanship for a period of not less than one year. (See Rotary's Limited Warranty Statement applicable to this product).

# PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Transmit submittals and deliverables required by this section.
- B. Furnish product as indicated
- C. Ensure that substrates are in suitable condition to receive the work of this section

#### 3.2 FABRICATION

Fabricate equipment in accordance with all specifications and approved drawings

# 3.3 INSTALLATION

- A. Prior to commencing any on-site work, contractor shall provide facility all the construction details for the lift along with requirements for any specialty embedded items associated with lifts. The contractor and lift installer will closely coordinate requirements during installation phase. Installer shall provide and install materials required for complete and operable installation as indicated on manufacturer's installation drawings.
- B. Provide 3-inch high concrete service pad with chamfered edges under control console.

#### C. Inspection

- 1. Examine surfaces to receive hoists, setting, beds, or accessories before installation begins.
- 2. Do not proceed with installation work until unsatisfactory conditions are corrected.

# D. Discrepancies

- 1. In the event of discrepancy, immediately notify the Owner.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- C. Cleaning Up: Upon completion of all installation, thoroughly clean and polish the exposed surfaces of all equipment

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# 3.4 START-UP DEMONSTRATION

Following installation, the equipment installer shall perform an acceptance test as recommended by the manufacturer. Prior to the test, submit a testing program for approval. The program shall show that the equipment meets all of the conditions described by this specification and that the equipment will perform as intended. Notification of Start-Up Demonstration will be scheduled two weeks in advance of the estimated date.

#### 3.5 TRAINING

After completion of installation the installer shall provide a training program to all operating personnel to correctly demonstrate operation and maintenance procedures of the equipment. As a minimum training shall include: (1) Proper use and maintenance procedures of the lift; (2) safety features; (3) Cleaning procedures; (4) Proper methods for storage and handling of materials, including troubleshooting; and (5) Servicing, adjusting, routine preventative maintenance. (6) The manufacturer shall supply Installation, Operation, Maintenance and Safety related instructions with each lift.

\* \* \* \* \* \* \* \* \* \* \*

#### **SECTION 21 05 29**

# HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

#### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This section describes the following:
  - 1. Hangers, supports, and anchors for fire protection equipment, tanks, and piping systems.
  - 2. Supplementary steel for support or attachment of fire protection tanks, equipment, and piping to general construction elements of the project.

#### 1.2 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
  - 1. ASHRAE Chapter 41: Absorption, Cooling, Heating, and Refrigeration Equipment
- B. IBC: International Building Code
- C. NFPA: National Fire Protection Association
  - 1. NFPA 13: Standard for the Installation of Sprinkler Systems
- D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, Inc.

#### 1.3 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings:
  - 1. Submit shop drawings of Contractor-fabricated piping support structures, pipe racks, and anchors.
  - 2. Suspended Piping: Indicate point loads and support locations, along with applicable details keyed to layouts.
  - 3. Support Frames, Piping, Tank, and Equipment Supports, and Anchorage: Indicate point loads and support locations, along with engineers' calculations and details keyed to the layouts pertaining to supports, support frames, and anchorages.
  - 4. Supplementary Steel: Show details of fabrication and installation. Indicate materials, thicknesses, gauges, sizes, dimensions, methods of joining and fastening, welds, finishes, details of reinforcement and embedment, attachments, anchorages, miscellaneous metal items incidental to basic fabrication shown, provisions for work of other trades, and other pertinent information. Submit structural calculations for necessary supplementary steel for supports, anchors, and attachment of equipment and pipes to general construction. Calculations shall be prepared, stamped, and signed by a registered professional structural engineer licensed in the state of Oregon.
  - 5. As-Constructed Drawings and Data.

#### **PART 2 - PRODUCTS**

# 2.1 SUPPORTS AND ANCHORAGE

- A. Provide pipe and equipment hangers and supports in accordance with the following:
  - 1. When supports and anchorages for tanks, equipment, conduit, and piping are not shown on the drawings, the Contractor shall be responsible for their design.
  - 2. Supports and anchorages shall resist forces due to hydraulic testing and seismic forces as specified in the OSSC for the ground motion accelerations corresponding to the project location
  - 3. Supports and anchorages shall not introduce stresses in the piping caused by thermal expansion or contraction.
  - 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. The following engineered support systems shall be designed, stamped, and signed by a registered professional structural engineer licensed in the state of Oregon:
  - 1. Supports, floor and roof-mounted tanks, and supports for suspended tanks and equipment.
  - 2. Support frames, such as pipe racks or stanchions, for piping and equipment which provide support from below.
  - 3. Tank equipment and piping support frame anchorage to supporting slab or structure.

# 2.2 SUPPORTS, GENERAL

- A. Acceptable Manufacturers: B-Line Systems, Anvil, Superstrut, or equal.
- B. Fabricate support members from welded standard structural shapes, pipe, and plate. Carry the necessary rollers, hangers, and accessories as required. Piping less than 4-inch pipe size may be supported from or by prefabricated roll-formed channels as specified in this section with necessary accessories to adequately support piping system.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Cush-a-Strip, Hydra-Zorb cushions, or equal.

# 2.3 PIPE ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Michigan Hanger, Superstrut, Tolco, or equal.
- B. Clamps: Superstrut Series 700 through 702.
- C. Insulated Horizontal Steel Piping:
  - 1. 2 Inches and Under: Anvil Fig. 300. Fig. 260 or 70 with Fig. 167 shield.
  - 2. Over 2 Inches: Anvil Fig. 300. Fig. 260 with Fig. 167 shield.
- D. Uninsulated Horizontal Steel Piping:
  - 1. 2 Inches and Under: Anvil Fig. 260.

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- 2. Over 2 Inches: Anvil Fig. 260.
- E. Sprinkler Bulk Mains: Anvil Fig. 69, or wrought U-hangers as required by NFPA 13.
- F. Riser Clamps, Steel Pipe: 3/4-inch to 20-inch, Anvil Fig. 261.

# 2.4 PIPE RACKS

- A. Acceptable Manufacturers: B-Line Systems, Superstrut, Uni-Strut, or equal.
- B. Supports and Accessories: Preformed roll-formed channels and accessories with electrochromate or equal finish and matching compatible accessories as shown, as specified, and as required.

# 2.5 PROTECTION SHIELDS

A. Select protection shields based on actual outside diameter of pipe plus insulation. Use protection shields at hanger or roller assemblies on cold water piping and where hangers are installed around insulation.

#### 2.6 BUILDING ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Superstrut, Tolco, or equal.
- B. Beam Hangers: Beam Clamps Anvil Fig. 228, adjustable malleable iron beam clamp, or Fig. 292, adjustable forged steel beam clamp.

#### C. Inserts:

- 1. Malleable iron or steel inserts, Superstrut M-732CB or S. Inserts sized for required rod to support load being carried.
- 2. Malleable iron or steel inserts, Anvil, Fig. 152. Inserts sized for required rod to support load being carried.
- D. Expansion Plugs: Similar and equal to Phillips "red-head" self-drilling flush shell, selected for safety factor of 4.

# **PART 3 - EXECUTION**

#### 3.1 HANGERS AND SUPPORTS

#### A. General:

- 1. Install all support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the drawings.
- 2. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.
- 3. Size hangers to clear insulation for piping services conveying liquids less than 70°F.
- 4. Support fire protection piping independently of other piping.

- 5. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods. Do not use tape for isolation.
- 6. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- 7. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- 8. Install piping systems in accordance with NFPA standards.

# B. Vertical Piping:

- 1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved by the Port.
- 2. Riser clamps shall be directly under fitting or welded to pipe.
- 3. Support risers at each floor of penetration.
- 4. Provide structural steel supports at the base of pipe risers. Size supports to carry all forces exerted by piping system when systems are in operation.

# C. Insulated Horizontal Piping:

- 1. Install hangers outside of insulation.
- 2. On piping 1 1/2-inch and larger, provide insulation protection shields at each hanger location.
- D. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary supporting steel.
  - 1. Channels: Unistrut with electro-chromate finish, or equal.
- E. Hanger Spacing: Provide hangers at minimum spacing in accordance with NFPA 13 installation standards.

#### F. Insulation Protection:

- 1. Where piping is suspended from insulation, provide 16-gauge galvanized steel protection shields, 12 inches long and under piping insulation at all points of suspension.
- 2. Band shields firmly to insulation to prevent slippage.

#### G. Building Attachments:

- 1. Where possible, support all piping and equipment from structural members, beams, and joists.
- 2. Provide structural steel angles, channels, or other members to support piping and equipment where structures do not occur as required for proper support.
- 3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.
- 4. Provide transverse and longitudinal bracing as required by code to provide a stabilized piping system. Bracing shall not introduce stresses in the piping system caused by thermal expansion or contraction.
- 5. Do not fasten or attach to unfilled steel roof deck structure.
- 6. Attach to concrete-filled steel floor deck structure for loads up to 400 pounds. Loads larger than 400 pounds shall be designed per code. Submit structural calculations stamped and signed by a registered professional structural engineer licensed in the state of Oregon,

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showing that the concrete-filled floor deck has sufficient capacity to support the load at the points of anchorage.

# H. Pipe Racks:

- 1. General: Provide racks as shown with additional elements to adequately support piping.
- 2. Coordination: Where mechanical piping, tubing, etc., and electrical conduit, wiremold, wireways, etc., follow common routings, coordinate routing. Allow sufficient clearance to adequately operate, access, and maintain all devices without dismantling racks.
- I. General: Support all piping within 2 feet of change of direction on both sides of fitting.

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## **SECTION 21 11 00** FIRE SUPPRESSION SPRINKLERS

#### PART 1 - GENERAL

- 1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Particular attention to design-build scope of work on the drawings.
- 1.2 Summary: This section includes fire-suppression sprinklers, piping, and equipment for the following building systems:
  - A. Wet-pipe, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers.

#### 1.3 Definitions:

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 for obtaining approval from authorities having jurisdiction.

## 1.4 System Performance Requirements:

- A. Design sprinklers and obtain approval from authorities having jurisdiction.
  - 1. Minimum Density for Automatic-Sprinkler Piping Design: As follows:
    - Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
    - 2) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500sq. ft. (9.5 mL/s over 139-sq. m) area.
    - 3) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500sq. ft. (12.6 mL/s over 139-sq. m) area.
    - Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. 4) (18.9 mL/s over 232-sq. m) area.
    - Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. 5) (25.2 mL/s over 232-sq. m) area.
    - Special Occupancy Hazard: As determined by authorities having 6) jurisdiction.
  - 2. Maximum Protection Area per Sprinkler: As follows:
    - Office Space: 225 sq. ft. (20.9 sq. m). 1)
    - 2) Storage Areas: 130 sq. ft. (12.1 sq. m).
    - Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m). 3)
    - 4) Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
    - 5) Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- B. Components and Installation: Capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.

### 1.5 Submittals:

- A. Product Data: For the following:
  - 1. Pipe and fitting materials and methods of joining for sprinkler piping.
  - 2. Pipe hangers and supports.
  - 3. Valves, including specialty valves, accessories, and devices.
  - 4. Alarm devices. Include electrical data.

- 5. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
- 6. Excess-pressure pumps. Include electrical data.
- 7. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction. Include hydraulic calculations, if applicable.
- C. Hydraulic calculations. All as required by local authorities.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- E. Maintenance Data: For each type of sprinkler specialty to include in maintenance manuals specified in Division 1.

## 1.6 Quality Assurance:

- A. Installer Qualifications: An experienced installer who has designed and installed firesuppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- B. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified engineer. Base calculations on results of fire-hydrant flow test.
- C. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.
- D. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."
  - 2. NFPA 231, "General Storage."
  - NFPA 231C, "Rack Storage of Materials."

### PART 2 - PRODUCTS

#### 2.1 Manufacturers:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Specialty Valves and Devices:
    - a. Badger Fire Protection, Inc.
    - b. Central Sprinkler Corp.
    - c. Firematic Sprinkler Devices, Inc.
    - d. Globe Fire Sprinkler Corp.
    - e. Grinnell Corp.
    - f. Reliable Automatic Sprinkler Co., Inc.
    - g. Star Sprinkler Corp.
    - h. Viking Corp.
  - 2. Water-Flow Indicators and Supervisory Switches:

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- a. Gamewell Co.
- b. Grinnell Corp.
- c. Pittway Corp.; System Sensor Div.
- d. Potter Electric Signal Co.
- e. Reliable Automatic Sprinkler Co., Inc.
- f. Viking Corp.
- g. Watts Industries, Inc.; Water Products Div.
- 3. Sprinkler, Drain and Alarm Test Fittings:
  - a. Central Sprinkler Corp.
  - b. Fire-End and Croker Corp.
  - c. Grinnell Corp.
  - d. Victaulic Co. of America.
- 4. Sprinkler, Branch-Line Test Fittings:
  - a. Elkhart Brass Mfg. Co., Inc.
  - b. Fire-End and Croker Corp.
  - c. Smith Industries, Inc.; Potter-Roemer Div.
- 5. Sprinkler, Inspector's Test Fittings:
  - a. Fire-End and Croker Corp.
  - b. G/J Innovations, Inc.
  - c. Triple R Specialty of Ajax, Inc.
- 6. Fire Department Connections:
  - a. Badger Fire Protection, Inc.
  - b. Elkhart Brass Mfg. Co., Inc.
  - c. Fire-End and Croker Corp.
  - d. Firematic Sprinkler Devices, Inc.
  - e. Grinnell Corp.
  - f. Guardian Fire Equipment, Inc.
  - g. Reliable Automatic Sprinkler Co., Inc.
  - h. Smith Industries, Inc.; Potter-Roemer Div.
- 7. Sprinklers:
  - a. Badger Fire Protection, Inc.
  - b. Central Sprinkler Corp.
  - c. Firematic Sprinkler Devices, Inc.
  - d. Globe Fire Sprinkler Corp.
  - e. Grinnell Corp.
  - f. Reliable Automatic Sprinkler Co., Inc.
  - g. Star Sprinkler Corp.
  - h. Viking Corp.
- 8. Indicator Posts and Indicator-Post, Gate Valves:
  - a. American Cast Iron Pipe Co.; Waterous Co.
  - b. Grinnell Corp.
  - c. McWane, Inc.; Clow Valve Co. Div.
  - d. McWane, Inc.; Kennedy Valve Div.
  - e. Nibco, Inc.
  - f. Stockham Valves & Fittings, Inc.
- 9. Indicator Valves:
  - a. Central Sprink, Inc.
  - b. Grinnell Corp.
  - c. McWane, Inc.; Kennedy Valve Div.

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- d. Milwaukee Valve Co., Inc.
- Nibco, Inc. e.
- f. Victaulic Co. of America.
- 10. Fire-Protection-Service Valves:
  - a. Central Sprink, Inc.
  - b. Central Sprinkler Corp.
  - c. Grinnell Corp.
  - d. McWane, Inc.; Kennedy Valve Div.
  - e. Nibco, Inc.
  - Stockham Valves & Fittings, Inc. f.
  - g. Victaulic Co. of America.
- 11. Keyed Couplings for Steel Piping:
  - a. Central Sprink, Inc.
  - b. Ductilic, Inc.
  - c. Grinnell Corp.
  - d. National Fittings, Inc.
  - e. Star Pipe Products, Inc.; Star Fittings Div.
  - f. Victaulic Co. of America.
- 12. Press-Seal Fittings for Steel Piping:
  - a. Victaulic Co. of America.
- 2.2 Piping Materials: Refer to 1.3 EXECUTION, "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- 2.3 Pipes and Tubes:
  - A. Standard-Weight Steel Pipe: ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in NPS 6 (DN150) and smaller, and Schedule 30 in NPS 8 (DN200) and larg-
  - B. Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN125) and smaller and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN150 to DN250).
- 2.4 Pipe and Tube Fittings:
  - A. Cast-Iron Threaded Fittings: ASME B16.4.
  - B. Malleable-Iron Threaded Fittings: ASME B16.3.
  - C. Steel, Threaded Couplings: ASTM A 865.
  - D. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.
  - E. Steel Flanges and Flanged Fittings: ASME B16.5.
  - UL-listed and FM-approved, ASTM A 47 Grooved-End Fittings: F. Steel. (ASTM A 47M), malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
- 2.5 Joining Materials: Refer to Division 23 Section "Common Work Results for HVAC" for pipeflange gasket materials and welding filler metals.
- 2.6 Fire-Protection-Service Valves:
  - A. General: UL listed and FM approved, with minimum 175-psig (1200-kPa) nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.
  - B. Gate Valves, NPS 2 (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.

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- C. Gate Valves, NPS 2-1/2 (DN65) and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- D. Indicator-Post, Gate Valves: UL 262, iron body, bronze mounted, solid-wedge disc, and nonrising stem with operating nut and flanged ends.
- E. Swing Check Valves, NPS 2 (DN50) and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
- Swing Check Valves, NPS 2-1/2 (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
- G. Split-Clapper Check Valves, NPS 4 (DN100) and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.

## 2.7 Specialty Valves:

- A. Alarm Check Valves: UL 193, 175-psig (1200-kPa) working pressure, designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
  - 1. Option: Grooved-end connections for use with keyed couplings.
  - 2. Drip Cup Assembly: Pipe drain without valves, and separate from main drain
  - 3. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- B. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.

# 2.8 Sprinklers:

- A. Automatic Sprinklers: With heat-responsive element complying with the following:
  - 1. UL 199, for applications except residential.
  - 2. UL 1626, for residential applications.
  - 3. UL 1767, for early suppression, fast-response applications.
- B. Sprinkler Types and Categories: Nominal ½" (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- C. Sprinkler types, features, and options include the following:
  - 1. Concealed ceiling sprinklers, including cover plate.
  - 2. Flow-control sprinklers, with automatic open and shut off feature.
  - 3. Flush ceiling sprinklers, including escutcheon.
  - 4. Pendent sprinklers.
  - 5. Recessed sprinklers, including escutcheon.
  - 6. Sidewall sprinklers.
  - 7. Upright sprinklers.
- D. Sprinkler Finishes: Chrome-plated
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- F. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

#### 2.9 Fire Department Connections:

A. Wall, Fire Department Connections: UL 405; cast-brass body with brass, wall, escutcheon plate; brass, lugged caps with gaskets and brass chains; and brass, lugged

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swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking "AUTO SPKR."

1. Type: Flush mounting.

2. Escutcheon Plate: Rectangular.

3. Finish: Polished brass.

#### 2.10 **Alarm Devices:**

- A. General: Types matching piping and equipment connections.
- B. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig (1725-kPa) pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- C. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

#### 2.11 Pressure Gages:

A. Pressure Gages: UL 393, 3½"- to 4½"- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa).

### PART 3 - EXECUTION

- 3.1 Piping Applications:
  - A. Do not use welded joints with galvanized steel pipe.
  - B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
  - C. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
  - D. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
  - E. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
  - F. Underground Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.
  - G. Underground Service-Entrance Piping: Use ductile-iron, grooved-end pipe and fittings; ductile-iron, keyed couplings; and grooved joints.
  - H. Sprinkler Feed Mains and Risers: Use the following:
    - 1. NPS 6 (DN100) and Smaller: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
  - Wet-Pipe, Sprinkler Branch Piping: Use the following:
    - 1. NPS 2 and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- 3.2 Valve Applications: Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - A. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.

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- 1. Shutoff Duty: Use gate valves.
- B. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.
  - 1. Shutoff Duty: Use gate, ball, or butterfly valves.
  - 2. Throttling Duty: Use globe, ball, or butterfly valves.

### 3.3 Joint Construction:

- A. Refer to Section "Common Work Results for HVAC" for basic piping joint construc-
- B. Ductile-Iron-Piping, Grooved Joints: Use ductile-iron pipe with radius-cut-grooved ends; ductile-iron, grooved-end fittings; and ductile-iron, keyed couplings. Assemble ioints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
- C. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, groovedend fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

## 3.4 Service-Entrance Piping:

- A. Refer to Section "Common Work Results for HVAC" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground service-entrance piping according to NFPA 24 and with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN65) and larger connections.
- G. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.
- M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- N. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- O. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 (DN8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

February 6, 2024 21-11-00-7 3.5 Specialty Sprinkler Fitting Installation: Install specialty sprinkler fittings according to manufacturer's written instructions.

#### 3.6 Valve Installation:

- A. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- B. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- C. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain-line connection.

## 3.7 Sprinkler Applications:

- A. General: Use sprinklers according to the following applications:
  - 1. Rooms without Ceilings: Pendent sprinklers.
  - 2. Rooms with Suspended Ceilings: Concealed sprinklers.
  - 3. Wall Mounting: Sidewall sprinklers.
  - 4. Sprinkler Finishes: Use sprinklers with the following finishes:
    - a. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
    - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    - Flush Sprinklers: Bright chrome, with painted white escutcheon.
    - d. Recessed Sprinklers: Bright chrome, with bright chrome escutch-
- 3.8 Sprinkler Installation: Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

#### 3.9 Connections:

- A. Connect water supplies to sprinklers. Include backflow preventers.
- B. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- C. Connect piping to specialty valves, specialties, fire department connections, and accessories.
- D. Electrical Connections: Power wiring is specified in Division 26.
- E. Connect alarm devices to fire alarm.

#### 3.10 Labeling and Identification:

- A. Install labeling & pipe markers on equipment & piping according to requirements in NFPA 13 and in Division 23 Section "Common Work Results for HVAC."
- B. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 23 Section "Mechanical Identification."

#### 3.11 Field Quality Control:

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance"
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

#### 3.12 Cleaning:

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

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3.13 Protection: Protect sprinklers from damage until Substantial Completion.

#### 3.14 Commissioning:

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete.
- C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- E. Verify that potable-water supplies have correct types of backflow preventers.
- F. Verify that fire department connections have threads compatible with local fire department equipment.
- G. Fill wet-pipe sprinkler piping with water.
- H. Energize circuits to electrical equipment and devices.
- Coordinate with fire alarm tests. Operate as required.

#### 3.15 Demonstration:

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Owner with at least seven days' advance notice.

END 21 11 00.

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### **SECTION 22 00 00**

#### PENETRATION FIRESTOPPING FOR PLUMBING

### **PART 1 - GENERAL**

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

#### 1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of firerated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

## 1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of duct, piping, and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.

### 1.04 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
  - 1. Section 03300 Cast-In-Place Concrete
  - 2. Section 04200 Masonry Work
  - 3. Section 07840 Firestopping

## 1.05 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Firestop Devices (XHJI)

- b. Fire Resistance Ratings (BXRH)
- c. Through-Penetration Firestop Systems (XHEZ)
- d. Fill, Voids, or Cavity Material (XHHW)
- e. Forming Materials (XHKU)
- International Firestop Council Guidelines for Evaluating Firestop Systems
   Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- G. All major building codes: ICBO, SBCCI, BOCA, and IBC.
- H. NFPA 101 Life Safety Code

## 1.06 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

### 1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- C. Submit material safety data sheets provided with product delivered to job-site.

### 1.08 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.
- C. The work is to be installed by a contractor with at least one of the following qualifications:

FM 4991 Approved Contractor
UL Approved Contractor
Hilti Accredited Fire Stop Specialty Contractor

- D. Firm with not less than 3 years experience with fire stop installation.
- E. Successfully completed not less than 3 comparable scale projects using similar systems.

## 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

#### 1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

# B. Scheduling

- Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

#### **PART 2 - PRODUCTS**

### 2.01 FIRESTOPPING - GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

### 2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
  - 1. Hilti, Inc., Tulsa, Oklahoma 800-879-8000 www.us.hilti.com
  - 2. Provide products from the above acceptable manufacturer; *no substitutions will be accepted.*

#### 2.03 MATERIALS

- A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls, the following products are acceptable:
  - 1. Hilti Cast-In Place Firestop Device (CP 680-P)
    - a. Add Aerator Adaptor when used in conjunction with aerator system.
  - 2. Hilti Tub Box Kit (CP 681) for use with tub installations.
  - 3. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
  - 4. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
  - 5. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
  - 6. Hilti Firestop Block (CFS-BL)
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Flexible Firestop Sealant (CP 606)

- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
  - 1. Hilti Flexible Firestop Sealant (CP 606)
  - 2. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Flexible Firestop Sealant (CP 606)
- G. Non-curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Firestop Putty Stick (CP 618)
  - 2. Hilti Firestop Plug (CFS-PL)
- H. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
  - 1. Hilti Firestop Collar (CP 643N)
  - 2. Hilti Firestop Collar (CP 644)
  - 3. Hilti Wrap Strips (CP 648E/648S)
- I. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Mortar (CP 637)
  - 2. Hilti Firestop Block (CFS-BL)
  - 3. Hilti Fire Foam (CP 620)
  - 4. Hilti Firestop Board (CP 675T)
- J. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Board (CP 675T)

- K. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Plug (CFS-PL)
- L. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

### **PART 3 - EXECUTION**

#### 3.01 **PREPARATION**

- Verification of Conditions: Examine areas and conditions under which work is to Α. be performed and identify conditions detrimental to proper or timely completion.
  - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
  - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - Comply with manufacturer's recommendations for temperature and 4. humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.02 COORDINATION

- Coordinate location and proper selection of cast-in-place Firestop Devices A. with trade responsible for the work. Ensure device is installed before placement of concrete.
- В. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

#### 3.03 INSTALLATION

- Α. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
  - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

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3. Protect materials from damage on surfaces subjected to traffic.

### 3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

## 3.05 IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration location on the entire project.
- A.1 The Documentation Form for through penetrations is to include:
  - 1. A Sequential Location Number
  - 2. The Project Name
  - Date of Installation
  - 4. Detailed description of the penetrations location
  - 5. Tested System or Engineered Judgment Number
  - 6. Type of assembly penetrated
  - 7. A detailed description of the size and type of penetrating item
  - 8. Size of opening
  - 9. Number of sides of assemblies addressed
  - 10. Hourly rating to be achieved
  - 11. Installers Name
- B. Copies of these documents are to be provided to the general contractor at the completion of the project.
- C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's Name, address, and phone number.
  - 3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
  - 4. Date of Installation.

- Through-Penetration firestop system manufacturer's name.
- Installer's Name.
- D. A firestop documentation manager software shall be used to document, track, and maintain the passive firestop systems throughout the construction and maintenance phase of the facility. The software solution shall be used to track and document every firestop system installed on the project and each subsequent addition, change, or removal of the firestop system. The firestop documentation shall be managed with a cloud-based software which allows the installer to use a standard smartphone or tablet device (either iOS, Android or Windows capable) to capture the relevant information for the installation. The following data shall be tracked for each penetration within the facility: product installed, system installed, date of installation, location of the penetration including a notation on the 2D plan image, F-rating, name of installer, photo (preinstallation and post-installation), and inspection status. The Owner and/ or Construction Manager may designate additional items to be tracked. The firestop documentation manager software must perform the following basic functions:
  - Create multiple projects/ facilities, add/create/ remove users for each project, upload documents including UL systems, 2D floor plans, product data, engineering judgments, etc.
  - Define data to track using pre-defined input fields or creating custom input fields as desired.
  - Capture multiple photos for each penetration, including a pre-installation and post-installation photo.
  - Scan QR Code on Hilti identification label to link the program data to a specific penetration location.
  - 5. Annotate (mark) location of penetration on 2D floor plan.
  - 6. Create reports by filtering data and utilizing report templates.
  - Online/ offline (for use in areas where data service is unavailable) synchronization of data between mobile device, online application and cloud-based system.
  - Ability to transfer ownership of projects from one customer to another from construction phase to facility maintenance.

Permanently attach Hilti identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to quickly identify the penetration attributes.

Acceptable Software: Hilti CFS-DM, from Hilti Inc., Tulsa, OK. Tel (800) 879-8000 or Hilti (Canada) Corporation, Mississauga, Ontario (800) 363-4458 website: <a href="https://www.us.hilti.com">www.hilti.ca.com</a>

Substitutions: Not permitted.

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2. Single Source: Obtain firestop documentation manager software and firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

## 3.06 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

### 3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

## **END OF SECTION**

### **SECTION 22 05 00**

#### COMMON WORK RESULTS FOR PLUMBING

#### 1.1. GENERAL

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

## B. Summary:

- 1. This Section includes the following basic mechanical materials and methods to complement other Division 22 and 23 Sections.
  - Piping materials and installation instructions common to most piping systems.
  - b. Escutcheons
  - c. Dielectric fittings.
  - d. Flexible connectors.
  - e. Equipment nameplate data requirements.
  - f. Labeling and identifying mechanical systems
  - g. Field-fabricated metal and wood equipment supports.
  - Installation requirements common to equipment specification sections.
  - i. Mechanical demolition.
  - j. Cutting and patching.
  - k. Touchup painting and finishing.
- 2. Pipe and pipe fitting materials are specified in Division 22 piping system Sections.

#### C. Definitions:

- Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- 2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- 3. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- 4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- 6. The following are industry abbreviations for plastic materials:
  - a. CPVC: Chlorinated polyvinyl chloride plastic.
  - b. NP: Nylon plastic.
  - c. PE: Polyethylene plastic.
  - d. PVC: Polyvinyl chloride plastic.
- 7. The following are industry abbreviations for rubber materials:
  - a. CR: Chlorosulfonated polyethylene synthetic rubber.
  - b. EPDM: Ethylene propylene diene terpolymer rubber.

## D. Quality Assurance:

- 1. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- 2. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

# E. Delivery, Storage, and Handling:

- 1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- 2. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- 3. Protect flanges, fittings, and piping specialties from moisture and dirt.

## F. Sequencing and Scheduling:

- Coordinate mechanical equipment installation with other building components.
- 2. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- 3. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- 4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- 5. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- 6. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
- 7. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

### 1.2. PRODUCTS

### A. Pipe and Pipe Fittings:

- 1. Refer to individual Division 22 piping Sections for pipe and fitting materials and joining methods.
- 2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## B. Joining Materials:

- Solder Filler Metals: ASTM B 32.
  - a. Alloy Sn95 or Alloy Sn94: Approximately 95% tin and 5% silver, with 0.10% lead content.
  - b. Alloy E: Approximately 95% tin and 5% copper, with 0.10% maximum lead content.
  - c. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10% maximum lead content.

- Alloy HB: Tin-antimony-silver-copper nickel, with 0.10% maximum lead content.
- e. Alloy Sb5: 95% tin and 5% antimony, with 0.20% maximum lead content.
- 2. Solvent Cements: Manufacturer's standard solvent cements for the following:
  - a. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
  - a. Sleeve: ASTM A 126, Class B, gray iron.
  - b. Followers: Malleable iron or ASTM A 536 ductile iron.
  - c. Gaskets: Rubber.
  - d. Bolts and Nuts: AWWA C111.
  - e. Finish: Enamel paint.

## C. Dielectric Fittings:

- General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- 2. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- 3. Insulating Material: Suitable for system fluid, pressure, and temperature.
- 4. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180° F (82° C).
- 5. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig (1035-kPa) minimum working pressure as required to suit system pressures.
- 6. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - Provide separate companion flanges and steel bolts and nuts for 150 psig (1035-kPa) minimum working pressure as required to suit system pressures.
- 7. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225° F (107° C).

# D. Identifying Devices and Labels:

- General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
- 2. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
  - a. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
  - b. Location: Accessible and visible location.
- 3. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1½"- (30-mm-) high letters for ductwork and not less than 3½"- (19-mm-) high letters for access door signs and similar operational instructions.

- a. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form
- Identification Paint: Standard identification enamel of colors indicated or, b. if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
- 4. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
  - Fabricate in sizes required for message. a.
  - Engraved with engraver's standard letter style, of sizes and with wording b. to match equipment identification.
  - Punch for mechanical fastening. C.
  - Thickness: 1/8", unless otherwise indicated. d.
  - Fasteners: Self-tapping stainless-steel screws or contact-type e. permanent adhesive.
- 5. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:
  - Green: Cooling equipment and components. a.
  - Yellow: Heating equipment and components. b.
  - Yellow/Green: Combination cooling and heating equipment and C. components.
  - Brown: Energy reclamation equipment and components. d.
  - Blue: Equipment and components that do not meet any criteria above. e.
  - f. For hazardous equipment, use colors and designs recommended by **ASME A13.1.**
  - Nomenclature: Include the following, matching terminology on schedules g. as closely as possible:
    - Name and plan number. 1)
    - 2) Equipment service.
    - 3) Design capacity.
    - 4) Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
  - h. Approximate 2½" by 4" (65 by 100 mm) for control devices. dampers, and valves; and 41/2" by 6" (115 by 150 mm) for equipment.
- 6. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
  - If multiple systems of same generic name are Multiple Systems: a. indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

#### 1.3. **EXECUTION**

- A. Piping Systems – Common Requirements:
  - General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion,

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- pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.
- 2. Install components with pressure rating equal to or greater than system operating pressure.
- 3. Install piping free of sags and bends.
- 4. Install piping to allow application of insulation plus 1" (25-mm) clearance around insulation.
- Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- 6. Install couplings according to manufacturer's written instructions.
- 7. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 8. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
  - a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - c. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
  - d. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    - 2) Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    - 3) Align threads at point of assembly.
    - 4) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    - 5) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- 9. Piping Connections: Make connections according to the following, unless otherwise indicated:
  - a. Install unions, in piping 2" NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2" NPS or smaller threaded pipe connection.
  - b. Install flanges, in piping 2½" NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
  - c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- B. Equipment Installation Common Requirements:
  - Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
  - 2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
  - 3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- 5. Install equipment giving right of way to piping installed at required slope.
- 6. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

## C. Labeling and Identifying:

- Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - a. Stenciled Markers: According to ASME A13.1.
  - b. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
  - c. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior non-concealed locations:
    - 1) Near each valve and control device.
    - 2) Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
    - Near locations if pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
    - 4) At access doors, manholes, and similar access points that permit view of concealed piping.
    - 5) Near major equipment items and other points of origination and termination.
    - 6) Spaced at maximum of 50' (15-m) intervals along each run. Reduce intervals to 25' (7.5 m) in congested areas of piping and equipment.
    - 7) On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- 2. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.
  - a. Lettering Size: Minimum ¼"- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24" (610 mm), ½"h- (12.7-mm-) high lettering for distances up to 72" (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  - b. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- 3. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.
- D. Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

## E. Demolition:

1. Disconnect, demolish, and remove Work specified in Division 22 Sections.

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- 2. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- 3. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- 4. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2" beyond face of adjacent construction. Cap and patch surface to match existing finish.
- 5. Removal: Remove indicated equipment from Project site.
- 6. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

# F. Cutting and Patching:

- Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- 2. Repair cut surfaces to match adjacent surfaces.

**END OF SECTION** 

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### **SECTION 22 05 13**

## **ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT**

#### 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

### 1.2 SUMMARY

- A. This section specifies the basic requirements for electrical components which are an integral part of packaged plumbing equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged plumbing equipment. In addition, this section covers necessary coordination issues between plumbing and electrical disciplines. All plumbing and electrical construction documents must be completely reviewed by the Plumbing and Electrical Contractors prior to the submission of bids. Any discrepancies in the documents should be brought to the Architect/Engineer's attention at that time. Failure to properly coordinate or review documents in advance of submission of bids will not be valid cause for changes to the overall Contract amount.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for plumbing equipment are scheduled on the Drawings.

### 1.3 REFERENCES

- A. The design, manufacture, testing and method of installation of all equipment and materials furnished under the requirements of this specification section shall conform to the following:
  - 1. ANSI/NEMA Standard MG 1: Motors and Generators
  - 2. NEMA Standard ICS 2: Industrial Control Devices, Controllers, and Assemblies.
  - 3. NEMA Standard 250: Enclosures for Electrical Equipment.
  - 4. NEMA Standard KS 1: Enclosed Switches.
  - ANSI/NFPA 70 National Electrical Code.
  - 6. AFBMA 9 Load Ratings and Fatigue Life for Ball Bearings.
  - 7. AFBMA 11 Load Ratings and Fatigue Life for Roller Bearings.
  - 8. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators.

### 1.4 SUBMITTALS

- A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, or as required by the individual equipment specification sections.
- B. Reference Section 22 05 00

## 1.5 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled and listed.

### 2. **PRODUCTS**

## 2.1 MOTORS

- A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
  - Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
  - 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Minimum service factors shall be as follows:

Motor Service Factor Schedule		
Horsepower:	3600 RPM:	1800 RPM:
1/6 – 1/3	1.35	1.35
1/2	1.25	1.25
3/4	1.25	1.25
1 – 1.25	1.25	1.15
1.5 - 150	1.15	1.15

- Two-speed poly-phase motors shall have two separate windings served by a single point electrical connection to the two speed starter. Two speed starters shall be located at the motor location unless otherwise noted.
- 4. Temperature Rating: Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).
- 5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than five (5) evenly timed starts per hour for manually controlled motors.
- 6. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
  - a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit each specific application.
  - b. Bearings: Ball or roller bearings with inner and outer shaft seals; re-greasable; designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor; for fractional horsepower, light duty motors, sleeve type bearings are permitted.
  - c. Enclosure Type: Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation; guarded drip-proof motors where exposed to contact by employees or building occupants; weather protected Type I for outdoor use, Type II where not housed.
  - d. Overload protection: Built-in thermal overload protection (in accordance with NEC requirements) and, where indicated, an internal sensing device suitable for signaling and stopping the motor at the starter.
- 7. Noise rating: "Quiet"
- 8. Efficiency: "Premium efficiency" motors, as defined in NEMA MG 1, most recent edition.
- 9. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- 10. Motors Used With Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by drive manufacturer. Motor shall be designed and labeled for use with variable frequency drives. Motor shall be designed with critical

- vibration frequencies outside the operating range of the drive output and shall be suitable for use throughout speed range without overheating.
- 11. Motors Used for Wet or Corrosive Duty: Severe duty with cast-iron frame, epoxy finish, stainless steel nameplate, polymer shaft seal, corrosion-resistant fasteners and fan, moisture-resistant windings, and non-wicking leads.

#### 2.2 SHEAVES

- A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.
- B. When replacing sheaves, use sheaves of at least the originally supplied sizes.
- C. Contractor shall be responsible for replacement sheaves required to achieve specified performance. Coordinate with testing and balancing of the equipment.

### 2.3 STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Motor-Starter Characteristics: Motor starters shall be compatible with the equipment they serve. In general, motor starter characteristics shall meet the requirements of Division 26 specification sections and as outlined as follows:

#### B. FULL VOLTAGE NON-REVERSING MAGNETIC AND COMBINATION STARTERS

- Provide magnetic starters for three phase motors in accordance with the requirements listed in the Contract Documents. Motor starters shall be full voltage non-reversing "across the line" magnetic type, rated in accordance with NEMA standard sizes and horsepower ratings. Magnetic starters shall not be less than NEMA size one.
- 2. Each starter shall have a removable hinged cover capable of being padlocked. Enclosures shall be NEMA 1 general purpose type unless indicated otherwise. Provide watertight and dust tight enclosures for units installed outside, in wet locations, or as indicated on the drawings with the subscript "WP". Starters shall be provided with double break silver alloy contacts. All contacts shall be replaceable without removing wiring or the starter from the enclosure.
- 3. Magnetic starters shall be provided with the following additional equipment:
  - a. Overload relays. These shall be an integral part of the motor starter. Overload relays shall have a minimum +10 percent adjustment from the nominal heater rating. Heaters shall be available such that when used with the +10 percent adjustment, a continuous selection of motor full load currents can be obtained through the size limitations of the starter. Overload relays shall be the manual reset type and shall be field convertible from manual to automatic reset. Overload relays shall be melting alloy or bimetallic type. Thermal units shall be of one piece construction and interchangeable. The starter unit shall be inoperative if the thermal unit is removed. Provide 3 overload relays, one for each phase of the three phase starter.
  - Provide fused disconnect switches for combination starters with Class R type fuse rejection clips. If breakers are shown, provide breakers with a minimum of 65,000 RMS symmetrical amps interrupting capacity.
- 4. Starters shall be suitable for the addition of at least three normally open and three normally closed sets of auxiliary contacts. Provide a minimum of two normally open and two normally closed sets of contacts unless additional contacts are scheduled on the drawings or required for proper control of the equipment.
- 5. In each magnetic starter, provide a cover mounted hand-off-auto selector switch complete with a manual overload reset button and a red "On" pilot light. Provide a control transformer

- with a secondary voltage of 120V, complete with primary overload and short circuit protection.
- 6. Time delay relays with time delay after energization shall be provided for starters indicated, or as required for proper control of equipment. Time delay feature shall be adjustable from 0 to 60 seconds and set as indicated on the drawings.
- 7. Where combination starters are shown on the drawings, a separate starter and disconnect switch may be substituted at the Contractor's option, provided adequate space is available for the installation.

#### C. MANUAL MOTOR STARTERS

 Thermal element type manual motor starters for single phase motors: Provide flush mounted units in finished areas and surface mounted units in unfinished areas. Starter shall have NEMA I general purpose enclosure, unless otherwise indicated, and shall be rated for the motor horsepower required.

#### D. MOTOR CONNECTIONS

- 1. Provide connections to motors in accordance with the requirements listed in the electrical specifications.
- 2. See Section 26 29 13 for the use of lugs for motor connections.

#### E. CAPACITORS

- 1. Capacitor features shall include:
  - a. Individual unit cells.
  - b. All welded steel housing.
  - c. Each capacitor shall be internally fused.
  - d. Non-flammable synthetic liquid impregnate.
  - e. Craft tissue insulation.
  - f. Aluminum foil electrodes
- 2. KVAR size shall be determined by the Contractor/Supplier and shall correct motor power factor to 95 percent or better and shall be installed on all motors 10 horsepower and larger that have an uncorrected power factor of less than 85 percent at rated load. Power factor correction is not required for motors used in conjunction with variable frequency drives.

#### 2.4 SAFETY SWITCHES

- A. Furnish and install heavy duty type safety switches, having the electrical characteristics, ratings and modifications shown on the drawings. All switches shall have:
  - 1. NEMA 1 general purpose enclosures unless otherwise noted for all interior applications.
  - 2. NEMA 3R rainproof enclosures unless otherwise noted for all exterior applications.
  - 3. Metal nameplates, front cover mounted that contain a permanent record of switch type, catalog number and H.P. ratings with both standard and time delay fuses.
  - 4. Handle that is padlockable in "OFF" position.
  - 5. Non-teasible, positive quick-make, quick-break mechanism.
  - 6. UL approval and shall bear the UL label.
  - 7. All fusible switches shall have Class R Fuse rejection clips.

### 2.5 DIVISION-26 RESPONSIBILITY

A. Unless otherwise noted, furnish and install single phase starters with thermal overload protection

for all single phase motors not indicated as part of the Division 22 responsibility. Furnish and install all full voltage, non-reversing, single speed motor starters for appropriate three phase equipment. Furnish and install disconnect switches for all three phase motors. Provide the following additional equipment as required.

- B. Provide auxiliary motor starter contacts as shown on the drawings or as required for proper control of equipment.
- C. Furnish and install all junction boxes.
- D. Furnish and install all motor power circuit conduit and wiring.
- E. Install power factor correction capacitors furnished by the Division-22 Contractor.

#### 2.6 DIVISION-22 RESPONSIBILITY

- A. Furnish and set all motors.
- B. Furnish combination starter/disconnect units for the following three phase powered equipment items (Starter/disconnect units shall include overload protection according to NEC requirements):
  - 1. Multiple Speed Motors (Multiple speed motor starters shall be furnished with decelerating relays.)
  - 2. Duplex Pumps with Alternator
  - 3. Sewage Ejector Pumps and Sump Pumps
- C. Furnish and install all electrical control circuit conduits and wiring and control devices required to perform the equipment control functions as specified in Division-22.
- D. Furnish starters, with thermal overload protection, and disconnects for the following single phase plumbing equipment:
  - 1. Pumps
- E. Furnish capacitors for power factor correction on all motors furnished under Division-22 in accordance with this Section.
- F. All electrical equipment provided, including the wiring and installation of electrical equipment shall be in strict accordance with the requirements of this Section and Division-26.

#### 3. EXECUTION

## 3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the

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adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

## 3.2 CONTRACTOR COORDINATION

- A. It is the responsibility of the Contractor and all Subcontractors to coordinate scope to ensure that all required electrical connections and control connections are provided in accordance with all specification sections. The Architect/Engineer is not responsible for determining which Contractor or Subcontractor will provide particular items.
- B. Unless otherwise indicated on drawings, all motors, equipment, controls, etc. shall be furnished, set in place and wired in accordance with this specification section and the following schedule.

END OF SECTION 22 05 13

#### **SECTION 22 05 29**

### HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

#### **PART 1 – GENERAL**

#### 1.01 SUMMARY

A. Section Includes pipe and equipment supports and hangers

#### 1.02 REFERENCES

- A. ASME B31.1 (American Society of Mechanical Engineers) Power Piping.
- B. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) Pipe Hangers and Supports Materials, Design and Manufacturer.
- C. NFPA 13 2010 (National Fire Protection Association) Installation of Sprinkler Systems.
- D. UPC 2012 (Uniform Plumbing Code) Defines support spacing of hangers
- E. ANSI/MSS SP-58 Pipe Hangers and Supports Materials, Design, and Manufacture.
- F. ANSI/MSS SP-69 Pipe Hangers and Supports Selection and Application.
- G. ANSI/MSS SP-127 Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

#### 1.03 RELATED SECTIONS

- A. Hangers and supports shall have the manufacturer's name and applicable size stamped in the part itself for identification.
- B. Hangers and supports shall be designed and manufactured in accordance with MSS SP 58.
- C. Hangers and supports for sprinkler piping shall conform to NFPA 13 specification.
- D. Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment
- E. Section 26 05 29 Hangers and Supports for Electrical Systems
- F. Section 07 72 65 Support Systems and Anchors.

### 1.04 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Submittal sheets with technical data available.
- B. Product Data: Submit manufacturers catalog data including load capacity.
- C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- D. Submit under provisions of Section 01 30 00 Administrative Requirements.
- E. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.

#### 1.05 QUALITY ASSURANCE

G. Hangers and supports shall have the manufacturer's name and applicable size stamped in February 6, 2024

the part itself for identification.

- Hangers and supports shall be designed and manufactured in accordance with MSS SP 58. H.
- I. Hangers and supports for sprinkler piping shall conform to NFPA 13 specification.
- J. Manufacturer Qualifications: Provide support systems components and accessories, including clamps and support pads from a single manufacturer who has minimum five vears experience manufacturing similar components.

#### DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer'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.

### **PART 2 – PRODUCTS**

#### 2.01 **MANUFACTURERS**

Α. Refer to section 22 00 01 for approved manufacturer.

#### 2.02 MANUFACTURED UNITS

- A. Pipe Hangers and Supports for Steel Pipe: The following is a list of acceptable hangers and supports for steel pipe with or without insulation:
  - Speed Lock Clevis (SLC) hanger: Reference Hilti SLC-EG 2" 8" 1.
  - 2. Insulation Shield: Reference Hilti Speed Lock (SLIS) Insulation Shield MH-SLIS 2" **-8**"
  - 3. Standard Clevis hanger: Reference Hilti SDC-EG 1/2" - 14"
  - 4. Short Hinged Riser Clamps (uninsulated pipe only:) Reference Hilti Speed Lock Riser MH-SLR-S 1" - 4"
  - 5. Long Hinged Riser Clamps: Reference Hilti Speed Lock Riser MH-SLR-LH 1" - 4"
  - 6. Slotted Riser Clamps: Reference Hilti Speed Lock Riser MH-SLR-LS
  - 7. Malleable Iron Split Ring hanger: Reference Hilti SR-EG 1/2" - 4"
  - 8. Adjustable Swivel / Loop hanger: Reference Hilti LH 1/2" - 8"
  - 9. Beam Clamps: Reference Hilti BC 1/4" - 3/4"
  - 10. Continuous Concrete Insert Strut - Reference Hilti Strut CIS 138-12 & Strut CIS 1316-12
  - 11. Steel Concrete Spot Insert – Reference Hilti Concrete Insert EG & Plain
- Pipe Hangers and Supports for Copper Pipe / Tube: The following is a list of acceptable В. hangers and supports for copper pipe / tube without insulation:
  - Reference Hilti Copper Speed Lock Riser Clamp MH-CSLR-LH 1" 4" 1.
  - 2. Malleable Iron Copper Split ring hanger – Reference Hilti Copper SR 1/2" - 3"

#### C. Trapeze Supports

- Trapeze Supports shall be constructed using 12 gauge structural steel conforming to ASTM A1011 GR. 33 and have a minimum dimension of 1 5/8" wide by 1 5/8" deep. Hilti strut HS-158-12 or stronger shall be used as the primary supporting member.
- 2. Piping shall be restrained on the strut using strut clamps. The following Strut Clamps shall be used:

Rigid Pipe: Reference Hilti Rigid Strut Clamps R45  $\frac{1}{2}$ " – 8" or Hilti RBA  $\frac{1}{2}$ " - 6" Copper Pipe – Reference Hilti MH-CB  $\frac{3}{8}$ " – 4"

### 2.03 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, continuous threaded.
- B. Split Nut: Reference Hilti MH-SLT Split Nut and Washer may be installed at any position on the continuous threaded rod.

## 2.04 HANGER SPACING

A. All piping shall be supported properly to avoid any sagging. Hanger spacing shall be determined using either Chapter 2, Part 5, Section 121 (ASME B31.1 – Standard for Pressure and Power Piping) or UPC 2012 whichever is deemed applicable by the project engineer.

#### 2.05 FINISHES

- A. Indoor Applications
  - 1. Hangers and supports for steel pipe shall be electro-galvanized or plain.
  - 2. Hangers and supports for copper pipe / tube shall have a copper electroplate finish.
  - For Trapeze applications, strut shall have either a pre-galvanized finish conforming to ASTM A653 GR 33 specification or (for copper pipe and tubing) a green electrodeposition coating.

# 2.06 ROOF SUPPORTS

- A. Provide piping support system complying with layout, elevations, slope and support frequency as indicated or required to comply with referenced or applicable codes and ordinances. Installation shall eliminate potential for stress on piping runs, fittings, bends and terminations. Isolate materials to prevent galvanic reaction and abrasive damage due to thermal expansion and vibration. Installation shall not exceed weight capacity of support.
- B. Supports shall be designed and manufactured in accordance with, MSS SP-58-2002 and MSS SP-69-2002. Seismic and wind resistant applications are manufactured to conform to MSS SP-127-2001.
- C. Pipe supports manufacture and installation shall comply with the International Fuel Gas Code:
- D. Nylon Non-Penetrating Adjustable Rooftop Pipe Supports Standard Duty:
  - 1. General: Pipe support base shall combine UV protected 33 percent fiberglass reinforced 6/6 Nylon with an adjustable stainless steel threaded rod and axel assembly and which securely attaches to the base. Base for support shall have flat solid lower surface with neoprene roof pad adhered to bottom surface. Pad shall provide for cushion between support and roof surface.
    - a. Standard Duty Single Post Support: Provide single post adjustable support with nylon clamp for separation of dissimilar metals and vibration dampening and where (x) indicates size of pipe and (y) is distance required is from roof surface to bottom of pipe.
    - b. Standard Duty Strut Assembly: Assembly shall include aluminum strut for supporting multiple piping runs. Piping shall be evenly spaced on the support and secured to strut using snap locking nylon pipe clamps.

- Standard Duty Roller Assembly: Assembly shall include a hard cast C. rubber roller assembly capable of providing impact resistance to prevent damage to roof or support during pipe installation. The assemblies shall be leveled using the adjustment feature and the stands spaced so that weights are evenly distributed.
- d. Standard Duty Bridging Assembly: Reference MAPA Bridging System with 2 feet, 3 feet, or 6 feet aluminum strut and two support bases as applicable to support larger quantities of line sets along a common corridor.
- Bridging Assembly: Reference MAPA Bridging System from 2 feet, through 6 feet heavy duty weather treated strut assemblies and support bases as applicable to support larger quantities of line sets along a common corridor. Provide pipe clamps and roller assemblies as required or indicated for piping support
- Heavy-Duty Walk Pads: To provide additional protection to the roof, support assembly shall include roof isolation pads to be placed under supports. Isolation pads shall be 1/2 inch 100 percent recycled black rubber design, sized and provided by manufacturer.
- E. Metal Non-Penetrating Adjustable Pipe Supports for Roof Mounted Piping and Equipment -**Heavy Duty:** 
  - 1. General: Pipe support base to be manufactured of grade 304 stainless steel with an adjustable stainless steel threaded rod and axel assembly, which shall securely attach to base. Supports shall be spaced so that weights are evenly distributed.
    - Heavy Duty Adjustable Strut Support: Manufactured from durable stainless steel and a weather resistant aluminum strut. This adjustable support allows piping to be installed level across tapered roofs.
    - d. Heavy Duty Roller Base Assembly shall include a hard cast rubber roller assembly capable of providing impact resistance to prevent damage to roof or support during pipe installation. The assemblies shall be leveled using the adjustment feature and the stands spaced so that weights are evenly distributed.
    - f. Heavy Duty Trapeze Master Base manufactured of grade 304 stainless steel designed to receive standard 1-5/8 inch (41 mm) weather treated strut assemblies
    - Heavy-Duty Walk Pads: To provide additional protection to the roof, h. support assembly shall include roof isolation pads to be placed under supports. Isolation pads shall be 1/2 inch 100 percent recycled black rubber design, sized and provided by MAPA Products.
- F. Where seismic or high wind zones are of concern: manufacturer recommends the Curb Support Series and accessories as an effective means by which piping and supports are positively secured directly to the roof deck to resist seismic and wind driven forces on the system.
  - 1. General: Structurally Attached support base to be manufactured of grade 304 stainless steel with continuously welded seams and rounded edges to prevent incidental damage to the roof surface and a 3" perimeter deck flange provides flashing to the roof deck.

Supports shall be spaced so that weights are evenly distributed.

- a. Heavy Duty Structurally Attached Single Post Support: Provide single post adjustable support with stainless steel pipe clamp containing a UV treated rubber cushion for separation of dissimilar metals and vibration dampening.
- b. Heavy Duty Structurally Attached Adjustable Strut Support: Manufactured from durable stainless steel and a weather resistant aluminum strut. This adjustable support allows piping to be installed level across tapered roofs.
- c. Heavy Duty Structurally Attached Roller Base Assembly shall include a hard cast rubber roller assembly capable of providing impact resistance to prevent damage to roof or support during pipe installation. The assemblies shall be leveled using the adjustment feature and the stands spaced so that weights are evenly distributed.
- d. Heavy Duty Structurally Attached Trapeze Support System: Provide complete trapeze support fully assembled with stainless steel base, strut, hangers as designed by manufacturer, to resist seismic and wind driven forces on the system and supported equipment and piping. Components shall be sized to resist forces as prescribed on drawings.

#### **PART 3 – EXECUTION**

#### 3.01 INSTALLATION

A. All Pipe Hanger and Support Installation shall conform to MSS-SP 58. Installation of hangers, supports, clamps and attachments shall be performed to properly support piping from building structure.

## 3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum ½ inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1½ inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Support vertical piping independently of connected horizontal piping.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers for pipe movement with disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

## 3.03 SUPPORT SPACING

A. All horizontal steel piping shall be supported in accordance with MSS-SP 58 tables 4.

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**END OF SECTION** 

## **SECTION 22 07 00**

### PLUMBING INSULATION

### 1.1 GENERAL

#### A. Summary:

- Section Includes: 1.
  - Plumbing piping insulation, jackets and accessories.
  - Plumbing equipment insulation, jackets and accessories. b.

#### 2. **Related Sections:**

- Section 07 84 00 Firestopping: Product requirements for firestopping for placement by this section.
- Section 09 90 00 Painting and Coating: Execution requirements for b. painting insulation jackets and covering specified by this section.

#### B. References:

- **ASTM International:** 1.
  - ASTM A167 Standard Specification for Stainless and Heat-Resisting a. Chromium-Nickel Steel Plate, Sheet, and Strip.
  - b. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - ASTM C195 Standard Specification for Mineral Fiber Thermal C. Insulating Cement.
  - ASTM C449/C449M Standard Specification for Mineral Fiber Hydraulicd. Setting Thermal Insulating and Finishing Cement.
  - ASTM C450 Standard Practice for Prefabrication and Field Fabrication e. of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
  - f. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
  - ASTM C534 Standard Specification for Preformed Flexible Elastomeric g. Cellular Thermal Insulation in Sheet and Tubular Form.
  - h. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
  - ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal i. Insulation for Commercial and Industrial Applications.
  - ASTM C578 Standard Specification for Rigid, Cellular Polystyrene j. Thermal Insulation.
  - ASTM C585 Standard Practice for Inner and Outer Diameters of Rigid k. Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  - ASTM C591 Standard Specification for Unfaced Preformed Rigid I. Cellular Polyisocyanurate Thermal Insulation.
  - ASTM C612 Standard Specification for Mineral Fiber Block and Board m. Thermal Insulation.
  - ASTM C795 Standard Specification for Thermal Insulation for Use in n. Contact with Austenitic Stainless Steel.
  - ASTM C921 Standard Practice for Determining the Properties of 0. Jacketing Materials for Thermal Insulation.
  - ASTM C1136 Standard Specification for Flexible, Low Permeance p. Vapor Retarders for Thermal Insulation.
  - ASTM D1784 Standard Specification for Rigid Poly (Vinyl Chloride) q. (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

- ASTM E84 Standard Test Method for Surface Burning Characteristics r. of Building Materials.
- ASTM E96 Standard Test Methods for Water Vapor Transmission of S. Materials.

#### 2. National Fire Protection Association:

NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

#### 3. **Underwriters Laboratories Inc.:**

UL 723 - Tests for Surface Burning Characteristics of Building Materials.

#### C. Submittals:

- Section 01 33 00 Submittal Procedures: Submittal procedures. 1.
- 2. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- 3. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- 4. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### D. **Quality Assurance:**

- 1. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 450 in accordance with ASTM E84.
- 2. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- 3. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

#### E. Qualifications:

- Manufacturer: Company specializing in manufacturing products specified in this 1. section with minimum three years experience.
- 2. Applicator: Company specializing in performing Work of this section with minimum three years experience.

#### F. Delivery, Storage, and Handling:

- Section 01 60 00 Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- 2. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- 3. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

#### G. **Environmental Requirements:**

- 1. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- 2. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- Maintain temperature before, during, and after installation for minimum period of 3. 24 hours.
- Н. Field Measurements: Verify field measurements prior to fabrication.

#### I. Warranty:

Section 01 70 00 - Execution and Closeout Requirements: Product warranties 1. and product bonds.

February 6, 2024 22-07-00-2 2. Furnish five year manufacturer warranty for man made fiber.

#### 2. **PRODUCTS**

#### A. Manufacturer:

- Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
  - Refer to section 22 00 01 for Plumbing Approved Manufacturers.

#### B. Pipe Insulation:

- TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
  - Thermal Conductivity: 0.23 at 75 degrees F. a.
  - Operating Temperature Range: 0 to 850 degrees F. b.
  - Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil C. kraft with self-sealing adhesive joints.
  - d. Jacket Temperature Limit: minus 20 to 150 degrees F.

#### 3. **EXECUTION**

#### A. Examination:

- Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- 2. Verify piping has been tested before applying insulation materials.
- 3. Verify surfaces are clean and dry, with foreign material removed.

#### В. Installation – Piping Systems:

- Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- Continue insulation through penetrations of building assemblies or portions of 2. assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
- 3. Piping Systems Conveying Fluids Below Ambient Temperature (including storm drainage):
  - Insulate entire system including fittings, valves, unions, flanges, a. strainers, flexible connections, and expansion joints.
  - Furnish factory-applied or field-applied vapor retarder jackets. Secure b. 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.
  - Insulate fittings, joints, and valves with molded insulation of like material C. and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

#### Hot Piping Systems less than 140 degrees F: 4.

- Furnish factory-applied or field-applied standard jackets. Secure with a. outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
- Insulate fittings, joints, and valves with insulation of like material and b. thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

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- Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- 5. Inserts and Shields:
  - a. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
  - b. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
    - 1) Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
    - 2) Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
  - c. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- 6. Buried Piping (within building): not insulated
- C. Schedules:
  - Water Supply Services Piping Insulation Schedule:

System	Less than 1"	1 1⁄4"	1 ½"	1 ¾" – 3"	4" and Larger	Notes
Domestic Hot Water Supply and Recirculation	1"	1"	1 ½"	1 ½"	1 ½"	
Domestic Cold Water	1"	1"	1"	1"	1"	
Storm Drainage – Primary	1"	1"	1"	1"	1"	
Storm Drainage - Overflow	1"	1"	1"	1"	1"	All Horizontal to vertical transition

## **END OF SECTION**

## **SECTION 22 11 00**

#### **FACILITY WATER DISTRIBUTION**

#### PART 1 - GENERAL

1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 Summary:

- A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.
- B. Related Sections include the following:
  - 1. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.

#### 1.3 Definitions:

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. PA: Polyamide (nylon) plastic.
- C. PE: Polyethylene plastic.
- D. PEX: Crosslinked polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

## 1.4 Performance Requirements:

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Domestic Water Distribution Piping: 125psi.

#### 1.5 Submittals:

A. Product Data: For pipe, tube, fittings, and couplings.

## 1.6 Quality Assurance:

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," and NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for combined fire-protection and domestic water service piping
- C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

# PART 2 - PRODUCTS

2.1 Piping Materials: Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

# 2.2 Copper Tubing:

A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

- 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded
- B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded
  - 4. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
    - a. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

## 2.3 Valves, General:

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

# 2.4 Copper-Alloy Ball Valves:

- A. Manufacturers:
  - 1. Three-Piece, Copper-Alloy Ball Valves:
    - a. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. Copper-Alloy Ball Valves, General: MSS SP-110.
- C. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full -port, chromeplated bronze ball; PTFE or TFE <Insert other> seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
- D. Refer to Section "Plumbing Specialties" for balancing and drain valves.

PART 3 - EXECUTION

# 3.1 Piping Applications:

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
  - 1. NPS 1-1/2 (DN 40) and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 2. NPS 2 (DN 50): Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 3. NPS 2-1/2 and up: Hard copper tube, Type L copper pressure fittings; and soldered joints.
- D. Underground Domestic Water Piping: Use any of the following piping materials for each size range:
  - 1. NPS 3 and Smaller: Soft Copper tube, Type K; copper pressure fittings; and swaged joints.
  - 2. NPS 4 and larger: Ductile Iron; mechanical joints.

## 3.2 Valve Applications:

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
  - 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
  - 3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Domestic Water Piping: Use the following types of valves:
  - 1. Ball Valves, NPS 2 (DN 50) and Smaller: Three-piece, CWP rating, copper
  - 2. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless, 150-psig (1035kPa) rating, ferrous alloy, with EPDM liner.
  - 3. Spring Loaded Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 125, bronze.
  - 4. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronzemounted cast iron.

#### 3.3 Piping Installation:

- A. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- B. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 23 Section "Common Work Results for HVAC" for wall penetration systems.
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service.
- D. Perform the following steps before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

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- 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
- E. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- F. Energize pumps and verify proper operation.

## 3.4 Joint Construction:

- Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

# 3.5 Valve Installation:

- A. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - Install hose-end drain valves at low points in water mains, risers, and branches.
  - 2. Install stop-and-waste drain valves where indicated.
- B. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

# 3.6 Hanger and Support Installation:

- A. Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
  - NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
  - 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
  - NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

#### 3.7 Connections:

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
  - 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
  - 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

# 3.8 Field Quality Control:

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
    - Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 2. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - 3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.
- 3.9 Adjusting: Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - A. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  - B. Adjust calibrated balancing valves to flows indicated.

#### 3.10

A. Clean and disinfect potable domestic water piping as follows:

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- 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
- 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - Fill system or part thereof with water/chlorine solution a) with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
    - Fill system or part thereof with water/chlorine solution b) with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
  - Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
- B. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

**END OF SECTION** 

## **SECTION 22 11 19**

### **PLUMBING SPECIALITIES**

#### PART 1 - GENERAL

1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 Summary:

- A. This Section includes the following plumbing specialties:
  - 1. Backflow preventers.
  - 2. Dishwasher air-gap fittings.
  - 3. Thermostatic water mixing valves.
  - 4. Water tempering valves.
  - 5. Strainers
  - 6. Outlet boxes.
  - 7. Washer-supply outlets.
  - 8. Wheel-handle wall hydrants.
  - 9. Nondraining nonfreeze post hydrants.
  - 10. Trap seal primer valves.
  - 11. Drain valves.
  - 12. Backwater valves.
  - 13. Miscellaneous piping specialties.
  - 14. Sleeve penetration systems.
  - 15. Cleanouts
  - 16. Floor drains.
  - 17. Trench drains.
  - 18. Roof drains.
  - 19. Thermal Balancing Valve

### 1.3 Definitions:

- A. The following are industry abbreviations for plastic piping materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. PE: Polyethylene plastic.
  - 3. PUR: Polyurethane plastic.
  - 4. PVC: Polyvinyl chloride plastic.

# 1.4 Performance Requirements:

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Domestic Water Piping: 125 psig (860 kPa)
  - 2. Sanitary Waste and Vent Piping: 10-foot head of water (30 kPa).
  - 3. Storm Drainage Piping: 10-foot head of water (30 kPa).
  - 4. Force-Main Piping: 100 psig (690 kPa)

# 1.5 Submittals:

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
  - 1. Backflow preventers and water regulators.
  - 2. Balancing valves, water filters, and strainers.
  - 3. Thermostatic water mixing valves and water tempering valves.
  - 4. Water hammer arresters, air vents, and trap seal primer valves and systems.
  - 5. Drain valves, hose bibbs, hydrants, and hose stations.

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- 6. Outlet boxes and washer-supply outlets.
- 7. Backwater valves, cleanouts, floor drains, open receptors, trench drains, and roof drains.
- 8. Sleeve penetration systems.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field test reports.
- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
  - 1. Backflow preventers and water regulators.
  - 2. Water filters.
  - 3. Thermostatic water mixing valves and water tempering valves.
  - 4. Trap seal primer valves and systems.
  - 5. Hose stations and hydrants.

# 1.6 Quality Assurance:

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
  - Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
  - 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

## PART 2 - PRODUCTS

# 2.1 Manufacturers:

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.2 Backflow Preventers:

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. General: ASSE standard, backflow preventers.
  - 1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
  - 2. Interior Components: Corrosion-resistant materials.
  - 3. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
  - 4. Strainer: On inlet, if indicated.
- C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

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- D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.
- E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.
- F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.
  - 1. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
- G. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, springloaded floating disc, test cocks, and atmospheric vent.
  - 1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
- H. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head of water (30-kPa) back Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.
- Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

# 2.3 Thermostatic Water Mixing Valves:

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.
  - Type: Bimetal thermostat, operation and pressure rating 125 psig (860 kPa)
  - 2. Type: Liquid-filled motor, operation and pressure rating 100 psig (690 kPa) minimum.
- C. Thermostatic Water Mixing Valves: Unit, with the following:
  - 1. Piping, valves, and unions.

#### 2.4 Strainers:

- A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.
  - 1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
  - 2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.
  - 3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
  - 4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
    - a. Drain: Pipe plug.

- 5. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.
- Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.

#### 2.5 Drain Valves:

- A. Drain Valves: MSS SP-110, NPS 3/4 (DN 20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
  - 1. Inlet: Threaded or solder joint.
  - 2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.
- B. Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 (DN 20) threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.
- C. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig (1380-kPa) minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 (DN 6) side drain outlet and cap.

### 2.6 Miscellaneous Piping Specialties:

- A. Hose Bibbs: Heavy commercial, freezeproof type.
- B. Air Vents: Float type for automatic air venting.
  - Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; [NPS 1/2 (DN 15)] minimum inlet; 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C); and threaded vent outlet.
  - 2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 (DN 10) minimum inlet, 150-psig (1035-kPa) minimum pressure rating, and threaded vent outlet.
- C. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.
- D. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
  - 1. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
  - 2. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.
- E. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- F. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.
- G. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
- H. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.
- Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

- J. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.
- K. Conductor Nozzles: Bronze body with threaded inlet for connected conductor size, and bronze wall flange with mounting holes.

## 2.7 Sleeve Penetration Systems:

- A. Available Manufacturers:
  - 1. Manufacturers:
    - a. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
  - 2. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
    - Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
    - b. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
      - Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

### 2.8 Cleanouts:

- A. Cleanouts:
  - 1. Application: Floor cleanout all cleanout or installation in exposed piping
  - 2. Products:
    - a. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
  - 3. Body or Ferrule Material: Cast iron.
  - 4. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
  - 5. Frame and Cover Shape: Round
  - 6. Top Loading Classification: Medium Duty.

### 2.9 Floor Drains:

- A. Floor Drains, Refer to drawing schedule:
  - 1. Products:
    - a. Refer to section 22 00 01 for Plumbing Approved Manufacturers.

#### 2.10 Roof Drains:

- 1. Cast-Iron, Large-Sump, General-Purpose Roof Drains
  - a. Standard: ASME A112.6.4, for general-purpose roof drains.
  - b. Body Material: Cast iron.
  - c. Dimension of Body: Nominal 14-inch (357-mm).
  - d. Outlet: Bottom.
  - e. Dome Material: Cast iron or PE
  - f. Water Dam: when specified: 2 inches (51 mm) high.
- 2. Products:
  - a. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- 2.11 Adjustable Thermal Balancing Valve:

## A. Manufacturers:

- 1. Reference: Caleffi 1164.
- 2. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. General: Adjustable thermal balancing valve for automatic balancing of domestic hot-water systems. Will automatically adjust flow based on desired setpoint temperature.
- C. Standards:
  - 1. NSF/ANSI/CAN 372 low-lead
  - NSF/ANSI/CAN 61
  - 3. International Plumbing Code
- D. Maximum Working Pressure: 230 psig
- E. Adjustable Working Temperature
  - 1. 95-140 deg
- F. Hydraulic Seals: Peroxide-cured EPDM.
- G. Adjustable Balancing Cartridge: Stainless steel and copper.
- H. Factory Setting 130 deg F

## PART 3 - EXECUTION

#### 3.1 Installation:

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping ioining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
- C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- D. Install strainers on supply side of each control valve, pressure regulator, and solenoid
- E. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- F. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- G. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- H. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

- 4. Locate at base of each vertical soil and waste stack.
- I. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- J. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- K. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- L. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- M. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- N. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
  - Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- O. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- P. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- Q. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- R. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- S. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

#### 3.2 Connections:

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 22 Sections.
- D. Ground equipment.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

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# 3.3 Protection:

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**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. Pipe hangers and supports.
- 5. Bedding and cover materials.

## B. Related Sections:

- 1. Section 03 30 00 Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
- 2. Section 07 84 00 Firestopping: Product requirements for firestopping for placement by this section.
- 3. Section 08 31 13 Access Doors and Frames: Product requirements for access doors for placement by this section.
- 4. Section 22 07 00 Plumbing Insulation: Product and execution requirements for pipe insulation.
- 5. Section 31 20 00 Earthwork: Soils for backfill in trenches. Aggregates for Earthwork: Aggregate for backfill in trenches. Trenching: Execution requirements for trenching required by this section.
- 6. Section 31 23 16 Excavation: Product and execution requirements for excavation and backfill required 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 A746 Standard Specification for Ductile Iron Gravity Sewer Pipe.
- 8. ASTM B32 Standard Specification for Solder Metal.
- ASTM B42 Standard Specification for Seamless Copper Pipe, Standard Sizes.
- ASTM B43 Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
- 11. ASTM B75 Standard Specification for Seamless Copper Tube.
- 12. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- 13. ASTM B251 Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- 14. ASTM B302 Standard Specification for Threadless Copper Pipe.
- 15. ASTM B306 Standard Specification for Copper Drainage Tube (DWV).
- 16. ASTM C443 Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- 17. ASTM C443M Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric).
- 18. ASTM C564 Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- 19. ASTM D1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- 20. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 21. ASTM D2241 Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- 22. ASTM D2464 Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- 23. ASTM D2466 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- 24. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- 25. ASTM D2665 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- 26. ASTM D2729 Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 27. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- 28. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers.
- 30. 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.
- 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. Section 01 33 00 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. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.4 Closeout Submittals:

- A. Section 01 70 00 Execution and Closeout Requirements: Closeout procedures.
- B. 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 for pumps and equipment.

## 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 three years experience.

## 1.6 Delivery, Storage, and Handling:

- A. Section 01 60 00 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.

# 1.7 Environmental Requirements:

- A. Section 01 60 00 Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.
- 1.8 Field Measurements: Verify field measurements prior to fabrication.

#### 1.9 Warranty:

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

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## PART 2 - PRODUCTS

- 2.1 Sanitary Sewer Piping, Buried Within 5 Feet of Building:
  - A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.
    - Fittings: Cast iron, ASTM A74.
    - 2. Joints: Neoprene compression gasket conforming to ASTM C564 or ASATM B29, pure lead and oakum.
    - 3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International®
  - B. Cast Iron Soil Pipe For Aggressive DWV Sanitary Waste (Only as Indicated on Drawings)
    - 1. Pipe and Fittings: ASTM A74
    - 2. Joints: Neoprene compression gasket conforming to ASTM C564.
    - 3. The inside of each pipe shall be reamed prior to coating to decrease the coefficient of friction. The pipe coating shall consist of chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high performance cathodic epoxy coating, and finally an electrically deposited, high performance anodic epoxy top coat. The fitting coating shall consist of a chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high performance cathodic epoxy coating, and finally an epoxy acrylic powder top coat.

4.

- C. PVC Pipe: ASTM D2665 and ASTM D1785, polyvinyl chloride (PVC) material. If allowed by local code.
  - 1. Fittings: ASTMD2665, PVC.
  - 2. Joints: ASTM D2855, solvent weld with primer conforming to ASTM F656 and ASTM D2564 solvent cement.
- 2.2 Sanitary Sewer Piping, Above Grade:
  - A. 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.
    - 3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International®
    - 4. All standard duty Hubless couplings shall be certified by NSF International®
  - B. Copper Pipe: ASTM B42.
    - Fittings: ASME B16.23, cast bronze, or ASME B16.29 wrought copper.
    - 2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
  - C. PVC Pipe: ASTM D2665 and ASTM D1785, polyvinyl chloride (PVC) material. If allowed by local code.
    - 1. Fittings: ASTM D2665, PVC.
    - 2. Joints: ASTM D2855, solvent weld with primer conforming to ASTM F656 and ASTM D2564 solvent cement.
- 2.3 Unions and Flanges:
  - A. Unions for Pipe 2 inches and Smaller:
    - Copper Piping: Class 150, bronze unions with soldered.

- 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- 3. PVC Piping: PVC.
- B. Flanges for Pipe 2-1/2 inches and Larger:
  - 1. Copper Piping: Class 150, slip-on bronze flanges.
  - 2. PVC Piping: PVC flanges.
  - 3. Gaskets: 1/16 inch thick preformed neoprene gaskets.
- C. 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.

# 2.4 Pipe Hangers and Supports:

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. Drain, Waste, and Vent: Conform to ASME B31.9.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
- G. Wall Support for Pipe Sizes 3 inches and Larger: Welded steel bracket and wrought steel clamp.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- J. Copper Pipe Support: Carbon-steel, copper-plated adjustable ring.

### PART 3 - EXECUTION

- 3.1 Examination:
  - A. Section 01 30 00 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.
  - 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:
  - A. Inserts:
    - 1. Provide inserts for placement in concrete forms.
    - 2. Provide 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 4 inches and larger.
    - 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 above slab.

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- B. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9 ASTM F708 and MSS SP 89.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adiacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
  - 7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping.
  - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - 10. Install hangers adjacent to motor driven equipment with vibration isolation; refer to Section 21 05 48.

# 3.4 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 piping in accordance with code.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Install all thermoplastic piping in accordance with ASTM D2321.
- F. Excavate pipe trench in accordance with Section 31 23 16.
- G. Install pipe to elevation required for fall.
- H. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches loose depth.
- Install pipe on prepared clean sand bedding. 4" depth minimum.
- J. Route pipe in straight line.
- K. Pipe Cover and Backfilling:
  - 1. Backfill trench in accordance with Section 31 23 23.
  - 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 6 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.

# L. Install Work in accordance with

## 3.5 Installation – Above Ground Piping:

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. 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. Refer to Section 21 05 16.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- M. Install bell and spigot pipe with bell end upstream.
- N. Sleeve pipes passing through partitions, walls and floors.
- O. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section.
- P. Support drainage piping at every joint.
- Q. PVC is not allowed in above ceiling return air plenum spaces. Contractor shall use cast iron, listed CPVC or other approved method.

## 3.6 Field Quality Control:

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Test sanitary waste and vent piping system in accordance with applicable code local authority having jurisdiction.

## 3.7 Schedules:

PIPE HANGER SPACING						
PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	HANGER ROD DIAMETER (Inches)				
Cast Iron (All Sizes)	5	5/8				
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8				
Copper Tube, 1-1/4 inches and smaller	6	1/2				
Copper Tube, 1-1/2 inches and larger	10	1/2				
PVC (All Sizes)	4	3/8				
Steel, 3 inches and smaller	12	1/2				
Steel, 4 inches and larger	12	5/8				

Note for Cast Iron Pipe: Provide close to joint on barrel. Also provide hanger at each change of direction and each branch connection.

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# **END OF SECTION**

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## **SECTION 22 14 00**

#### **FACILITY STORM DRAINAGE**

#### PART 1 - GENERAL

## 1.1 Summary:

## A. Section Includes:

- 1. Storm water piping buried within 5 feet of building.
- 2. Storm water piping above grade.
- 3. Unions and flanges.
- 4. Valves
- 5. Pipe hangers and supports.
- 6. Roof drains.
- 7. Parapet drains.
- 8. Canopy and cornice drains.
- 9. Special purpose downspout covers.
- 10. Downspout nozzles.
- 11. Area drains.
- 12. Cleanouts
- 13. Bedding and cover materials.
- 14. Section 31 20 00 Fill: Requirements for backfill to be placed by this section.

#### 1.2 References:

- A. American Society of Mechanical Engineers:
  - ASME A112.21.1M Floor Drains.
  - 2. ASME A112.21.2M Roof Drains.
  - 3. ASME B16.23 Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
  - 4. ASME B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
  - 5. ASME B31.9 Building Services Piping.

### B. ASTM International:

- 1. ASTM A74 Standard Specification for Cast Iron Soil Pipe and Fittings.
- 2. ASTM B32 Standard Specification for Solder Metal.
- ASTM B306 Standard Specification for Copper Drainage Tube (DWV).
- 4. ASTM C14 Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
- 5. ASTM C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- 6. ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- 7. ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections.
- 8. ASTM C564 Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- 9. ASTM C700 Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
- 10. ASTM D1785 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- 11. ASTM D2235 Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- 12. ASTM D2464 Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

- 13. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- 14. ASTM D2665 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- 15. ASTM D2680 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- 16. ASTM D2729 Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 17. ASTM D2751 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- 18. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- 19. ASTM D3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 20. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- 21. ASTM F679 Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- 22. ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers.

# 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.

### 1.3 Submittals:

- A. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump-pumps, catch basins 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. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
- D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

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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. Project Record Documents: Record actual locations of equipment and clean-outs.

### 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 three years experience.

# 1.6 Delivery, Storage, and Handling:

- A. Section 01 60 00 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.

## 1.7 Environmental Requirements:

- A. Section 01 60 00 Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.
- 1.8 Field Measurements: Verify field measurements prior to fabrication.

# 1.9 Warranty:

- A. Section 01 70 00 Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish one year manufacturer warranty for all work.

# PART 2 - PRODUCTS

- 2.1 Storm Water Piping, Buried Within 5 Feet of Building:
  - A. 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.

## 2.2 Storm Water Piping, Above Grade:

- A. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
  - 1. Fittings: ASTM D2665 or ASTM D3034, PVC.
  - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

# 2.3 Drain Tile, Below grade:

- A. Single Wall High density corrugated polyethylene with filter sock. ADS Single wall heavy duty pipe with ADS Filter sock.
  - 1. Fittings: ASTM F667
  - 2. Joints: ASTM F667
  - 3. Sock: Filter Sock shall meet the requirements of ASTM D6707

# 2.4 Unions and Flanges:

- A. Flanges for Pipe 2-1/2 inches and Larger:
  - 1. Copper Piping: Class 150, slip-on bronze flanges.
  - 2. PVC Piping: PVC flanges.
  - 3. CPVC Piping: CPVC flanges.
  - 4. Gaskets: 1/16 inch thick preformed neoprene gaskets.
- B. 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.

## 2.5 Pipe Hangers and Supports:

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. Drain, Waste, and Vent: Conform to ASME B31.9 ASTM F708.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
- D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
- G. Wall Support for Pipe Sizes 3 inches and Larger: Welded steel bracket and wrought steel clamp.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

#### 2.6 Roof Drains:

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. Roof Drain (RD-1):
  - 1. Assembly: ASME A112.21.2M.
  - 2. Body: Lacquered cast iron with sump.
  - 3. Strainer: Removable cast metal cast iron dome.
  - 4. Accessories: Coordinate with roofing type, refer to Section:
    - a. Membrane flange and membrane clamp with integral gravel stop.
    - b. Adjustable under deck clamp.
    - c. Roof sump receiver.
    - d. Waterproofing flange.
    - e. Controlled flow weir.
    - f. Leveling frame.
    - g. Adjustable extension sleeve for roof insulation.
    - h. Perforated or slotted ballast guard extension for inverted roof.
    - i. Perforated stainless steel ballast guard extension.
- C. Roof Drain (RD-2):
  - 1. Assembly: ASME A112.21.2M.
  - 2. Body: Lacquered cast iron with sump.
  - 3. Strainer: Removable cast metal cast iron dome.
  - 4. Pipe extended to 2 inches above flood elevation.
  - 5. Accessories: Coordinate with roofing type, refer to Section:
    - a. Membrane flange and membrane clamp with integral gravel stop.
    - b. Adjustable under deck clamp.
    - c. Roof sump receiver.
    - d. Waterproofing flange.
    - e. Controlled flow weir.
    - f. Leveling frame.
    - g. Adjustable extension sleeve for roof insulation.
    - h. Perforated or slotted ballast guard extension for inverted roof.
    - i. Perforated stainless steel ballast guard extension.
- D. Lacquered cast iron body with flashing clamp collar and epoxy coated grate.

## 2.7 Downspout Nozzles:

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. Product Description: Cast bronze body and wall flange round with straight bottom section.

## 2.8 Cleanouts:

- A. Exterior Surfaced Areas (CO-1): Round cast nickel bronze access frame and nonskid cover.
- B. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- C. Interior Finished Floor Areas (CO-3): Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

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- D. Interior Finished Wall Areas (CO-4): 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 (CO-5): Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

## PART 3 - EXECUTION

#### 3.1 Examination:

- A. Section 01 30 00 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.
- 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:

#### A. Inserts:

- 1. Provide inserts for placement in concrete forms.
- 2. Provide 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 4 inches and larger.
- 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 above slab.

## B. Pipe Hangers and Supports:

- 1. Install in accordance with ASME B31.9 ASTM F708 and MSS SP 89.
- 2. Support horizontal piping as scheduled.
- 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- 4. Place hangers within 12 inches of each horizontal elbow.
- 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- 7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
- 8. Provide copper plated hangers and supports for copper piping.
- 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

# 3.4 Installation - Buried Piping Systems:

- A. Verify connection to storm sewer size, location, and invert are as indicated on
- B. Establish elevations of buried piping with not less than five ft of cover.
- C. Establish minimum separation of 10 from other services piping in accordance with applicable code.
- D. Excavate pipe trench in accordance with Section.

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- E. Install pipe to elevation as indicated on Drawings.
- F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches depth.
- G. Install pipe on prepared bedding.
- H. Route pipe in straight line.
- I. Install plastic ribbon tape continuous over top of pipe. above pipe line; coordinate with Section. Refer to Section.Install trace wire continuous over top of pipe. above pipe line; coordinate with Section 31 20 00. Refer to Section.
- J. Pipe Cover and Backfilling:
  - 1. Backfill trench in accordance with Section 31 20 00.
  - 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 4 inches compacted layers to 6 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.

## K. Install Work in accordance with

## 3.5 Installation – Above Ground Piping:

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearance 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. Install 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. Group piping to conserve space.
- H. Group piping whenever practical at common elevations.
- Support cast iron drainage piping at every joint.
- J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- K. Provide clearance in hangers and from structure and other equipment for installation of insulation.
- L. Provide access where valves and fittings are not accessible.
- M. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- P. Install bell and spigot pipe with bell end upstream.
- Q. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
- R. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section.

## 3.6 Installation – Drain Tile

A. Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 3- through 24-inch (75 to 600 mm) diameters shall be one foot (0.3 m). Maximum fill heights depend on embedment material and compaction level; please refer to

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Technical Note 2.03. Contact your local ADS representative or visit our website at www.ads-pipe.com for a copy of the installation guidelines.

## 3.7 Field Quality Control:

- A. Section 01 70 00 Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test storm drainage piping system in accordance with applicable code local authority having jurisdiction.

## **END OF SECTION**

#### **SECTION 22 15 00**

## GENERAL SERVICE COMPRESSED-AIR SYSTEMS

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Compressed air piping.
  - 2. Unions and flanges.
  - 3. Valves.
  - 4. Strainers.
  - 5. Pipe hangers and supports.
  - 6. Flexible connectors.
  - 7. Relief valves.
  - 8. Compressed air outlets.
  - 9. Air compressor.
  - 10. Oil less air compressor.
  - 11. Compressed air after cooler.
  - 12. Refrigerated compressed air dryer.
  - 13. Desiccant compressed air dryer.
  - 14. Air receiver.
  - 15. Air pressure reducing valve.
  - 16. Pressure regulators.
  - 17. Compressed air filters.
  - 18. Hose connectors.
  - 19. Underground pipe markers.

#### 1.2 REFERENCES

- A. American Society of Mechanical Engineers:
  - 1. ASME B16.3 Malleable Iron Threaded Fittings.
  - 2. ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.
  - 3. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - 4. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes.
  - 5. ASME B31.1 Power Piping.
  - 6. ASME B31.9 Building Services Piping.
  - 7. ASME Section VIII Boiler and Pressure Vessel Code Pressure Vessels.
  - 8. ASME Section IX Boiler and Pressure Vessel Code Welding and Brazing Qualifications.

## B. ASTM International:

- 1. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- 2. ASTM A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- 3. ASTM A234/A234M Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- ASTM A312/A312M Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
- 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 B62 Standard Specification for Composition Bronze or Ounce Metal Castings.
- 9. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- 10. ASTM B584 Standard Specification for Copper Alloy Sand Castings for General Applications.
- 11. ASTM D2513 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- 12. ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- 13. ASTM F1281 Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
- 14. ASTM F1282 Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
- 15. 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. 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 70 Cast Iron Gate Valves, Flanged and Threaded Ends.
  - 5. MSS SP 71 Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - 6. MSS SP 80 Bronze Gate, Globe, Angle and Check Valves.
  - 7. MSS SP 89 Pipe Hangers and Supports Fabrication and Installation Practices.
  - 8. MSS SP 110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- E. National Electrical Manufacturers Association:
  - 1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NSF International:
  - 1. NSF 61 Drinking Water System Components Health Effects.

#### 1.3 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate piping system schematic with electrical and connection requirements general assembly of components, mounting and installation details, and general layout of control and alarm panels.
- C. Product Data:
  - 1. Piping: Submit data on pipe materials, fittings, and accessories.
  - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each
  - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
  - 4. System Components: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes. When applicable, include electrical characteristics and connection requirements.

- 5. Compressors: Submit type, capacity, and performance characteristics. Include electrical characteristics and connection requirements.
- D. Product Data: Submit manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.
- E. Manufacturer's Installation Instructions: Submit hoisting and setting requirements, starting procedures.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

## 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of equipment piping, valves, outlets and components.
- C. Operation and Maintenance Data: Submit assembly views, lubrication instructions, replacement part numbers and availability.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.
- C. 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 years experience.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept equipment on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.
- C. Protect piping and equipment from weather and construction traffic. Maintain factory packaging and caps in place until installation.
- D. Deliver each length of piping with manufacturer's plugged or capped ends and keep sealed until installation.

E. Deliver fittings, valves, and other components in sealed containers and keep sealed until installation.

#### 1.8 WARRANTY

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for pumps, compressors, refrigerated dryers and valves excluding packing.

## **PART 2 PRODUCTS**

#### 2.1 COMPRESSED AIR PIPING

- 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. Steel Pipe: ASTM A53/A53M Schedule 40, black, cut grooved ends.
  - 1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, or ASTM A234/A234M carbon steel, grooved ends.
  - 2. Joints: Grooved mechanical couplings meeting ASTM F1476.
    - a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with steel piping sizes, rigid type.
    - b. Gasket: Elastomer composition for operating temperature range from 86 degrees F to 180 degrees F.
    - c. Accessories: Steel bolts, nuts, and washers.

## 2.2 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
  - 1. Ferrous Piping: Class 150, malleable iron, threaded.
  - 2. Copper Piping: Class 150, bronze unions with soldered.
  - 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
  - 4. Stainless Steel Piping: 300 psig, threaded type with compression type ends.
- B. 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. Gaskets: 1/16 inch thick preformed neoprene gaskets.

## 2.3 BALL VALVES

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. BA-2 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, threaded ends, locking lever handle.

#### 2.4 CHECK VALVES

- A. Horizontal Swing Check Valves:
  - 1. Manufacturers:
    - a. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
  - 2. CK-1 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, threaded ends.

#### 2.5 STRAINERS

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. ST-1 2 inch and Smaller: Y pattern, ASTM B62 bronze body, threaded ends, Class 150, 1/16 inch stainless steel perforated screen.
- C. ST-2 2 inch and Smaller: Y pattern, ASTM A126 cast iron body, threaded ends, Class 250, 1/16 inch stainless steel perforated screen.

## 2.6 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. Conform to ASME B31.9 MSS SP 58 and MSS SP 69.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
- G. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- J. Copper Pipe Support: Copper-plated, carbon steel ring.

## 2.7 FLEXIBLE CONNECTORS

- A. Manufacturers:
  - 1. Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- B. 2 inches and Smaller: Corrugated bronze hose with single layer of bronze exterior braiding, Schedule 40 black steel ends; maximum working pressure 170 psig, threaded or soldered connections.

C. 2-1/2 inches and Larger: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, Class 150 flanged ends; maximum working pressure 190 psig.

#### 2.8 RELIEF VALVES

A. Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

#### 2.9 COMPRESSED AIR OUTLETS

A. Compressed Air Outlets: Quick Connector: 3/8 inch brass, snap on connector with self closing valve, Style verify with owner.

## 2.10 AIR COMPRESSOR

A. Air Compressor: Duplex tank mounted compressor unit consisting of air-cooled compressor, air receiver, after cooler, and operating controls.

## B. Reciprocating Compressors:

- 1. Unit: Reciprocating compressor with positive displacement oil pump lubrication system, suction inlet screen, discharge service valves, on cast iron or welded steel base for motor and compressor with provision for V-belt adjustment.
- Automatic Capacity Reduction Equipment: Suction valve unloading device with lifting mechanism operated by. Furnish unloaded compressor start.
- 3. Motor: Constant speed 1800 rpm with electronic overheating protection in each phase with full voltage starting. Refer to Section 21 05 13.
- 4. Control Panel: Factory mounted and wired, NEMA 250 Type 1 enclosure, steel construction, with power and control wiring, factory wired for single point power connection.
  - a. Starter: Furnish with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
  - b. Safety Controls: Manually reset low oil pressure cutout.
  - c. Panel Face: Compressor run light, start-stop switch, elapsed time meter.
- 5. Control Panel: Factory mounted and wired NEMA 250 Type 1 enclosure, with starter and refrigeration controls including:
  - a. Non-fused molded-case, disconnect switch.
  - b. Single point power connection and grounding lug.
  - c. Anti-recycle timer.
  - d. Solid state overload relay for each compressor.
  - e. Phase loss-reversal monitor.
  - f. Cycle counter and hour meter for each compressor.
  - g. Automatic shutdown on compressor overload.
- 6. Automatic Capacity Reduction: Continuously variable slide valve with infinitely variable control to 25 percent of full load.

#### C. Controls:

- 1. Pressure Switch: Line voltage contactor to break at 100 psi with minimum differential of 20 psi.
- 2. Compressor Regulation: Lead-lag switch with time delay relay.
- 3. Electrical Alternation: Operate lead compressor for 12 hour time period. When lead compressor fails, start second compressor to automatically maintain air pressure.
- D. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

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E. Disconnect Switch: Factory mount in control panel.

#### 2.11 AIR RECEIVER

- A. Air Receiver: Vertical, built to ASME Section VIII regulations for working pressure of 125 psi. Flange or screw inlet and outlet connections.
- B. Fittings: Adjustable pressure regulator, safety valve, pressure gage, drain valve, and automatic float actuated condensate trap.
- C. Tank Finish: Shop primed.

#### 2.12 PRESSURE REGULATORS

- A. Pressure Regulators: Diaphragm operated, bronze body, direct acting, spring loaded, manual pressure setting adjustment, rated for 250 psig inlet pressure.
- B. Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring loaded, manual pressure setting adjustment, and rated for 250 psig inlet pressure.

## 2.13 COMPRESSED AIR FILTERS

A. Mechanical Separation Filter: 2 stage. Furnish with deflector plates, resin impregnated ribbon type filters with 40 micron thick edge filtration and drain valve.

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

B. Coalescing Filters: Furnish with activated carbon capable of removing water and oil aerosols, with color-change dye indicating when carbon is saturated and warning light indicating when maximum pressure drop has been exceeded.

## 2.14 HOSE CONNECTORS

- A. Hose Connectors: Corrugated stainless steel tubing with stainless steel wire braid covering and ends welded to inner tubing.
- B. Working Pressure: 250 psig minimum.
- C. End Connections:
  - 1. 2 inches and Smaller: Threaded steel pipe nipple.
  - 2. 2-1/2 inches and Larger: Class 150 Flanges.

## PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 30 00 Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify connection size, location, and invert are as indicated on Drawings.

## 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- 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 - 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 slab.

#### 3.4 INSTALLATION - HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with.
- B. Support horizontal piping as scheduled.
- C. Install hangers to provide 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. Design hangers for pipe movement without disengagement of supported pipe.
- F. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

#### 3.5 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS

- A. Install drip connections with valves at low points of piping system.
- B. Install take-off to outlets from top of main, with shut off valve after take off. Slope take-off piping to outlets.
- C. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.
- D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
- E. Cut pipe and tubing accurately and install without springing or forcing.
- F. Slope piping in direction of flow.
- G. Stainless Steel Pipe with press-type Joints: Square cut ends to plus or minus 0.030 inches tolerance. Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting during assembly. Press joint using manufacturer's tool with proper sized jaw.
- H. Copper Pipe with press-type Joints: Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting. Check a lignment against mark to assure tubing is fully inserted. Press joint using manufacturer's tool.
- I. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions. Refer to Section 22 05 29.
- J. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
- K. Install pipe identification in accordance with Section 22 05 53.
- L. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.
- M. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.
- N. Install strainers on inlet side of pressure regulators.

## 3.6 INSTALLATION - EQUIPMENT

- A. Install air compressor on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than compressor base on each side. Refer to Section 03 30 00.
- B. Install air compressor unit on vibration isolators. Level and bolt in place. Refer to Section.
- C. Install air valve and drain connection on horizontal casing.
- D. Install line size shut-off valve and check valve on compressor discharge.

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- E. Install replaceable cartridge type filter silencer for each compressor.
- F. Install shut-off valve on water inlet to after cooler. Pipe drain to floor drain.
- G. Install condensate drain piping to nearest floor drain.
- H. Install bypass with valves around air dryer. Use factory insulated inlet and outlet connections.
- I. Provide bypass with valves, around receivers.

## 3.7 FIELD QUALITY CONTROL

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.
- C. Verify for atmospheric pressure in piping systems, other than system under test.
- D. Test system with dry compressed air or dry nitrogen with test pressure in piping system at 50 psi.

## 3.8 CLEANING

- A. Section 01 70 00 Execution Requirements: Requirements for cleaning.
- B. Blow systems clear of free moisture and foreign matter.

#### 3.9 SCHEDULES

SYSTEM DESCRIPTION	VALVE SERVICE		
	SHUTOFF	THROTTLING	CHECK
Process Compressed Air	BA2		CK1

PIPE HANGER SPACING			
	MAXIMUM	HANGER ROD	
PIPE SIZE	HANGER SPACING	DIAMETER	
Inches	Feet	Inches	
1/2	7	3/8	
3/4	7	3/8	
1	7	3/8	
1-1/4	7	3/8	
1-1/2	9	3/8	
2	10	3/8	
2-1/2	11	1/2	

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3	12	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	3/4
10	22	7/8
12	23	7/8
14	25	1
16	27	1
18	28	1
20	30	1-1/4
24	32	1-1/4
PVC (All Sizes)	6	3/8

## END OF SECTION

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## **SECTION 22 34 00**

#### **FUEL-FIRED DOMESTIC WATER HEATERS**

#### PART 1 - GENERAL

- 1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 Summary: This Section includes the following fuel-fired water heaters:
  - A. Commercial, gas water heaters.
  - B. Expansion tanks.
  - C. Circulation pumps.
  - D. Accessories

#### 1.3 Submittals:

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring.
- C. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.
- D. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.
- E. Warranty: Special warranty specified in this Section.

## 1.4 Quality Assurance:

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ANSI Compliance: Provide gas water heaters that comply with ANSI standards for gas water heaters and related products and that bear AGA certification label.
- E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
  - ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.

## 1.5 Warranty:

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

- 2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - Commercial, High-Efficiency, Sealed-Combustion-Chamber, Gas Water Heaters: A.
    - Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- 2.2 Commercial, High-Efficiency, Gas Water Heater Systems:
  - The WATER HEATER shall be constructed with a heavy gauge galvanized steel jacket assembly, primed and pre-painted on both sides with a minimum dry film thickness of 0.70 mils. The jacket design shall allow single unit venting connection without the use of external draft hood devices.
  - The water containing section shall be of a "Fin Tube" design, with straight copper tubes having extruded integral fins spaced seven (7) fins per inch. The tubes shall terminate into a one piece, glass lined, cast iron header. There shall be no bolts, gaskets or "O" rings in the head configuration. There shall be access to the front header of the heat exchanger for the purposes of inspection, cleaning or repair. The heat exchanger shall be mounted in a stress free jacket assembly in order to provide a "free floating design" able to withstand the effects of thermal shock. The WATER HEATER shall bear the ASME "HLW" stamp for 160 PSI working pressure and shall be National Board listed. The complete heat exchanger assembly shall carry a five (5) year limited warranty. The WATER HEATER shall be equipped with a factory supplied circulating pump of sufficient capacity to ensure scale-free heater performance. The pump shall be all bronze and provided for operation on 120 volt, 60 cycle, 1 phase power supply (unless otherwise specified).
  - The combustion chamber shall be sealed and completely enclosed with ceramic fiberboard insulation. A burner/flame observation port shall be provided. burners shall be constructed of high temperature stainless steel and fire on a horizontal plane. The WATER HEATER shall have a variable speed combustion air blower to precisely control the fuel/air mixture for maximum efficiency.
  - The WATER HEATER shall be certified and listed by C.S.A. International under D. the applicable harmonized ANSI Z21.13 standard for the US and Canada. The WATER HEATER shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The WATER HEATER shall operate at a minimum of 85% thermal efficiency.
  - E. Standard operating controls shall include a 3 stage programmable digital temperature controller with an LCD display to control water temperatures. The digital temperature control shall display water inlet temperature and water outlet temperature as well as individual stage set points and differentials. The digital controller shall have a +/-1° F accuracy. The control panel shall have a lighted master switch to indicate main power on, sequential indicating lights and diagnostic indicator lights.
  - The WATER HEATER shall provide 3 individual stages of control. Multiple main gas valves with redundant valve seats and built in low gas pressure regulators shall be supplied as standard for each stage of burner operation. Gas valves will be referenced to the combustion chamber to ensure proper air/gas mixture for efficient combustion. Each proportional stage shall provide for on/off control of individual gas valves for the burners and cycling of a variable speed combustion air fan as required to maintain maximum efficiency at all stages of operation.
  - The standard operating control system shall include a proven electronic Hot Surface Ignition system with full flame monitoring capability. The ignition module shall go into a hard lockout on flame failure which requires pushing a separate manual reset button to allow the ignition module to begin a new trial for ignition sequence. The ignition module shall go into a soft lockout on conditions of low air, low voltage, or low igniter current. At a soft lockout, the module will pause for a timed period based on the fault and then begin a new trial for ignition sequence. If the soft lockout fault has not been corrected, the module will continue in the soft lockout condition.

The ignition system shall provide remote indication of a full diagnostic sequence via a flashing ignition module status light on the control panel.

- H. Additional standard controls shall include a high temperature limit control, an air pressure switch to monitor low air and blocked flue conditions, low voltage transformer with a 5 amp circuit breaker for the control circuit and an ASME temperature and pressure relief valve. The manufacturer shall verify proper operation of the burners, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping. A quality test report shall be shipped with each unit.
- A 24 VAC control circuit and components shall be used. All components shall be easily accessed and serviceable. All wire harness connections to components shall have multi-pin plug in type connectors to ease service, troubleshooting and lower removal and replacement cost.
- J. The units control panel shall contain the electronic temperature controllers LCD display and Diagnostic Information Center containing individual indicators of unit's operational status and control sensed fault conditions. Indication lights shall be provided for power on, prepurge, trial for ignition, flame failure, low air and one light for each individual stage of burner operation. The ignition module status light shall also be visible from the units control panel.
- K. The WATER HEATER shall be approved for indoor or outdoor installation. The WATER HEATER shall be approved for Vertical, Direct Venting. Venting shall be classified Category I, negative draft, non-condensing, to use type "B" double wall venting materials. The DirectAire venting systems shall allow direct connection of a duct to supply combustion air to the unit. The DirectAire Vertical vent system may draw combustion from either the side wall or roof top, DirectAire Horizontal must draw combustion air from the sidewall.
- L. The WATER HEATER shall have an independent laboratory rating for Oxides of Nitrogen (NOx) of less than 30 ppm corrected to 3% O<sub>2</sub>.
- M. The CIRCULATING PUMP shall be all bronze and operate on a 120 volt, 60 cycle, 1 phase power supply (unless otherwise specified). The pump shall be wired to run with intermittent pump operation.
- N. An inner chamber designed to receive all circulation to and from the water heater to eliminate turbulence in the tank. The baffled tank shall supply 80% of tank capacity without a drop in outlet temperature.

#### 2.3 Water Heater Accessories:

- A. Combination Temperature and Pressure Relief Valves: According to the following:
  - 1. Gas Water Heaters: ANSI Z21.22, combination temperature and pressure relief valve.
- B. Vacuum Relief Valves: According to the following:
  - 1. Gas Water Heaters: ANSI Z21.22.
  - 2. Exception: Omit if water heater has integral vacuum-relieving device.
- C. Gas Shutoff Valves: ANSI Z21.15, manually operated. Furnish for installation in piping.
- D. Gas Pressure Regulators: ANSI Z21.18, appliance type, factory or field installed. Include pressure rating, capacity, and pressure differential required for water heater and gas supply. Delete paragraph below except for multiple water heater arrangements. Verify availability.
- E. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE 90.1 or ASHRAE 90.2.

PART 3 - EXECUTION

#### 3.1 Water Heater Installation:

- Α. Install commercial water heaters on concrete bases.
- В. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- Install and connect gas water heaters according to NFPA 54. C.
  - Install appliance, gas pressure regulators on gas-burner inlets of water heaters without pressure regulators.
  - 2. Install vent piping from gas-train pressure regulators and valves to outside of building where required. Terminate vent piping with brassscreened vent cap fitting. Do not combine vents except with approval of authorities having jurisdiction.
- D. Install pressure relief valves in water piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.
- E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for drain valves.
- F. Install thermometers on water heater inlet and outlet piping.
- Arrange for insulation on equipment and piping not furnished with factory-applied G. insulation.
- Install piping-type heat traps on inlet and outlet piping of water heater storage Η. tanks without integral or fitting-type heat traps.
- Fill water heaters with water. ١.
- Charge compression tanks with air. J.

#### 3.2 Connections:

- Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- В. Install piping adjacent to machine to allow service and maintenance.
- Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-C. water-circulating piping with shutoff valve, check valve, and union.
- D. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection.
- Make connections with dielectric fittings where piping is made of dissimilar metal. E.
- F. Gas. Water Heater Vent Connections: In accordance with manufacturers direction. Delete two paragraphs below if no electrical components.
- Electrical Connections: Power wiring and disconnect switches are specified in G. Division 26 Sections. Arrange wiring to allow unit service.
- Ground equipment. Η.
  - Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

#### 3.3 Demonstration:

- Train Owner's maintenance personnel to adjust, operate, and maintain water heaters.
  - Train Owner's maintenance personnel on procedures for starting and 1. stopping troubleshooting, servicing, and maintaining equipment.
  - Review data in maintenance manuals. Refer to Division 1 Section 2. "Contract Closeout."
  - 3. Review date in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

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4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

**END OF SECTION** 

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## **SECTION 22 44 00**

## **PLUMBING FIXTURES**

## 1.1 GENERAL

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Summary: This Section includes plumbing fixtures and related components.

## C. Definitions:

- 1. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- Fitting: Device that controls flow of water into or out of plumbing fixture.
   Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

#### D. Submittals:

- Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- 2. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- 3. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

## E. Quality Assurance:

- Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - a. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- 3. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- 4. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

- 5. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- 6. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- 7. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- 8. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - b. Hand Sinks: NSF 2 construction.
  - c. Plastic Laundry Trays: ANSI Z124.6.
  - d. Plastic Mop-Service Basins: ANSI Z124.6.
  - e. Plastic Sinks: ANSI Z124.6.
  - f. Plastic Whirlpool Bathtubs: ANSI Z124.1 and ASME A112.19.7M.
  - g. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - h. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
  - i. Vitreous-China Fixtures: ASME A112.19.2M.
  - j. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
  - k. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- 9. Comply with the following applicable standards and other requirements specified for lavatory faucets:
  - a. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - b. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - c. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - d. Faucet Hose: ASTM D 3901.
  - e. Faucets: ASME A112.18.1M.
  - f. Hose-Connection Vacuum Breakers: ASSE 1011.
  - g. Hose-Coupling Threads: ASME B1.20.7.
  - h. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - NSF Materials: NSF 61.
  - j. Pipe Threads: ASME B1.20.1.
  - k. Supply and Drain Fittings: ASME A112.18.1M.
- 10. Comply with the following applicable standards and other requirements specified for shower faucets:
  - a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
  - b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  - c. Faucets: ASME A112.18.1M.
  - d. Hand-Held Showers: ASSE 1014.
  - e. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
  - f. Hose-Coupling Threads: ASME B1.20.7.
  - g. Manual-Control Antiscald Faucets: ASTM F 444.

- h. Pipe Threads: ASME B1.20.1.
- i. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- 11. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  - Atmospheric Vacuum Breakers: ASSE 1001.
  - b. Brass and Copper Supplies: ASME A112.18.1M.
  - c. Manual-Operation Flushometers: ASSE 1037.
  - d. Plastic Tubular Fittings and Piping: ASTM F 409.
  - e. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
  - f. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- 12. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - a. Floor Drains: ASME A112.21.1M.
  - b. Grab Bars: ASTM F 446.
  - c. Hose-Coupling Threads: ASME B1.20.7.
  - d. Off-Floor Fixture Supports: ASME A112.6.1M.
  - e. Pipe Threads: ASME B1.20.1.
  - f. Plastic Toilet Seats: ANSI Z124.5.
  - g. Supply and Drain Protective Shielding Guards: ICC A117.1.
- F. Coordination: Coordinate roughing-in and final plumbing fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

## 1.2. PRODUCTS

- A. Toilet Seats:
  - Toilet Seats: Solid plastic.
    - a. Configuration: Open front without cover.
    - b. Size: Elongated
    - c. Class: Heavy-duty commercial.
    - d. Color: White
    - e. Material: Solid Plastic
- B. Protective Shielding Guards: Protective Shielding Guard, Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.
- C. Fixture Supports: Lavatory Support, Type I, lavatory carrier with exposed arms and tie rods, Type II, lavatory carrier with concealed arms and tie rod or Type III, lavatory carrier with hanger plate and tie rod. Include steel uprights with feet.
  - 1. Accessible Fixture Support: Include rectangular steel uprights.
- D. Water Closets:
  - 1. Water Closets: vitreous-china fixture designed for flushometer valve operation. Refer to drawing schedules.

- a. Products:
  - 1) American Standard, Inc.
  - 2) Crane Plumbing/Fiat Products
  - 3) Kohler Co.
  - 4) TOTO USA, Inc.
  - 5) U.S. Industries, Eljer Plumbingware Div
- b. Style: Flush valve siphon jet.
  - 1) Bowl Type: Elongated with siphon-jet design.
    - a) Design Consumption: 1.28 gal./flush (5 L/flush).
  - 2) Color: White.
  - 3) Design Consumption: 1.28 gal./flush (6 L/flush).
- E. Urinal:
  - 1. Vitreous-china fixture designed for flushometer valve operation. Refer to drawing schedules.
    - a. Products:
      - 1) American Standard, Inc.
      - 2) Crane Plumbing/Fiat Products
      - 3) Kohler Co.
      - 4) TOTO USA, Inc.
      - 5) U.S. Industries, Eljer Plumbingware Div
    - b. Style: Flush valve wall mount.
      - 1) washout design.
      - 2) Color: White.
- F. Design Consumption: 0.5 gal./flush (2 L/flush)
- G. Lavatories:
  - 1. Lavatories: Accessible, vitreous-china fixture.
    - a. Faucet Hole Punching: Three, 2-inch (51-mm) centers, holes.
    - b. Products:
      - 1) American Standard, Inc.
      - 2) Crane Plumbing/Fiat Products
      - 3) Kohler Co.
      - 4) TOTO USA, Inc.
      - 5) U.S. Industries, Eljer Plumbingware Div
    - C.
    - d. Faucet Hole Location: Top.
    - e. Color: White
    - f. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
    - g. Drain: Grid.
    - h. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chromeplated cast-brass trap; thick tubular brass waste to wall; and wall escutcheon.
    - Protective Shielding Guards: as scheduled.
  - 2. Bar Sinks, Residential, single-compartment, counter-mounting, stainlesssteel fixture.

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- a. Products:
  - 1) Dayton Products, Inc.
  - 2) Elkay Manufacturing Co.
  - 3) Franke Consumer Products, Inc., Federal Home Products Div.
  - 4) Just Manufacturing Co.
  - 5) Moen, Inc.
  - 6) Sterling Plumbing Group, Inc.
- b. Drain: 3-1/2-inch (89-mm) crumb cup.
- c. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated cast-brass trap, 0.045-inch- (1.1-mm-) thick tubular brass waste to wall, and wall escutcheon.

#### H. Kitchen Sinks

- Residential, two-compartment, stainless-steel fixture. Refer to drawing schedules.
  - a. Products:
    - 1) Elkay Manufacturing Co.
    - 2) Franke Consumer Products, Inc., Federal Home Products Div.
    - 3) Just Manufacturing Co.
    - 4) Moen, Inc.
    - 5) Sterling Plumbing Group, Inc.
  - b. Food disposer, 1/2hp, as scheduled.
  - c. Accessories as scheduled
- I. Service Basins:
  - 1. Service Basins: Flush-to-wall, floor-mounting precast terrazzo or heavy plastic basin with rim guard.
    - a. Products:
      - 1) Acorn Engineering Co.
      - 2) Crane Plumbing/Fiat Products
      - 3) Florestone Products Co
      - 4) Precast Terrazzo Enterprises, Inc.
      - 5) Stern-Williams Co.
      - 6) JONESPEC Speciality Plumbing Products
      - 7) Mustee, E. L. & Sons, Inc.
      - 8) American Standard
      - 9) Swan Corp. (The)
    - b. Refer to schedule.
    - c. Accessories. As scheduled.
    - d. Drain: Grid with NPS 3 (DN 80) outlet.
- J. Commercial Personal Showers:

- 1. Complete accessible shower assemblies including shower base, receptor, strainer, trap, shower wall enclosures, head assembly, shower valve.
- 2. General Fabrication
  - 1) Exposed Parts finish: Type 304 stainless steel or chrome-plated brass.
  - 2) Nominal stainless steel thickness: 0.050 inch (1.3 mm) minimum.
  - 3) Valve Bodies: Solid brass castings.
  - 4) Flow Control 2gpm unless noted otherwise.
- 3. Pressure balancing or thermostatic mixing valves ASSE 1016. ADA Compliant
- 4. Handheld Showerhead. Hand held shower head on a 60" ½" flexible hose with quick disconnect and bracket.
- 5. Fixed shower head. Fixed head adjustable spray
- 6. Diverter Valve. Accessible.
- 7. Barrier Free Seat. As indicated by the drawings.
- 8. Grab Bars. Accessible
- Shower Basin. Accessible
  - a. Slip resistant to ASTM F462
  - b. solid surface, textured floor, center drain
  - c. Drain: Grid with NPS 2 (DN 80) outlet.
- 10. Walls. Fiberglass/Acrylic. Finish selection by
- 11. Finish. Polished Chrome or as directed by Architect

#### 1.3. EXECUTION

## A. Examination:

- Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- 2. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- 3. Proceed with installation only after unsatisfactory conditions have been corrected.

## B. Fixture Installation:

- 1. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- 2. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
  - a. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - b. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - c. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

- 3. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- 4. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- 5. Install wall-hanging fixtures with tubular waste piping attached to supports.
- 6. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- 7. Install counter-mounting fixtures in and attached to casework.
- 8. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- 9. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - a. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.
- 10. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- 11. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- 12. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- 13. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- 14. Install toilet seats on water closets.
- 15. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- 16. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- 17. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- 18. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- 19. Install traps on fixture outlets.
  - a. Exception: Omit trap on fixtures with integral traps.
  - b. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- 20. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- 21. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- 22. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 23 Section "Common Work Results for HVAC" for escutcheons.

- 23. Set shower receptors, and service basins in leveling bed of cement grout.
- 24. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

## C. Connections:

- 1. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- 2. Connect water supplies from water distribution piping to fixtures.
- 3. Connect drain piping from fixtures to drainage piping.
- 4. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- 5. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- 6. Ground Equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

## D. Field Quality Control:

- 1. Verify that installed fixtures are categories and types specified for locations where installed.
- 2. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- 3. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- 4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- 5. Install fresh batteries in sensor-operated mechanisms.

## E. Adjusting:

- 1. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- 2. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
- 3. Replace washers and seals of leaking and dripping faucets and stops.

## F. Cleaning:

- 1. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - a. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - b. Remove sediment and debris from drains.

## G. Protection:

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- 1. Provide protective covering for installed fixtures and fittings.
- 2. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 44 00

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## **SECTION 22 45 00**

#### **EMERGENCY PLUMBING FIXTURES**

## **PART 1 GENERAL**

## 1.1 SUMMARY

## A. Section Includes:

- 1. Emergency showers.
- 2. Eyewash equipment.
- 3. Eye/face wash equipment.
- 4. Combination units.
- 5. Water-tempering equipment.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.

## 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

## 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components Health Effects," for fixture materials that will be in contact with potable water.
- D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

## PART 2 - PRODUCTS

## 2.1 EMERGENCY SHOWERS

- A. Freestanding, Plumbed Emergency Showers,
  - 1. Manufacturers: Subject to compliance with requirements
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. Bradley Corporation.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. Haws Corporation.
    - f. Sellstrom Manufacturing Company.
    - g. Speakman Company.
    - h. WaterSaver Faucet Co.
  - 3. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
  - 4. Supply Piping: [NPS 1 (DN 25)] minimum galvanized steel, chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - 5. Control-Valve Actuator: refer to schedule.
  - 6. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass, stainless steel, or plastic.
  - 7. Mounting: Pedestal.

## B. Freeze-Protected, Plumbed Emergency Showers

- 1. Manufacturers: Subject to compliance with requirements,
- 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. <u>B-L-S Industries, Inc.</u>
  - b. Bradley Corporation.
  - c. Encon Safety Products.
  - d. Guardian Equipment Co.
  - e. Haws Corporation.
  - f. Speakman Company.
- 3. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
- 4. Supply Piping: NPS 1-1/4 (DN 32) galvanized steel with flow regulator and stayopen control valve.
- 5. Control-Valve Actuator: Pull rod.
- 6. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass, stainless steel, or plastic
- 7. Heating System: 120 or 240-V ac electric, and insulation with protective jacket.
- 8. Mounting: Pedestal.

## 2.2 EYEWASH EQUIPMENT

- A. Standard, Freestanding, Plumbed Eyewash Units
  - 1. Manufacturers: Subject to compliance with requirements,
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. <u>Bradley Corporation</u>.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. <u>Haws Corporation</u>.
    - f. Sellstrom Manufacturing Company.
    - g. Speakman Company.
    - h. WaterSaver Faucet Co.
  - 3. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
  - 4. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - 5. Control-Valve Actuator: Paddle
  - 6. Spray-Head Assembly: Two receptor-mounted spray heads.
  - 7. Receptor: Chrome-plated brass or stainless-steel or Plastic bowl.
  - 8. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2
  - 9. Mounting: Pedestal.
- B. Accessible, Freestanding, Plumbed Eyewash Units,
  - 1. Manufacturers: Subject to compliance with requirements,
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. Bradley Corporation.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. WaterSaver Faucet Co.
  - 3. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
  - 4. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - 5. Control-Valve Actuator: Paddle.
  - 6. Spray-Head Assembly: Two receptor-mounted spray heads.
  - 7. Receptor: Chrome-plated brass or stainless-steel or Plastic bowl.
  - 8. Drain Piping: [NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2
  - 9. Mounting: Offset pedestal.
  - 10. Special Construction: Comply with ICC/ANSI A117.1.

## 2.3 EYE/FACE WASH EQUIPMENT

- A. Standard, Freestanding, Plumbed, Eye/Face Wash Units
  - 1. Manufacturers: Subject to compliance with requirements,
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. <u>Bradley Corporation</u>.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. <u>Haws Corporation</u>.
    - f. Sellstrom Manufacturing Company.
    - g. Speakman Company.
    - h. WaterSaver Faucet Co.
  - 3. Capacity: Not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
  - Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - 5. Control-Valve Actuator: Paddle.
  - 6. Spray-Head Assembly: Two or four receptor-mounted spray heads.
  - 7. Receptor: Chrome-plated brass or stainless-steel] or Plastic bowl.
  - 8. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2
  - 9. Mounting: Pedestal.
- B. Accessible, Freestanding, Plumbed, Eye/Face Wash Units, <Insert drawing designation>:
  - 1. Manufacturers: Subject to compliance with requirements,
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. Bradley Corporation.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. WaterSaver Faucet Co.
  - 3. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
  - 4. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - 5. Control-Valve Actuator: Paddle.
  - 6. Spray-Head Assembly: Two or four receptor-mounted spray heads.
  - 7. Receptor: Chrome-plated brass or stainless-steel or Plastic bowl.
  - 8. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2.
  - 9. Mounting: Offset pedestal.

10. Special Construction: Comply with ICC/ANSI A117.1.

## 2.4 COMBINATION UNITS

- A. Standard, Plumbed Emergency Shower with Eyewash Combination Units
  - 1. Manufacturers: Subject to compliance with requirements:
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. <u>Bradley Corporation</u>.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. Haws Corporation.
    - f. <u>Sellstrom Manufacturing Company</u>.
    - g. Speakman Company.
    - h. WaterSaver Faucet Co.

## 3. Piping:

- a. Material: Galvanized steel or Chrome-plated brass or stainless steel.
- b. Unit Supply: NPS 1-1/4 (DN 32) minimum.
- c. Unit Drain: Outlet at back or side near bottom.

## 4. Shower:

- a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Pull rod .
- d. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass or stainless steel or plastic.
- e. Mounting: Pedestal.

## 5. Eyewash Unit:

- a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Paddle.
- d. Spray-Head Assembly: Two receptor-mounted spray heads.
- e. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
- f. Mounting: Attached shower pedestal.
- g. Drench-Hose Option: May be provided instead of eyewash unit.
  - 1) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
  - 2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
  - 3) Mounting: Bracket on shower pedestal.

- B. Accessible, Plumbed Emergency Shower with Eyewash Combination Units:
  - 1. Manufacturers: Subject to compliance with requirements:
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. Bradley Corporation.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. Haws Corporation.
    - f. Sellstrom Manufacturing Company.
    - g. Speakman Company.
    - h. WaterSaver Faucet Co.

## 3. Piping:

- a. Material: Galvanized steel or Chrome-plated brass or stainless steel.
- b. Unit Supply: [NPS 1-1/4 (DN 32) minimum.
- c. Unit Drain: Outlet at back or side near bottom.

#### Shower:

- a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Pull rod.
- d. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass or stainless steel or plastic.
- e. Mounting: Pedestal.

## 5. Eyewash Unit:

- a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Paddle.
- d. Spray-Head Assembly: Two receptor-mounted spray heads.
- e. Receptor: Chrome-plated brass or stainless-steel or Plastic bowl.
- f. Mounting: Attached shower pedestal.
- g. Drench-Hose Option: May be provided instead of eyewash unit.
  - 1) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
  - 2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
  - 3) Mounting: Bracket on shower pedestal.

## C. Standard, Plumbed Emergency Shower with Eye/Face Wash Combination Units:

1. Manufacturers: Subject to compliance with requirements

- 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Acorn Safety; a division of Acorn Engineering Company.
  - b. Bradley Corporation.
  - c. Encon Safety Products.
  - d. Guardian Equipment Co.
  - e. Haws Corporation.
  - f. Sellstrom Manufacturing Company.
  - g. Speakman Company.
  - h. WaterSaver Faucet Co.

## 3. Piping:

- a. Material: Galvanized steel or Chrome-plated brass or stainless steel.
- b. Unit Supply: NPS 1-1/4 (DN 32) minimum.
- c. Unit Drain: Outlet at back or side near bottom.

#### 4. Shower:

- a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Pull rod.
- d. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass or stainless steel or plastic.
- e. Mounting: Pedestal.

## 5. Eye/Face Wash Unit:

- a. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Paddle.
- d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
- e. Receptor: Chrome-plated brass or stainless-steel or Plastic bowl.
- f. Mounting: Attached shower pedestal.
- g. Drench-Hose Option: May be provided instead of eye/face wash unit.
  - 1) Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
  - 2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
  - 3) Mounting: Bracket on shower pedestal.
- D. Accessible, Plumbed Emergency Shower with Eye/Face Wash Combination Units
  - 1. Manufacturers: Subject to compliance with requirements,
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.

- b. Bradley Corporation.
- c. Encon Safety Products.
- d. Guardian Equipment Co.
- e. Haws Corporation.
- f. Sellstrom Manufacturing Company.
- g. Speakman Company.
- h. WaterSaver Faucet Co.

## 3. Piping:

- a. Material: Galvanized steel or Chrome-plated brass or stainless steel
- b. Unit Supply: NPS 1-1/4 (DN 32) minimum.
- c. Unit Drain: Outlet at back or side near bottom.

#### Shower:

- a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
- Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Pull rod.
- d. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass or stainless steel or plastic.
- e. Mounting: Pedestal.

#### 5. Eye/Face Wash Unit:

- a. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Paddle.
- d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
- e. Receptor: Chrome-plated brass or stainless-steel or Plastic bowl.
- f. Mounting: Attached to shower pedestal.
- g. Drench-Hose Option: May be provided instead of eye/face wash unit.
  - 1) Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
  - 2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
  - 3) Mounting: Bracket on shower pedestal.

#### E. Freeze-Protected, Plumbed Emergency Shower with Eyewash Combination Units

- 1. Manufacturers: Subject to compliance with requirements
- 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide [product indicated on Drawings or comparable product by one of the following:
  - a. <u>B-L-S Industries, Inc.</u>
  - b. Bradley Corporation.
  - c. Encon Safety Products.
  - d. Guardian Equipment Co.

- e. Haws Corporation.
- f. Speakman Company.
- 3. Piping: Galvanized steel.
  - a. Unit Supply: NPS 1-1/4 (DN 32) minimum from bottom.
- 4. Heating System: Electric, 120 or 240-V ac; and insulation with protective jacket and thermometer.
  - a. Heating Capacity: 10 deg F (6 deg C) temperature> minimum above ambient temperature.

#### 5. Shower:

- a. Shower Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Pull rod.
- d. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass or stainless steel or plastic].
- e. Mounting: Pedestal.

## 6. Eyewash Unit:

- a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
- b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
- c. Control-Valve Actuator: Paddle.

#### 7. Eye/Face Wash Unit:

- a. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
- b. Control-Valve Actuator: Paddle.
- 8. Appurtenances:

#### 2.5 WATER-TEMPERING EQUIPMENT

- A. Hot- and Cold-Water, Water-Tempering Equipment
  - 1. Manufacturers: Subject to compliance with requirements:
  - 2. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Acorn Safety; a division of Acorn Engineering Company.
    - b. Armstrong International, Inc.
    - c. <u>Bradley Corporation</u>.
    - d. Encon Safety Products.
    - e. Guardian Equipment Co.
    - f. <u>Haws Corporation</u>.

- g. <u>Lawler Manufacturing Co., Inc.</u>
- h. <u>Leonard Valve Company</u>.
- i. Powers; a division of Watts Water Technologies, Inc.
- j. Speakman Company...
- 3. Description: Factory-fabricated equipment with thermostatic mixing valve.
  - a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
  - b. Supply Connections: For hot and cold water.

#### 2.6 EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation.
  - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
  - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment.
- G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system.
- H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system.
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.
- J. Fill self-contained fixtures with flushing fluid.

#### 2.7 **CONNECTIONS**

- Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having Α. water-tempering equipment.
- B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- C. Connect cold water and electrical power to electric heating water-tempering equipment.
- D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping.
- E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- F. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

#### 2.8 **IDENTIFICATION**

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

#### 2.9 FIELD QUALITY CONTROL

- Mechanical-Component Testing: After plumbing connections have been made, test for Α. compliance with requirements. Verify ability to achieve indicated capacities.
- В. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection.
  - Leak Test: After installation, charge system and test for leaks. Repair leaks and 2. retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
  - Test and adjust controls and safeties. Replace damaged and malfunctioning 4. controls and equipment.
- C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- Prepare test and inspection reports. D.

## 2.10 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION 22 45 00

#### **SECTION 22 47 00**

#### **DRINKING FOUNTAINS AND WATER COOLERS**

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Drinking fountains.
  - 2. Pressure water coolers.
  - 3. Bottle water coolers.
  - Water-station water coolers.
  - 5. Remote water coolers.
  - 6. Fixture supports.

#### 1.3 DEFINITIONS

- A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- C. Fitting: Device that controls flow of water into or out of fixture.
- D. Fixture: Drinking fountain or water cooler, unless one is specifically indicated.
- E. Remote Water Cooler: Electrically powered equipment for generating cooled drinking water.
- F. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Maintenance Data: For fixtures to include in maintenance manuals specified in Division 1.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable B. Buildings and Facilities; and Public Law 101-336, "Americans with Disabilities Act"; about fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about fixtures for people with disabilities.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-E. Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

#### 1.6 COORDINATION

Coordinate roughing-in and final fixture locations, and verify that fixtures can be installed to A. comply with original design and referenced standards.

#### PART 2 - PRODUCTS

#### 2.1 **MANUFACTURERS**

- Water Coolers: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-hanging A. fixture.
  - 1. Available Products:
    - Refer to section 22 00 01 for Plumbing Approved Manufacturers.
  - 2. Cabinet: Single or Bilevel with two attached cabinets, as indicated by schedule.
  - Bubbler: One, with automatic stream regulator, located on each cabinet deck. 3.
  - Control: Push bar. 4.
  - Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve and filter.
  - Drain[s]: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with 6. ASME A112.18.1M.
  - 7. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    - Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F a. (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
    - Electrical Characteristics: 120-V ac; single phase; 60 Hz. b.
  - Support: As recommended by manufacturer. 8.
- B. Water Coolers: ARI 1010, Type PB, pressure with bubbler, Style RE, recessed fixture.

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#### 1. Products:

- Refer to section 22 00 01 for Plumbing Approved Manufacturers.
- 2. Cabinet: All stainless steel.
- Bubbler: One, with automatic stream regulator, located on deck.
- Control: Push bar.
- Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve and filter. 5.
- Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with 6. **ASME A112.18.1M.**
- 7. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
  - a. Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
  - Electrical Characteristics: 120-V ac; single phase; 60 Hz. b.
- 8. Ventilation Grille: Stainless steel.
- 9. Support: Mounting frame for attaching to substrate.

#### PART 3 - EXECUTION

#### 3.1 **EXAMINATION**

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- В. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 **APPLICATIONS**

- A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.
- B. Use mounting frames for recessed water coolers, unless otherwise indicated.
- C. Set freestanding and pedestal drinking fountains on floor.
- D. Set remote water coolers on floor, unless otherwise indicated.
- E. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

#### 3.3 INSTALLATION

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- A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.
- В. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- C. Install fixtures level and plumb.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Refer to Division 15 Section "Valves" for general-duty valves.
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

#### 3.4 **CONNECTIONS**

- Piping installation requirements are specified in other Division 15 Sections. Drawings indicate A. general arrangement of piping, fittings, and specialties.
- В. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

#### 3.5 FIELD QUALITY CONTROL

- Water-Cooler Testing: After electrical circuitry has been energized, test for compliance with A. requirements. Test and adjust controls and safeties.
- B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- C. Report test results in writing.

#### 3.6 **ADJUSTING**

Adjust fixture flow regulators for proper flow and stream height. A.

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B. Adjust water-cooler temperature settings.

## 3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

**END OF SECTION** 

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# SECTION 23 00 00 PENETRATION FIRESTOPPING FOR HEATING, AIR CONDITIONG, AND VENTILATION

#### **PART 1 - GENERAL**

#### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

#### 1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of firerated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

#### 1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of duct, piping, and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.

#### 1.04 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
  - 1. Section 03300 Cast-In-Place Concrete
  - 2. Section 04200 Masonry Work
  - 3. Section 07840 Firestopping
  - 4. Section 09200 Gypsum Drywall Systems

#### 1.05 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Firestop Devices (XHJI)
    - b. Fire Resistance Ratings (BXRH)

- c. Through-Penetration Firestop Systems (XHEZ)
- d. Fill, Voids, or Cavity Material (XHHW)
- e. Forming Materials (XHKU)
- D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- G. All major building codes: ICBO, SBCCI, BOCA, and IBC.
- H. NFPA 101 Life Safety Code

#### 1.06 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

#### 1.07 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.
- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must

include both project name and contractor's name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

#### 1.08 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.
- C. The work is to be installed by a contractor with at least one of the following qualifications:

FM 4991 Approved Contractor
UL Approved Contractor
Hilti Accredited Fire Stop Specialty Contractor

- D. Firm with not less than 3 years experience with fire stop installation.
- E. Successfully completed not less than 3 comparable scale projects using similar systems.

## 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

#### 1.10 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Scheduling

- Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

#### **PART 2 - PRODUCTS**

#### 2.01 FIRESTOPPING - GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

#### **ACCEPTABLE MANUFACTURERS** 2.02

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
  - 1. Hilti, Inc., Tulsa, Oklahoma 800-879-8000 www.us.hilti.com
  - 2. Provide products from the above acceptable manufacturer; no substitutions will be accepted.

#### 2.03 **MATERIALS**

- A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls, the following products are acceptable:
  - 1. Hilti Cast-In Place Firestop Device (CP 680-P) for use with combustible penetrants.
  - 2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
  - 3. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
  - Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and 4. combustible penetrants.
  - Hilti Firestop Block (CFS-BL) 5.
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Flexible Firestop Sealant (CP 606)

- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
  - 1. Hilti Flexible Firestop Sealant (CP 606)
  - 2. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Flexible Firestop Sealant (CP 606)
- G. Non-curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Firestop Putty Stick (CP 618)
  - 2. Hilti Firestop Plug (CFS-PL)
- H. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
  - 1. Hilti Firestop Collar (CP 643N)
  - 2. Hilti Firestop Collar (CP 644)
  - 3. Hilti Wrap Strips (CP 648E/648S)
- I. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Mortar (CP 637)
  - 2. Hilti Firestop Block (CFS-BL)
  - 3. Hilti Fire Foam (CP 620)
  - 4. Hilti Firestop Board (CP 675T)
- J. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Board (CP 675T)

- K. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Plug (CFS-PL)
- L. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

#### **PART 3 - EXECUTION**

## 3.01 PREPARATION

- 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. Verify penetrations are properly sized and in suitable condition for application of materials.
  - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.02 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

#### 3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
  - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

#### 3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

#### 3.06 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- A. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

#### 3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

#### **END OF SECTION**

#### **SECTION 23 05 00**

#### COMMON WORK RESULTS FOR HVAC

#### PART 1 - GENERAL

1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Mechanical contractor to provide full as-built red line drawings to the GC and owner

#### 1.2 Summary:

- A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Escutcheons
  - Dielectric fittings.
  - 4. Flexible connectors.
  - 5. Equipment nameplate data requirements.
  - 6. Labeling and identifying mechanical systems.
  - 7. Field-fabricated metal and wood equipment supports.
  - 8. Installation requirements common to equipment specification sections.
  - 9. Mechanical demolition.
  - 10. Cutting and patching.
  - 11. Touchup painting and finishing.

#### 1.3 Definitions:

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms. furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. CPVC: Chlorinated polyvinyl chloride plastic.
  - 2. NP: Nylon plastic.
  - 3. PE: Polyethylene plastic.
  - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. CR: Chlorosulfonated polyethylene synthetic rubber.
  - 2. EPDM: Ethylene propylene diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Welding certificates.
- B. Certificates of Compliance for pressure vessels.
- C. Submit shop drawings or cuts showing construction size, arrangement, operating clearances, performance characteristics and capacity of materials and equipment. Each item of equipment proposed shall be a standard catalog product of the approved manufacturer.

- D. Samples, drawings, specifications, catalogs, etc., submitted for approval shall be properly labeled indicating specific service for which material or equipment is to be used.
- E. Submit access door locations to the Architect for approval. Equipment requiring access doors shall not be installed prior to approval of access door locations.
- F. Coordination Drawings:
  - 1. Provide coordination drawings in accordance with Division 1 Section "Project Management and Coordination". Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components (i.e. electrical, plumbing, structural and architectural work). Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
    - a. Planned piping layout, including valve and specialty locations.
    - b. Clearances for installation and maintaining insulation.
    - c. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly reguired for periodic maintenance.
    - d. Equipment and accessory service connections and support details.
    - e. Fire-rated wall and floor penetrations.
    - Sizes and location of required concrete pads and bases.
    - g. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
    - h. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
    - See Division 23, Section "Metal Ducts" for ductwork installation drawing requirements.
    - Reflected Ceiling Plans:
      - i. Ceiling suspension assembly members.
      - ii. Other systems installed in same space as ducts.
      - iii. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
      - Ceiling-mounting items, including lighting fixiv. tures, diffusers, grilles, speakers, access panels, and special molding.
      - ٧. Refer to architectural ceiling plans for additional requirements.

- 1.5 Quality Assurance:
  - A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
  - B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.
- 1.6 Delivery, Storage, and Handling:

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- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt. debris. and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

#### 1.7 Sequencing and Scheduling:

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-inplace concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
- G. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

#### PART 2 - PRODUCTS

#### 2.1 Manufacturers:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

#### 2.2 Pipe and Pipe Fittings:

- A. Refer to individual Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

#### 2.3 Joining Materials:

- A. Solder Filler Metals: ASTM B 32.
  - Allov Sn95 or Allov Sn94: Approximately 95 percent tin and 5 percent silver. with 0.10 percent lead content.
  - 2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
  - 3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
  - 4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
  - 5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
- B. Solvent Cements: Manufacturer's standard solvent cements for the following:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- C. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

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- 1. Sleeve: ASTM A 126, Class B, gray iron.
- 2. Followers: Malleable iron or ASTM A 536 ductile iron.
- 3. Gaskets: Rubber
- 4. Bolts and Nuts: AWWA C111
- 5. Finish: Enamel paint.

#### 2.4 Dielectric Fittings:

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig (1035-kPa) minimum working pressure as required to suit system pressures.
- F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, fullface or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Provide separate companion flanges and steel bolts and nuts for 150 psig (1035-kPa) minimum working pressure as required to suit system pressures.
- G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

## 2.5 Identifying Devices and Labels:

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
  - Data: Manufacturer, product name, model number, serial number, capacity. operating and power characteristics, labels of tested compliances, and similar essential data.
  - 2. Location: Accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- (30-mm-) high letters for ductwork and not less than 3/4inch- (19-mm-) high letters for access door signs and similar operational instructions.
  - 1. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and
  - 2. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for col-
- D. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
  - 1. Fabricate in sizes required for message.
  - 2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
  - Punch for mechanical fastening.

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- 4. Thickness: 1/8 inch, unless otherwise indicated.
- 5. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
- E. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:
  - 1. Green: Cooling equipment and components.
  - 2. Yellow: Heating equipment and components.
  - 3. Yellow/Green: Combination cooling and heating equipment and compo-
  - 4. Brown: Energy reclamation equipment and components.
  - 5. Blue: Equipment and components that do not meet any criteria above.
  - 6. For hazardous equipment, use colors and designs recommended by **ASME A13.1.**
  - 7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
    - 1) Name and plan number.
    - 2) Equipment service.
    - 3) Design capacity.
    - 4) Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
  - 8. Size: Approximate 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- F. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
  - 1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

#### PART 3 - EXECUTION

- 3.1 Piping Systems Common Requirements:
  - A. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
  - B. Install components with pressure rating equal to or greater than system operating pressure.
  - C. Install piping free of sags and bends.
  - D. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.
  - E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
  - F. Install couplings according to manufacturer's written instructions.
  - G. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
  - H. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
    - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

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- 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
- 4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1) Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
  - 2) Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
  - Align threads at point of assembly. 3)
  - 4) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
  - 5) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- Piping Connections: Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
  - 2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

#### 3.2 Equipment Installation – Common Requirements:

- A. Install equipment to provide maximum possible headroom if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible loca-
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

## 3.3 Labeling and Identifying:

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Stenciled Markers: According to ASME A13.1.
  - 2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.

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- 3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:
  - Near each valve and control device.
  - Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch if flow pattern is not obvious.
  - Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
  - At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5) Near major equipment items and other points of origination and termination.
  - 6) Spaced at maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
  - On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.
  - Lettering Size: Minimum 1/4-inch- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), 1/2-inch- (12.7-mm-) high lettering for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  - 2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.
- 3.4 Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- 3.5 Cutting and Patching:
  - A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
  - B. Repair cut surfaces to match adjacent surfaces.

**END OF SECTION** 

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## SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

#### 1.1 SUMMARY

A. Section includes single- and three-phase motors for application on equipment provided under other sections.

#### 1.2 REFERENCES

- A. American Bearing Manufacturers Association:
  - 1. ABMA 9 Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
  - NEMA MG 1 Motors and Generators.
- C. International Electrical Testing Association:
  - 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 catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.
- C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

#### 1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years experience.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 Product Requirements: Product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.
- C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

#### PART 2 PRODUCTS

#### 2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

- A. Manufacturers:
  - 1. Cooper Industries Inc.
  - 2. Eaton Corp.
  - 3. General Electric Co.
- B. Motors 3/4 hp and Larger: Three-phase motor as specified below.
- C. Motors Smaller Than 3/4 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.
- D. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
  - 1. Voltage: As indicated on Drawings.
  - 2. Service Factor: 1.25.
  - 3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
  - Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
  - Insulation System: NEMA Class F.
  - 6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
  - Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
  - 8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
  - 9. Sound Power Levels: Conform to NEMA MG 1.
- E. Single Phase Motors:
  - 1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
  - 2. Voltage: 115 115/230 230 volts, single phase, 60 Hz.
- F. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

#### PART 3 EXECUTION

#### 3.1 EXISTING WORK

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

#### 3.2 INSTALLATION

- A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- B. Install engraved plastic nameplates in accordance with Section 26 05 53.
- C. Ground and bond motors in accordance with Section 26 05 26.

#### 3.3 FIELD QUALITY CONTROL

- A. Section 01 70 00 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 7.15.

**END OF SECTION** 

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#### **SECTION 23 05 29**

#### **HVAC HANGERS AND SUPPORTS**

## 1. GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe, ductwork, and equipment hangers, supports, anchors, saddles and shields.
- B. Mechanical flashing.
- C. Equipment curbs.
- D. Mechanical sleeves and seals.
- E. Flashing and sealing equipment and pipe stacks.
- F. Sealants, firestop insulation, putty and compounds.
- G. Pipe Stands

## 1.2 REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

- A. Quality assurance.
- B. References.
- C. Submittals.
- D. Operation and maintenance manuals.
- E. Project record documents.
- F. Delivery, storage, and handling.

#### 2. PRODUCTS

#### 2.1 PIPE HANGERS AND SUPPORTS

- A. Hydronic Piping:
  - 1. Conform to International Mechanical Code, ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89 as applicable.
- B. Steam and Steam Condensate Piping:
  - 1. Conform to International Mechanical Code, ASME B31.1, ASTM F708, MSS SP58, MSS SP69, MSS SP89, as applicable.
- C. Refrigerant Piping

1. Conform to International Mechanical Code, ASME B31.1, ASTM F708, MSS SP58, MSS SP69, MSS SP89, as applicable.

## D. Hangers and Supports:

- 1. Hangers for Hot and Cold Pipe Sizes 1/2 to 1-1/2 Inch, Carbon steel, adjustable swivel, band type.
- 2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- 3. Hangers for Hot Pipe Sizes 2 to 4 Inches; Carbon steel, adjustable, clevis.
- 4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- 6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
- 7. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron roll.
- 8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- 9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
- 10. Vertical Support: Steel riser clamp.
- 11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 12. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 13. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- 14. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- 15. Roof Support for Hot and Cold Pipe: See PIPE STANDS section below.
- 16. Hangers for insulated pipe shall be enlarged to compensate for insulation thickness so that hangers support insulation.

#### 2.2 DUCTWORK HANGERS AND SUPPORTS

- A. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- B. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- C. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

- F. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - Supports for Exposed Stainless-Steel Ducts: Stainless-steel shapes and plates. 2.

#### 2.3 **ACCESSORIES**

- A. Hanger Rods: ASTM A36 steel or galvanized threaded both ends, threaded one end, or continuous threaded.
  - 1. Ductwork: Use double nuts and lock washers on threaded rod supports.

#### 2.4 **INSERTS**

Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded A. connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

#### 2.5 **FLASHING**

- Α. Metal Flashing: 26 gage galvanized steel.
- B. Metal Counterflashing: 22 gage galvanized steel.
- C. Flexible Flashing: 47 mil thick sheet buty; compatible with roofing.
- Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements. D.

#### **EQUIPMENT CURBS** 2.6

A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer. Minimum 18 inch height, unless specified otherwise.

#### **SLEEVES** 2.7

- Sleeves for Pipes through Fire Rated Floors and Walls: Schedule 40 steel pipe. Α.
- Sleeves for Pipes Through Non-fire Rated Floors and Walls: 18 gage galvanized B. steel.
- C. Sleeves for Ductwork: Galvanized steel.

#### SEALANTS, FIRESTOP INSULATION, PUTTY, AND COMPOUNDS 2.8

- Firestopping Insulation: Glass fiber type, non-combustible, UL listed. Α.
- B. Firestop Putty: Non-harding, non-shrinking, UL listed.
- Firestop Compounds: Cementitous material, non-shrinking, UL listed. C.
- D. Sealants:

- 1. Non fire/smoke rated partitions: Acrylic or silicone-based caulking.
- Fire/smoke rated partitions: Silicone based caulking; UL listed. 2.

#### 2.9 **MECHANICAL SEALS**

- Mechanical Seals: Modular mechanical type, consisting of interlocking EPDM Α. synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with type 316 stainless steel bolts and reinforced plastic polymer pressure plates which cause rubber sealing elements to expand when tightened, providing a watertight and gas-tight seal and electrical insulation.
  - 1. Provide high-temperature silicone links rated for 400 Deg. F for steam and condensate applications.
  - 2. A sleeve shall be provided for each mechanical seal.
    - Thermoplastic sleeves: Sleeve shall have smooth walls and shall be made a. of molded non-metallic high-density polyethylene (HDPE) with an integral solid water stop. Advance Products & Systems Model PWS or equivalent.
    - Steel sleeves: Sleeve shall have smooth walls, shall be made of Schedule b. 40 steel with an integral welded solid water stop, and shall have corrosionresistant coating, Advance Products & Systems Model GWS or equivalent.

#### 2.10 PIPE STANDS (ROOF)

- General Requirements for Pipe Stands: Shop or field -fabricated assemblies made of Α. manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or Vshaped cradle to support pipe, for roof installation without membrane penetration.
- High-Type, Single-Pipe Stand: C.
  - Description: Assembly of base, vertical and horizontal members, and pipe 1. support, for roof installation without membrane penetration.
  - Base: Plastic 2.
  - Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - Horizontal Member: Cadmium-plated-steel or stainless-steel with plastic or 4. stainless-steel, roller-type pipe support.
- High-Type, Multiple-Pipe Stand: D.
  - 1. Description: Assembly of Bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - Bases: One or more; plastic 2.
  - Vertical Members: Two or more protective-coated-steel channels. 3.
  - Horizontal member: Protective-coated-steel channel. 4.
  - 5. Pipe Supports: galvanized-steel, clevis-type pipe hangers.

E. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

# 3. EXECUTION

### 3.1 INSTALLATION

Install in accordance with manufacturer's instructions.

# 3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- 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 over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

# 3.3 PIPE HANGERS AND SUPPORTS

- Support horizontal piping as scheduled.
- B. Support fire protection systems piping independently from other piping systems. Fire main piping may be trapezed with other piping systems. Coordinate trapeze hangers with the Sprinkler Contractor.
  - 1. Reference sections 21 05 29 and 22 05 29 for additional information regarding fire protection and plumbing piping supports and hangers.
- C. Install hangers to provide 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 and at intervals of no more than 12 ft. Support vertical cast iron pipe at each floor at hub.
- H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports for non-insulated copper pipe.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat steel hangers and supports in the mechanical room and other exposed areas. Refer to the Architectural reflected ceiling plans for location of exposed ceilings. Hangers and supports located in attic space, crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- М. Adjust hangers to distribute loads equally on attachments and to achieve specified pipe slopes.
- Saddles, Shields and Inserts N.
  - 1. Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
  - 2. Install protective shields MSS Type 40 on cold piping that has vapor barrier. Shields shall span an arc of 180 degrees (360 degrees on trapeze hangers with U-bolt clamps) and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<b>THICKNESS</b>
1 through 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 through 14	24	0.075
16 through 24	24	0.105

- Pipes 8 inches and larger shall have wood inserts. 3.
- Insert materials shall be at least as long as the protective shield. Provide manufacturer-recommended saddles, inserts, and/or shields where cellular foam insulation is used. The removal of sections of cellular foam insulation for the purpose of pipe support is not acceptable.

#### 3.4 HANGER AND SUPPORT INSTALLATION

- Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," A. Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - Install powder-actuated concrete fasteners after concrete is placed and 2. completely cured.
  - Use powder-actuated concrete fasteners for standard-weight aggregate 3. concretes or for slabs more than 4 inches thick.

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- 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.

# 3.5 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

# 3.6 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls and floors.
- B. Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.
- C. 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 SLEEVES

- A. Provide pipe and duct sleeves at all fire/smoke rated partitions, exterior wall penetrations and wall penetrations into exposed areas. Pipe and duct sleeves are not required for penetrations through non-rated concealed partitions.
- B. Wall sleeves shall not be used to support pipes or ducts.
- C. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Size so as to allow for continuous insulation wrapping through sleeve.
- E. Sleeves through floors shall extend a minimum 2" above the finish floor level. Sleeves through walls should be flush with wall surface.
- F. Where piping or ductwork penetrate non-rated ceilings or walls, close off space between pipe or duct and adjacent work with urethane rod stock and caulk airtight.
- G. Seal pipe and duct penetrations through non-rated floors.
  - 1. Where piping is not located in a rated shaft and it penetrates a single non-rated floor, close off space between pipe and adjacent work with urethane rod stock and caulk airtight.
  - 2. Where piping is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between pipe and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound.
  - 3. Where ductwork is not located in a rated shaft and it penetrates a single nonrated floor, close off space between duct and adjacent work with appropriate firerated sealant, insulation, putty, or compound.
  - 4. Where ductwork is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between duct and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound. Install fire damper in duct at each floor level. Ductwork containing fume exhaust air shall not be provided with fire dampers.
- H. Where piping or ductwork penetrate rated floor, ceiling, or wall, close off space between pipe or duct with appropriate fire rated sealant, insulation, putty or compound. Refer to the Drawings for fire/smoke rated wall locations and the appropriate ratings.
- Provide on ductwork close fitting metal collar or escutcheon covers on the side of penetration that are exposed to view.
- Install chrome plated steel escutcheons on piping at finished surfaces.
- K. Provide mechanical seals and sleeves through exterior wall and floor penetrations and 3 hour or higher fire rated partitions.
- L. All ductwork through exterior walls to be installed with flashing and counter flashing.

# 3.8 HANGER SCHEDULES

A. Reference International Plumbing Code and International Mechanical Code where applicable.

END OF SECTION 23 05 29

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### **SECTION 23 05 93**

# **TESTING, ADJUSTING AND BALANCING FOR HVAC**

### **PART 1 GENERAL**

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Testing adjusting, and balancing of air systems.
  - 2. Testing adjusting, and balancing of hydronic systems.
  - 3. Measurement of final operating condition of HVAC systems.
  - 4. Sound measurement of equipment operating conditions.
  - 5. Vibration measurement of equipment operating conditions.

# 1.2 REFERENCES

- A. Associated Air Balance Council:
  - 1. AABC MN-1 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - ASHRAE 111 Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. Natural Environmental Balancing Bureau:
  - NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

# 1.3 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
- Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms.
- D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and Copy of NEBB Certificate of Conformance Certification.
- F. Submit draft copies of report for review prior to final acceptance of Project.
- G. Furnish reports in binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

# 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

# 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance ASHRAE 111 NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- B. Maintain one copy of each document on site.
- C. Prior to commencing Work, calibrate each instrument to be used.

# 1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years experience.
- B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

# 1.7 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

# 1.8 SCHEDULING

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

# **PART 2 PRODUCTS**

Not Used.

# **PART 3 EXECUTION**

### 3.1 EXAMINATION

- A. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Verify systems are complete and operable before commencing work. Verify the following:
  - 1. Systems are started and operating in safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.

- 3. Proper thermal overload protection is in place for electrical equipment.
- 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
- 5. Duct systems are clean of debris.
- Fans are rotating correctly. 6.
- 7. Fire and volume dampers are in place and open.
- Air coil fins are cleaned and combed. 8.
- 9. Access doors are closed and duct end caps are in place.
- 10. Air outlets are installed and connected.
- 11. Duct system leakage is minimized.
- 12. Hydronic systems are flushed, filled, and vented.
- 13. Pumps are rotating correctly.
- 14. Proper strainer baskets are clean and in place or in normal position.
- 15. Service and balancing valves are open.

#### 3.2 **PREPARATION**

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- В. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

#### 3.3 **INSTALLATION TOLERANCES**

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
- В. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

### 3.4 **ADJUSTING**

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- В. Verify recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

February 6, 2024 23 05 93 - 3  Check and adjust systems approximately six months after final acceptance and submit report.

# 3.5 AIR SYSTEM PROCEDURE

- Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Contractor shall verify motor loading (current draw) during full economizer, normal operation, and night operation. This applies to all fan motors supply, return, and power exhaust.
- C. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- Measure air quantities at air inlets and outlets.
- Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- F. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- G. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- H. Contractor shall replace motor sheaves as required to obtain balance. Contractor shall not be responsible for motor replacement.
- Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- J. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- K. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- M. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- N. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near building entries.
- Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

- P. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.
- Q. On fan powered VAV boxes, adjust airflow switches for proper operation.

### 3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Use calibrated fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
- C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

# 3.7 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
  - Fire Pumps.
  - 2. Plumbing Pumps.
  - HVAC Pumps.
  - 4. Air Cooled Water Chillers.
  - 5. Air Coils.
  - 6. Terminal Heat Transfer Units.
  - 7. Air Handling Units.
  - 8. Fans.
  - 9. Air Filters.
  - 10. Air Terminal Units.
  - 11. Air Inlets and Outlets.
- B. Report Forms
  - Title Page:
    - a. Name of Testing, Adjusting, and Balancing Agency
    - b. Address of Testing, Adjusting, and Balancing Agency
    - c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
    - d. Project name
    - e. Project location
    - f. Project Architect
    - g. Project Engineer

- h. Project Contractor
- i. Project altitude
- j. Report date
- 2. Summary Comments:
  - a. Design versus final performance
  - b. Notable characteristics of system
  - c. Description of systems operation sequence
  - d. Summary of outdoor and exhaust flows to indicate building pressurization
  - e. Nomenclature used throughout report
  - f. Test conditions
- 3. Instrument List:
  - a. Instrument
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Range
  - f. Calibration date
- 4. Electric Motors:
  - a. Manufacturer
  - b. Model/Frame
  - c. HP/BHP and kW
  - d. Phase, voltage, amperage; nameplate, actual, no load
  - e. RPM
  - f. Service factor
  - g. Starter size, rating, heater elements
  - h. Sheave Make/Size/Bore
- 5. V-Belt Drive:
  - a. Identification/location
  - b. Required driven RPM
  - c. Driven sheave, diameter and RPM
  - d. Belt, size and quantity
  - e. Motor sheave diameter and RPM
  - f. Center to center distance, maximum, minimum, and actual
- 6. Pump Data:
  - a. Identification/number
  - b. Manufacturer
  - c. Size/model
  - d. Impeller
  - e. Service
  - f. Design flow rate, pressure drop, BHP and kW
  - g. Actual flow rate, pressure drop, BHP and kW
  - h. Discharge pressure
  - i. Suction pressure
  - j. Total operating head pressure
  - k. Shut off, discharge and suction pressures
  - I. Shut off, total head pressure
- 7. Chillers:
  - a. Identification/number
  - b. Manufacturer
  - c. Capacity
  - d. Model number
  - e. Serial number

- f. Evaporator entering water temperature, design and actual
- g. Evaporator leaving water temperature, design and actual
- h. Evaporator pressure drop, design and actual
- i. Evaporator water flow rate, design and actual
- j. Condenser entering water temperature, design and actual
- k. Condenser pressure drop, design and actual
- I. Condenser water flow rate, design and actual
- 8. Cooling Coil Data:
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Entering air DB temperature, design and actual
  - g. Entering air WB temperature, design and actual
  - h. Leaving air DB temperature, design and actual
  - i. Leaving air WB temperature, design and actual
  - j. Water flow, design and actual
  - k. Water pressure drop, design and actual
  - I. Entering water temperature, design and actual
  - m. Leaving water temperature, design and actual
  - n. Saturated suction temperature, design and actual
  - o. Air pressure drop, design and actual
- 9. Heating Coil Data:
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Water flow, design and actual
  - g. Water pressure drop, design and actual
  - h. Entering water temperature, design and actual
  - i. Leaving water temperature, design and actual
  - j. Entering air temperature, design and actualk. Leaving air temperature, design and actual
  - I. Air pressure drop, design and actual
- 10. Return Air/Outside Air Data:
  - a. Identification/location
  - b. Design air flow
  - c. Actual air flow
  - d. Design return air flow
  - e. Actual return air flow
  - f. Design outside air flow
  - g. Actual outside air flow
  - h. Return air temperature
  - i. Outside air temperature
  - j. Required mixed air temperature
  - k. Actual mixed air temperature
  - Design outside/return air ratio
     Actual outside/return air ratio
- 11. Exhaust Fan Data:
  - a. Location
  - b. Manufacturer

- c. Model number
- d. Serial number
- e. Air flow, specified and actual
- f. Total static pressure (total external), specified and actual
- g. Inlet pressure
- h. Discharge pressure
- i. Sheave Make/Size/Bore
- j. Number of Belts/Make/Size
- k. Fan RPM
- 12. Duct Traverse:
  - a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air temperature
  - Air correction factor
- 13. Duct Leak Test:
  - a. Description of ductwork under test
  - b. Duct design operating pressure
  - c. Duct design test static pressure
  - d. Duct capacity, air flow
  - e. Maximum allowable leakage duct capacity times leak factor
  - f. Test apparatus
    - 1) Blower
    - 2) Orifice, tube size
    - 3) Orifice size
    - 4) Calibrated
  - g. Test static pressure
  - h. Test orifice differential pressure
  - i. Leakage
- 14. Air Monitoring Station Data:
  - a. Identification/location
  - b. System
  - c. Size
  - d. Area
  - e. Design velocity
  - f. Design air flow
  - g. Test velocity
  - h. Test air flow
- 15. Flow Measuring Station:
  - a. Identification/number
  - b. Location
  - c. Size
  - d. Manufacturer
  - e. Model number
  - f. Serial number
  - g. Design Flow rate
  - h. Design pressure drop
  - i. Actual/final pressure drop

- j. Actual/final flow rate
- k. Station calibrated setting
- 16. Terminal Unit Data:
  - a. Manufacturer
  - b. Type, constant, variable, single, dual duct
  - c. Identification/number
  - d. Location
  - e. Model number
  - f. Size
  - g. Minimum static pressure
  - h. Minimum design air flow
  - i. Maximum design air flow
  - j. Maximum actual air flow
  - k. Inlet static pressure
- 17. Air Distribution Test Sheet:
  - a. Air terminal number
  - b. Room number/location
  - c. Terminal type
  - d. Terminal size
  - e. Area factor
  - f. Design velocity
  - g. Design air flow
  - h. Test (final) velocity
  - i. Test (final) air flow
  - j. Percent of design air flow
- 18. Sound Level Report:
  - a. Location
  - b. Octave bands equipment off
  - c. Octave bands equipment on
  - d. RC level equipment on
- 19. Vibration Test:
  - a. Location of points:
    - 1) Fan bearing, drive end
    - 2) Fan bearing, opposite end
    - 3) Motor bearing, center (when applicable)
    - 4) Motor bearing, drive end
    - 5) Motor bearing, opposite end
    - 6) Casing (bottom or top)
    - 7) Casing (side)
    - 8) Duct after flexible connection (discharge)
    - 9) Duct after flexible connection (suction)
  - b. Test readings:
    - 1) Horizontal, velocity and displacement
    - 2) Vertical, velocity and displacement
    - 3) Axial, velocity and displacement
  - c. Normally acceptable readings, velocity and acceleration
  - d. Unusual conditions at time of test
  - e. Vibration source (when non-complying)

**END OF SECTION** 

City of Huber Heights – New Public Works Facility

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# **SECTION 23 07 00**

### **HVAC INSULATION**

### **PART 1 GENERAL**

# 1.1 SUMMARY

- A. Section Includes:
  - 1. HVAC piping insulation, jackets and accessories.
  - 2. HVAC equipment insulation, jackets and accessories.
  - 3. HVAC ductwork insulation, jackets, and accessories.

### B. Related Sections:

- 1. Section 07 84 00 Firestopping: Product requirements for firestopping for placement by this section.
- 2. Section 09 90 00 Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

### 1.2 REFERENCES

### A. ASTM International:

- ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- 2. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- 3. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- 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.
- ASTM C450 Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
- 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.
- 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 C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
- 18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket 19. Insulation Used to Externally Insulate HVAC Ducts.
- ASTM D1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) 20. Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- 21. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
- 22. ASTM E84 - Standard Test Method for Surface Burning Characteristics of **Building Materials.**
- 23. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- 24. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- В. Sheet Metal and Air Conditioning Contractors':
  - SMACNA HVAC Duct Construction Standard Metal and Flexible.
- C. National Fire Protection Association:
  - NFPA 255 Standard Method of Test of Surface Burning Characteristics of **Building Materials.**
- D. Underwriters Laboratories Inc.:
  - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
  - 2. UL 1978 - Standard for Safety for Grease Ducts.

### 1.3 **SUBMITTALS**

- A. Section 01 33 00 - 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 for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, and NFPA 255.
- 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.
- D. Maintain one copy of each document on site.

### 1.5 **QUALIFICATIONS**

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

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В. Applicator: Company specializing in performing Work of this section with minimum three years experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- В. 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.

### 1.7 **ENVIRONMENTAL REQUIREMENTS**

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- В. 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.

#### 1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

### 1.9 WARRANTY

- Section 01 70 00 Execution and Closeout Requirements: Product warranties and A. product bonds.
- B. Furnish five year manufacturer warranty for man made fiber.

# **PART 2 PRODUCTS**

### **MANUFACTURER** 2.1

- Manufacturers for Glass Fiber and Mineral Fiber Insulation Products: A.
  - 1. Refer to section 23 00 01 for approved manufacturer.
  - 2.
- В. Manufacturers for Closed Cell Elastomeric Insulation Products:
  - Refer to section 23 00 01 for approved manufacturer.
- Manufacturers for Polyisocyanurate Foam Insulation Products: C.
  - Refer to section 23 00 01 for approved manufacturer.
- D. Manufacturers for Extruded Polystyrene Insulation Products:
  - 1. Refer to section 23 00 01 for approved manufacturer.

#### 2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
  - Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
  - 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 (minus 29 to 66 degrees C).
- В. TYPE P-2: ASTM C547, molded glass fiber pipe insulation.
  - Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
- C. TYPE P-3: ASTM C552-07, Cellular glass insulation
  - Thermal Conductivity: 0.29 at 75 degrees F (0.040 at 24 degrees C).
  - 2. Operating Temperature Range:-450 to 900 degrees F
  - 3. Vapor Barrier Jacket: VentureClad 1577CW-E, 6 mil, 0 permability, embossed natural aluminum finish
  - 4. Jacket Temperature Limit: minus 30 to 300 degrees F
- D. TYPE P-4: ASTM C612; semi-rigid, fibrous glass board noncombustible.
  - 1. Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).
- E. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
  - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F (minus 57 to 82 degrees C).
- F. TYPE P-6: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
  - Thermal Conductivity: 0.30 at 75 degrees F (0.043 at 24 degrees C).
  - 2. Maximum Service Temperature: 300 degrees F (149 degrees C).
  - 3. Operating Temperature Range: Range: Minus 58 to 300 degrees F (minus 50 to 149 degrees C).
- G. TYPE P-7: ASTM C534, Type I, flexible, nonhalogen, closed cell elastomeric insulation, tubular.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 24 degrees C). 1.
  - 2. Maximum Service Temperature: 250 degrees F (120 degrees C).
  - Operating Temperature Range: Range: Minus 58 to 250 degrees F (minus 50 to 3. 120 degrees C).
- Н. TYPE P-8: ASTM C547, Type I or II, mineral fiber preformed pipe insulation, noncombustible.
  - 1. Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
  - 2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
  - 3. Canvas Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric treated with fire retardant lagging adhesive.
- I. TYPE P-9: ASTM C591, Type IV, polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.
  - Density: 2.0 pounds per cubic foot (32 kg per cubic meter). 1.

- 2. Thermal Conductivity: 180 day aged value of 0.19 at 75 degrees F (0.027 at 24 degrees C).
- 3. Operating Temperature Range: Range: Minus 297 to 300 degrees F (minus 183 to 149 degrees C).
- Vapor Barrier Jacket: ASTM C1136. Type I, factory applied film of 6 mils (0.15 4. mm) thickness and water vapor permeance of 0.02 perms.
- J. TYPE P-10: ASTM C578, Type XIII, extruded polystyrene insulation, formed into shapes for use as pipe insulation.
  - Thermal Conductivity: 180 day aged value of 0.259 at 75 degrees F (0.037 at 24 degrees C).
  - Operating Temperature Range: Range: Minus 297 to 165 degrees F (minus 183 2. to 74 degrees C).
  - Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 6 mils (0.15 3. mm) thickness and water vapor permeance of 0.02 perms.
- K. TYPE P-11: ASTM C533; Type I, hydrous calcium silicate pipe insulation, rigid molded white: asbestos free.
  - Thermal Conductivity: 0.45 at 200 degrees F (0.0650 at 93 degrees C). 1.
  - 2. Operating Temperature Range: 140 to 1200 degrees F (60 to 649 degrees C).
- L. TYPE P-12: ASTM C547, molded glass fiber pipe insulation.
  - Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C). 1.
  - Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft 2. with self-sealing adhesive joints.
  - 3. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
  - 4. Canvas Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric treated with fire retardant lagging adhesive.

#### 2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
  - white Kraft paper with glass fiber yarn, bonded to aluminized film.
  - Moisture vapor transmission: ASTM E96; 0.02 perm-inches. 2.
- В. **PVC Plastic Pipe Jacket:** 
  - Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
  - 2. Thickness: 10 mil (0.25 mm).
  - Connections: Brush on welding adhesive or Pressure sensitive color matching 3. vinyl tape.
- C. **ABS Plastic Pipe Jacket:** 
  - Jacket: One piece molded type fitting covers and sheet material, off-white color.
  - 2. Minimum service temperature: -40 degrees F (-40 degrees C).
  - 3. Maximum service temperature of 180 degrees F (82 degrees C).
  - 4. Moisture vapor transmission: ASTM E96; 0.012 perm-inches.
  - 5. Thickness: 30 mil (0.76 mm).
  - Connections: Brush on welding adhesive. 6.
- D. Aluminum Pipe Jacket:
  - **ASTM B209.** 1.
  - 2. Thickness: 0.016 inch (0.40 mm) thick sheet.

- 3. Finish: Smooth.
- 4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
- 5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
- 6. Metal Jacket Bands: 3/8 inch (10 mm) wide:
- Stainless Steel Pipe Jacket: ASTM A167 Type 302 304 stainless steel. 7.
- 8. Thickness: 0.010 inch (0.25 mm) thick.
- 9. Finish: Smooth.
- 10. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.
- E. Field Applied Glass Fiber Fabric Jacket System:
  - Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
  - 2. Glass Fiber Fabric:
    - Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight. a.
    - b. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
    - C. Weave: 5 x 5.
  - 3. Indoor Vapor Retarder Finish:
    - Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
    - Vinyl emulsion type acrylic, compatible with insulation, color. b.

#### 2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- В. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches (40 mm) 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 (50 mm) diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches (150 mm) long, matching thickness and contour of adjoining insulation.
- Ε. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- Η. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

### 2.5 **EQUIPMENT INSULATION**

- A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
  - Thermal Conductivity: 0.24 at 75 degrees F ( 0.032 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 450 degrees F (minus 18 to 232 degrees C).
  - 3. Density: 1.5 pound per cubic foot (24 kilogram per cubic meter).

- В. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft aluminum foil iacket.
  - 1. Thermal Conductivity: 0.24 at 75 degrees F (0.035 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 450 degrees F (minus 18 to 232 degrees C).
  - 3. Density: 3.0 pound per cubic foot (48 kilogram per cubic meter).
  - Jacket Temperature Limit: minus 20 to 150 degrees F (minus 29 to 66 degrees 4.
- C. TYPE E-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C). 1.
  - 2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).
  - 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 (minus 29 to 66 degrees C).
- D. TYPE E-4: ASTM C612; semi-rigid, fibrous glass board noncombustible.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C).
  - 2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).
- E. TYPE E-5: ASTM C612; glass fiber, semi-rigid board, noncombustible.
  - Thermal Conductivity: 0.23 at 75 degrees F (0.033 at 24 degrees C).
  - Maximum Operating Temperature: 850 degrees F (450 degrees C). 2.
  - Density: 3.0 pound per cubic foot (48 kilogram per cubic meter). 3.
- F. TYPE E-6: ASTM C553; mineral fiber blanket, Type I.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 24 degrees C).
  - 2. Maximum Operating Temperature: 1000 degrees F (538 degrees C).
  - 3. Density: 1.0 pound per cubic foot (16 kilogram per cubic meter).
- G. TYPE E-7: ASTM C533; Type II, hydrous calcium silicate block insulation, asbestos free.
  - Thermal Conductivity: 0.45 at 200 degrees F (0.0650 at 93 degrees C).
  - 2. Operating Temperature Range: 140 to 1200 degrees F (60 to 649 degrees C).
- Н. TYPE E-8: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
  - 2. Operating Temperature Range: Range: Minus 70 to 220 degrees F (minus 57 to 105 degrees C).
- I. TYPE E-9: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
  - 2. Operating Temperature Range: Range: Minus 70 to 220 degrees F (minus 57 to 105 degrees C).
  - 3. Vapor Barrier Jacket: VentureClad 1577CW-E, 6 mil, 0 permability, embossed natural aluminum finish
  - Jacket Temperature Limit: minus 30 to 300 degrees F 4.

#### 2.6 **EQUIPMENT INSULATION JACKETS**

- A. PVC Plastic Equipment Jacket:
  - 1. Product Description: ASTM D1784, sheet material, off-white color.
  - 2. Minimum Service Temperature: -40 degrees F (-40 degrees C).
  - 3. Maximum Service Temperature: 150 degrees F (66 degrees C).
  - Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches. 4.

- 5. Thickness: 10 mil (0.25 mm).
- 6. Connections: Brush on welding adhesive Pressure sensitive color matching vinvl tape.
- B. Aluminum Equipment Jacket:
  - **ASTM B209.**
  - 2. Thickness: 0.016 inch (0.40 mm) thick sheet.
  - 3. Finish: Smooth.
  - 4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
  - Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached 5. protective liner.
  - 6. Metal Jacket Bands: 3/8 inch (10 mm) wide;
- C. Stainless Steel Equipment Jacket:
  - ASTM A167 Type 302 304 stainless steel.
  - 2. Thickness: 0.010 inch (0.25 mm) thick.
  - 3. Finish: Smooth.
  - 4. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless
- D. Canvas Equipment Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.
- E. Vapor Retarder Jacket:
  - 1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
  - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- F. Field Applied Glass Fiber Fabric Jacket System:
  - Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool. 1.
  - 2. Glass Fiber Fabric:
    - Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight. a.
    - Blanket: 1.0 lb/cu ft (16 kg/cu m) density. b.
    - Weave: 5 x 5. C.
  - 3. Indoor Vapor Retarder Finish:
    - Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
    - b. Vinyl emulsion type acrylic, compatible with insulation, black color.

### 2.7 **EQUIPMENT INSULATION ACCESSORIES**

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- В. Covering Adhesive Mastic: Compatible with insulation.
- C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- E. Adhesives: Compatible with insulation.

#### 2.8 **DUCTWORK INSULATION**

TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory A. applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.

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- 1. Thermal Conductivity: 0.30 at 75 degrees F (0.043 at 24 degrees C).
- 2. Maximum Operating Temperature: 250 degrees F (121 degrees C).
- 3. Density: 0.75 pound per cubic foot (12 kilogram per cubic meter).
- В. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied all service facing meeting ASTM C1136, Type II.
  - Thermal Conductivity: 0.24 at 75 degrees F (at 24 degrees C).
  - 2. Density: 1.6 pound per cubic foot (26 kilogram per cubic meter).
- C. TYPE D-3: ASTM C612, Type IA or IB, rigid glass fiber, no facing.
  - Thermal Conductivity: 0.24 at 75 degrees F (0.035 at 24 degrees C).
  - 2. Density: 1.6 pound per cubic foot (26 kilogram per cubic meter).
- D. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
  - Thermal Conductivity: 0.28 at 75 degrees F (0.040 at 24 degrees C).
  - Density: 1.5 pound per cubic foot (24 kilogram per cubic meter). 2.
  - 3. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  - 4. Maximum Air Velocity: 6,000 feet per minute (30.5 meter per second).
- E. TYPE D-5: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
  - Thermal Conductivity: 0.23 at 75 degrees F (0.033 at 24 degrees C).
  - 2. Density: 3.0 pound per cubic foot (48 kilogram per cubic meter).
  - 3. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  - 4. Maximum Air Velocity: 4,000 feet per minute (20.3 meter per second).
- F. TYPE D-6: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
  - Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 24 degrees C).
  - 2. Service Temperature Range: Range: Minus 58 to 180 degrees F (minus 50 to 82 degrees C).
- G. TYPE D-7: ASTM C518, Owens Corning "Thermapink" Extruded Polystyrene insulation
  - Thermal Conductivity: 0.20 at 75 degrees F (0.039 at 24 degrees C).
  - 2. Service Temperature Range: Range: -10 to 150 degrees F
  - 3. Vapor Barrier Jacket: VentureClad 1577CW-E, 6 mil, 0 permability, embossed natural aluminum finish
  - 4. Jacket Temperature Limit: minus 30 to 300 degrees F
- Н. TYPE D-8: Inorganic blanket encapsulated with scrim reinforced foil meeting UL 1978.
  - Thermal Conductivity: 0.42 at 500 degrees F 1.
  - 2. Weight: 130 pound per 1000 square foot per inch
  - Flame spread rating of 0 and smoke developed rating of 0 in accordance with 3. ASTM E84.
- I. TYPE D-9: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
  - Thermal Conductivity: 0.30 at 75 degrees F (0.043 at 24 degrees C).
  - 2. Maximum Operating Temperature: 250 degrees F (121 degrees C).
  - 3. Density: 0.75 pound per cubic foot (12 kilogram per cubic meter).
  - 4. Canvas Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric treated with fire retardant lagging adhesive.

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# 2.9 DUCTWORK INSULATION JACKETS

- A. Aluminum Duct Jacket:
  - 1. ASTM B209.
  - Thickness: 0.016 inch (0.40 mm) thick sheet.
  - 3. Finish: Smooth.
  - 4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
  - 5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
  - 6. Metal Jacket Bands: 3/8 inch (10 mm) wide;
- B. Vapor Retarder Jacket:
  - Kraft paper with glass fiber yarn and bonded to aluminized film 0.0032 inch (0.081 mm) vinyl.
  - 2. Moisture vapor transmission: ASTM E96; 0.02 perm.
  - 3. Secure with pressure sensitive tape.
- C. Canvas Duct Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.
- D. Outdoor Duct Jacket: VentureClad self adhesive aluminum jacketing system.
- E. Membrane Duct Jacket: ASTM D4637; Type I, EPDM; non-reinforced, 0.045 inch (mm) thick, 48 inch (1220 mm) wide roll; white color.

# 2.10 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
- E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- F. Lagging Adhesive: Fire resistive to ASTM E84 NFPA 255 UL 723.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.
- Membrane Adhesives: As recommended by membrane manufacturer.

# **PART 3 EXECUTION**

# 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

- В. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

#### 3.2 **INSTALLATION - PIPING SYSTEMS**

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- В. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
  - Insulate entire system including fittings, valves, unions, flanges, strainers, flexible 1. connections, pump bodies, and expansion joints.
  - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factoryapplied 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:
  - Apply insulation close to equipment by grooving, scoring, and beveling insulation. 1. 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.
  - Cover wire mesh or bands with cement to a thickness to remove surface 3. irregularities.
- E. Polyisocyanurate Foam Insulation Extruded Polystyrene Insulation:
  - 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 (60 degrees C):
  - 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.
  - Insulate fittings, joints, and valves with insulation of like material and thickness as 2. 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. Hot Piping Systems greater than 140 degrees F (60 degrees C):
  - 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. Insulate flanges and unions at equipment.

### Η. Inserts and Shields:

- Piping 1-1/2 inches (40 mm) Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
- 2. Piping 2 inches (50 mm) Diameter and Larger: Install insert between support shield and piping and under finish jacket.
  - Insert Configuration: Minimum 6 inches (150 mm) 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.
- Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield 3. between roller and inserts.

### **Insulation Terminating Points:** I.

- Coil Branch Piping 1 inch (25 mm) and Smaller: Terminate hot water piping at 1. union upstream of the coil control valve.
- 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
- 3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

#### J. Closed Cell Elastomeric Insulation:

- Push insulation on to piping. 1.
- 2. Miter joints at elbows.
- 3. Seal seams and butt joints with manufacturer's recommended adhesive.
- 4. When application requires multiple layers, apply with joints staggered.
- 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

### K. High Temperature Pipe Insulation:

- Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- L. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.
- M. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.
- N. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
- 0. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.
- Ρ. Heat Traced Piping Exterior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.

### 3.3 **INSTALLATION - EQUIPMENT**

- A. Factory Insulated Equipment: Do not insulate.
- В. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. **Equipment Containing Fluids Below Ambient Temperature:** 
  - Insulate entire equipment surfaces.
  - 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
  - 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factoryapplied 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.
  - 4. Finish insulation at supports, protrusions, and interruptions.
- E. Equipment Containing Fluids 140 degrees F (60 degrees C) Or Less:
  - Do not insulate flanges and unions, but bevel and seal ends of insulation. 1.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment Containing Fluids Over 140 degrees F (60 degrees C):
  - Insulate flanges and unions with removable sections and jackets.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- G. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- Η. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.
- I. Cover glass fiber cellular glass hydrous calcium silicate cellular foam insulation with aluminum jacket.
- J. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- Prepare equipment insulation for finish painting. Refer to Section 09 90 00. L.

#### 3.4 **INSTALLATION - DUCTWORK SYSTEMS**

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- В. Insulated ductwork conveying air below ambient temperature:
  - Provide insulation with vapor retarder jackets.

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- 2. Finish with tape and vapor retarder jacket.
- 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
- 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
  - Provide with or without standard vapor retarder jacket. 1.
  - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet (3 meters) above finished floor): Finish with aluminum jacket.
- E. **External Glass Fiber Duct Insulation:** 
  - Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
  - 2. Secure insulation without vapor retarder with staples, tape, or wires.
  - 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
  - 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
  - Stop and point insulation around access doors and damper operators to allow 5. operation without disturbing wrapping.
- F. External Elastomeric Duct Insulation:
  - Adhere to clean oil-free surfaces with full coverage of adhesive.
  - 2. Seal seams and butt joints with manufacturer's recommended adhesive.
  - When application requires multiple layers, apply with joints staggered. 3.
  - 4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
  - Lift ductwork off trapeze hangers and insert spacers. 5.
- G. **Duct Liner:** 
  - 1. Adhere insulation with adhesive for 100 percent coverage.
  - 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
  - Seal and smooth joints. Seal and coat transverse joints. 3.
  - 4. Seal liner surface penetrations with adhesive.
  - 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
- Η. Kitchen Exhaust Ductwork:
  - Cover duct by wrapping with insulation using butt joint with collar method. 1.
  - 2. Overlap seams of each method by 3 inches (76 mm).
  - 3. Attach insulation using steel banding or by welded pins and clips.
  - 4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.
- I. **Ducts Exterior to Building:** 
  - Install insulation according to external duct insulation paragraph above. 1.
  - 2. Provide external insulation with vapor retarder jacket. Cover with with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
  - Finish with mineral fiber outdoor duct jacket or aluminum duct jacket or 3. membrane duct jacket.

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4.	Calk seams at flanges and joints.	Located major longitudinal seams on t	ottom
	side of horizontal duct sections.		

J. Prepare duct insulation for finish painting. Refer to Section 09 90 00.

# 3.5 SCHEDULES

# A. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches (mm)
Indoor Supply Ducts (externally insulated)	D-1	2.0 (50)
Indoor Return Ducts (externally insulated)	D-1	2.0 (50)
Supply Air, Return Air, Exhaust Air duct exterior to building	D-6 (w/ VentureClad Jacket)	3.0 (75)

# **END OF SECTION**

# SECTION 23 09 01 HVAC BUILDING MASTER CONTROL FRONT END

### **PART 1 GENERAL**

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes base bid control equipment for HVAC systems and components. Refer to drawings for controls scope of work.

# 1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. LAN: Local area network.
- C. MS/TP: Master-slave/token-passing.
- D. PICS: Protocol Implementation Conformance Statement.

# 1.4 SYSTEM DESCRIPTION

A. Control system consists of thermostats, sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

### 1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  - Each control device labeled with setting or adjustable range of control.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.

- 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- 3. Details of control panel faces, including controls, instruments, and labeling.
- 4. Written description of sequence of operation.
- 5. Schedule of dampers including size, leakage, and flow characteristics.
- 6. Schedule of valves including leakage and flow characteristics.
- 7. Listing of connected data points, including connected control unit and input device.

# 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
- D. Comply with ASHRAE 135 for DDC system control components.

# 1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

# 1.8 COORDINATION

A. Coordinate location of thermostats, and other exposed control sensors with plans and room details before installation.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work.

# 2.2 ANALOG CONTROLLERS

A. Step Controllers: Six- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

- B. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
  - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

# 2.3 BUILDING DDC FRONT END MASTER CONTROLLER

- A. MC Shall detail, furnish, install, program, debug, test, and commission a complete and usable DDC web based front end controller complete and ready to use.
- B. Reference: Carrier I-Vu and I-Vu Integrator. Equal equipment will be considered providing performance and features are demonstrably equal.
- C. PC Interface. Interface with the front end shall be by owner PC over owner installed Ethernet. MC shall furnish and install software on a designated owner PC.
- D. Communication. Web server or workstation and area controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135-2001, BACnet Annex J.
- E. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.
- F. BACnet. Web server or workstation shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Operator Workstation (B-OWS) device profile as specified in ASHRAE/ANSI 135-2001, BACnet Annex L.
- G. Integration to Third Party Equipment. System shall supports third party integration with open protocols (BACnet, MODBUS, LonWorks).
- H. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
  - 1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10sec.
  - 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
  - 3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
  - 4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.

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- 5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
- 6. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
- I. System Tools and Capabilities. System tools shall include automatic system database configuration, controller download, online help, password based system security with automated logout, system self diagnostics, alarm management, trending, reports, graphics, and custom programming; all equal to or exceeding the reference.

# 2.4 SENSORS

- A. Electronic Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
  - 1. Thermistor temperature sensors as follows:
    - a. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
    - b. Wire: Twisted, shielded-pair cable.
    - c. Insertion Elements in Ducts: Single point, [8 inches (20 cm)] long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (1 sq. m).
    - d. Room Sensors: Match room thermostats, locking cover.
    - e. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
  - 2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Building Static-Pressure Range: 0 to 0.25 inch wg (0 to 62 Pa).
    - d. Duct Static-Pressure Range: 0 to 5 inches wg (0 to 1243 Pa).

# 2.5 THERMOSTATS

- A. Electric solid-state, microcomputer-based room thermostat.
- B. Selection features include deg F or deg C display, 12- or 24-hour clock, keyboard disable, remote sensor, fan on-auto.
- C. Battery replacement without program loss.
- D. Auxilliary relay for outside air damper operation.
- E. Locking metal cover. Stamped stainless steel sheetmetal construction with stamped slats to allow air circulation. All covers to have a common key. Thermostat display features include the following:
  - a. Time of day.
  - b. Actual room temperature.
  - c. Programmed temperature.
  - d. Programmed time.

- e. Day of week.
- f. System mode indications include "heating," "off," "fan auto," and "fan on."

# 2.6 ACTUATORS

- A. Electric solid-state, microcomputer-based room thermostat.
- B. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
- C. Electronic Damper Actuators: Direct-coupled type designed for minimum 60,000 fullstroke cycles at rated torque.
  - 1. Dampers: Size for running torque calculated as follows:
    - Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. (86.8 kg-cm/sq. m) of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. (62 kg-cm/sq. m) of damper.
    - c. Parallel-Blade Damper without Edge Seals: 4 inch-pounds/sq. ft (49.6 kg-cm/sq. m) of damper.
    - d. Opposed-Blade Damper without Edge Seals: 3 inch-pounds/sq. ft. (37.2 kg-cm/sq. m) of damper.
  - 2. Coupling: V-bolt and V-shaped, toothed cradle.
  - 3. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
  - Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
  - 5. Power Requirements (Two-Position Spring Return): 24-V ac.
  - 6. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
  - 7. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.

# 2.7 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

# 2.8 DAMPERS

A. Dampers: AMCA-rated, parallel -blade design; 0.1084-inch (2.8-mm) minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less

than 0.0635-inch (1.6-mm) galvanized steel with maximum blade width of 8 inches (203 mm).

- Blades shall be secured to zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
- 2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
- 3. For standard applications, include optional closed-cell neoprene edging.
- 4. For low-leakage applications, use parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 4 inches wg (995 Pa) when damper is being held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

### PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

### 3.2 INSTALLATION

- A. Install equipment level and plumb.
- B. Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate all 60 inches (1524 mm) above the floor.
  - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- C. Install guards on thermostats in the following locations:
  - Entrances.
  - 2. Public areas.
  - 3. Where indicated.
- D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- E. Install labels and nameplates to identify control components
- F. Install labels and nameplates to identify control components
- G. Install hydronic instrument wells, valves, and other accessories
- H. Install refrigerant instrument wells, valves, and other accessories.

Ι. Install duct volume-control dampers.

#### 3.3 **ELECTRICAL WIRING AND CONNECTION INSTALLATION**

- Install raceways, boxes, and cabinets according to Division 26 Sections. Α.
- Install building wire and cable according to Division 26 sections. B.

#### 3.4 CONNECTIONS

- Α. Drawings indicate general arrangement of piping, fittings, and specialties.
  - Install piping adjacent to machine to allow service and maintenance.
- В. Ground equipment.
  - Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

#### 3.5 FIELD QUALITY CONTROL

- Manufacturer's Field Service: Engage a factory-authorized service representative to Α. inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
  - Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - Operational Test: After electrical circuitry has been energized, start units to 2. confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
- В. Replace damaged or malfunctioning controls and equipment.
  - Start, test, and adjust control systems.
  - Demonstrate compliance with requirements, including calibration and testing, and 2. control sequences.
  - 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.
  - 4. Verify local control units including self-diagnostics.

#### 3.6 **DEMONSTRATION**

- Train Owner's maintenance personnel to adjust, operate, and maintain control systems Α. and components.
  - Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

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- 2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 40 hours' dedicated instructor time on-site.
- 3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

# 3.7 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

**END OF SECTION 230901** 

# SECTION 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

# **PART 1 GENERAL**

### 1.1 SUMMARY

A. Section includes control equipment and software.

### B. Related Sections:

- Section 23 09 00 Instrumentation and Control for HVAC: Control system components.
- Section 23 09 93 Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
- Section 25 50 00 Integrated Automation Facility Controls: For overall building automation and control systems.
- 4. 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 MC85.1 Terminology for Automatic Control.

### 1.3 SYSTEM DESCRIPTION

- A. Automatic solar controls and control system using field programmable microprocessor based units.
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- C. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

### 1.4 SUBMITTALS

- A. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate the following:
  - 1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
  - 2. Connected data points, including connected control unit and input device.
  - 3. System graphics showing monitored systems, data (connected and calculated) point addresses, and operator notations.
  - 4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

- Description and sequence of operation for operating, user, and application software.
- 6. Use terminology in submittals conforming to ASME MC85.1.
- 7. Coordinate submittals with information requested in Section 23 09 93.
- C. Product Data: Submit data for each system component and software module.
- D. Manufacturer's Installation Instructions: Submit installation instruction for each control system component.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
  - Revise shop drawings to reflect actual installation and operating sequences.
  - 2. Submit data specified in "Submittals" in final "Record Documents" form.

# C. Operation and Maintenance Data:

- 1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
- 2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
- 3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

# 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 100 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

# 1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

### 1.8 MAINTENANCE SERVICE

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for maintenance service.
- B. Furnish service and maintenance of control systems for one years from Date of Substantial Completion.

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- C. Furnish complete service of controls systems, including callbacks. Make minimum of 2 complete normal inspections of approximately 3 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls. Submit written report after each inspection.
- D. Furnish two complete inspections, one in each season, to inspect, calibrate, and adjust controls. Submit written report after each inspection.
- E. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
- F. Perform work without removing units from service during building normal occupied hours.
- G. Provide emergency call back service during working hours for this maintenance period.
- H. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
- I. Perform maintenance work using competent and qualified personnel under supervision of manufacturer or original installer.
- J. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

### PART 2 PRODUCTS

# 2.1 CONTROL UNITS

- A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.
- B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.
- C. Control Units Functions:
  - 1. Monitor or control each input/output point.
  - 2. Completely independent with hardware clock/calendar and software to maintain control independently.
  - 3. Acquire, process, and transfer information to operator station or other control units on network.
  - Accept, process, and execute commands from other control unit's or devices or operator stations.
  - 5. Access both data base and control functions simultaneously.

- Record, evaluate, and report changes of state or value occurring among associated points. Continue to perform associated control functions regardless of status of network.
- 7. Perform in stand-alone mode:
  - a. Start/stop.
  - b. Duty cycling.
  - c. Automatic Temperature Control.
  - d. Demand control via a sliding window, predictive algorithm.
  - e. Event initiated control.
  - f. Calculated point.
  - g. Scanning and alarm processing.
  - h. Full direct digital control.
  - i. Trend logging.
  - j. Global communications.
  - k. Maintenance scheduling.

### D. Global Communications:

- 1. Broadcast point data onto network, making information available to other system controls units.
- Transmit input/output points onto network for use by other control units and use data from other control units.

# E. Input/output Capability:

- 1. Discrete/digital input (contact status).
- 2. Discrete/digital output.
- 3. Analog input.
- 4. Analog output.
- 5. Pulse input (5 pulses/second).
- 6. Pulse output (0-655 seconds in duration with 0.01-second resolution).
- F. Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs. Furnish control units with minimum 30 percent spare capacity.
- G. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.
- H. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard-wired LAN or 60 seconds over voice grade phone lines.
- I. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
  - Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from workstation.
  - 2. Control output points but change only database state or value; leave external field hardware unchanged.
  - 3. Enable control-actions on output points but change only data base state or value.

- J. Local display and adjustment panel: control-unit containing digital display, and numerical keyboard. Display and adjust:
  - 1. Input/output point information and status.
  - 2. Controller set points.
  - 3. Controller tuning constants.
  - 4. Program execution times.
  - 5. High and low limit values.
  - 6. Limit differential.
  - 7. Set/display date and time.
  - 8. Control outputs connected to the network.
  - 9. Automatic control outputs.
  - 10. Perform control unit diagnostic testing.
- K. Points in "Test" mode.

# 2.2 LOCAL AREA NETWORKS (LAN):

- A. Furnish communication between control units over local area network (LAN).
- B. LAN Capacity: Not less than 60 stations or nodes.
- C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
- D. LAN Data Speed: Minimum 19.2 Kb.
- E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
- F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.
- G. Network Support: Time for global point to be received by any station, less than 3 seconds. Furnish automatic reconfiguration when station is added or lost. In event transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

# 2.3 OPERATING SYSTEM SOFTWARE

- A. Input/output Capability From Operator Station:
  - 1. Request display of current values or status in tabular or graphic format.
  - 2. Command selected equipment to specified state.
  - 3. Initiate logs and reports.
  - Change analog limits.
  - 5. Add, delete, or change points within each control unit or application routine.
  - Change point input/output descriptors, status, alarm descriptors, and unit descriptors.
  - 7. Add new control units to system.
  - 8. Modify and set up maintenance scheduling parameters.
  - 9. Develop, modify, delete or display full range of color graphic displays.
  - 10. Automatically archive select data even when running third party software.

- 11. Capability to sort and extract data from archived files and to generate custom reports.
- 12. Support two printer operations.
- 13. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
- 14. Data printer: Print reports, page prints, and data base prints.
- 15. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
- 16. Print selected control unit database.
- B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.
- C. Data Base Creation and Support: Use standard procedures for changes. Control unit automatically checks workstation data base files upon connection and verify data base match. Include the following minimum capabilities:
  - 1. Add and delete points.
  - 2. Modify point parameters.
  - 3. Change, add, or delete English language descriptors.
  - 4. Add, modify, or delete alarm limits.
  - 5. Add, modify, or delete points in start/stop programs, trend logs, and other items.
  - 6. Create custom relationship between points.
  - 7. Create or modify DDC loops and parameters.
  - 8. Create or modify override parameters.
  - 9. Add, modify, and delete applications programs.
  - 10. Add, delete, develop, or modify dynamic color graphic displays.

# D. Dynamic Color Graphic Displays:

- 1. Utilizes custom symbols or system supported library of symbols.
- 2. Sixteen (16) colors.
- 3. Sixty (60) outputs of real-time live dynamic data for each graphic.
- 4. Dynamic graphic data.
- 5. 1,000 separate graphic pages.
- 6. Modify graphic screen refresh rate between 1 and 60 seconds.

### E. Operator Station:

- 1. Accept data from LAN as needed without scanning entire network for updated point data.
- 2. Interrogate LAN for updated point data when requested.
- 3. Allow operator command of devices.
- 4. Allow operator to place specific control units in or out of service.
- 5. Allow parameter editing of control units.
- 6. Store duplicate data base for every control unit and allow down loading while system is on line.
- 7. Control or modify specific programs.
- 8. Develop, store and modify dynamic color graphics.
- 9. Data archiving of assigned points and support overlay graphing of this data using up to four (4) variables.

# F. Alarm Processing:

- Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state or value and alarms causing automatic dial-out.
- 2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
- 3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
- 4. Display alarm reports on video. Display multiple alarms in order of occurrence.
- 5. Define time delay for equipment start-up or shutdown.
- 6. Allow unique routing of specific alarms.
- 7. Operator specifies when alarm requires acknowledgment.
- 8. Continue to indicate unacknowledged alarms after return to normal.
- 9. Alarm notification:
- 10. Print automatically.
- 11. Display indicating alarm condition.
- 12. Selectable audible alarm indication.
- G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change of state, specified state, or alarm occurrence or return to normal.
- H. Automatic Restart: Automatically start field equipment on restoration of power. Furnish time delay between individual equipment restart and time of day start/stop.

# I. Messages:

- Automatically display or print user-defined message subsequent to occurrence of selected events.
- 2. Compose, change, or delete message.
- 3. Display or log message at any time.
- 4. Assign any message to event.

### J. Reports:

- 1. Manually requested with time and date.
- 2. Long term data archiving to hard disk.
- 3. Automatic directives to download to transportable media including floppy diskettes for storage.
- 4. Data selection methods to include data base search and manipulation.
- 5. Data extraction with mathematical manipulation.
- 6. Data reports to allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
- 7. Generating reports either normally at operator direction, or automatically under workstation direction.
- 8. Either manually display or print reports. Automatically print reports on daily, weekly, monthly, yearly or scheduled basis.
- 9. Include capability for statistical data manipulation and extraction.
- 10. Capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

# L. Data Collection:

- 1. Automatically collect and store in disk files.
- 2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2-year period.
- 3. Daily consumption for up to 30 meters over a 2 year period.
- 4. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
- 5. Archiving of stored data for use with system supplied custom reports.

# M. Graphic Display: Support graphic development on work station with software features:

- 1. Page linking.
- 2. Generate, store, and retrieve library symbols.
- 3. Single or double height characters.
- 4. Sixty (60) dynamic points of data for each graphic page.
- 5. Pixel level resolution.
- 6. Animated graphics for discrete points.
- 7. Analog bar graphs.
- 8. Display real time value of each input or output line diagram fashion.

### N. Maintenance Management:

- 1. Run time monitoring, for each point.
- 2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
- 3. Equipment safety targets.
- 4. Display of maintenance material and estimated labor.
- 5. Target point reset, for each point.

# O. Advisories:

- 1. Summary containing status of points in locked out condition.
- 2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
- 3. Report of power failure detection, time and date.
- 4. Report of communication failure with operator device, field interface unit, point and programmable control unit.

# 2.4 LOAD CONTROL PROGRAMS

- A. General: Support inch-pounds and S.I. metric units of measurement.
- B. Automatic Time Scheduling:
  - 1. Self-contained programs for automatic start/stop/scheduling of building loads.
  - 2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
  - 3. Special day's schedule supporting up to 30 unique date/duration combinations.
  - Number of loads assigned to time program; with each load having individual time program.
  - Each load assigned at least 16 control actions for each day with 1 minute resolution.

- 6. Furnish the following time schedule operations:
  - a. Start.
  - b. Optimized Start.
  - c. Stop.
  - d. Optimized Stop.
  - e. Cycle.
  - f. Optimized Cycle.
- Capable of specifying minimum of 30 holiday periods up to 100 days in length for the year.
- 8. Create temporary schedules.
- 9. Broadcast temporary "special day" date and duration.
- C. Start/Stop Time Optimization:
  - Perform optimized start/stop as function of outside conditions, inside conditions, or both.
  - 2. Adaptive and self-tuning, adjusting to changing conditions unattended.
  - 3. For each point under control, establish and modify:
    - a. Occupancy period.
    - b. Desired temperature at beginning of occupancy period.
    - c. Desired temperature at end of occupancy period.
- D. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.
  - 1. Employ arithmetic, algebraic, Boolean, and special function operations.
  - 2. Treat calculated values like any other analog value; use for any function where a "hard wired point" might be used.
- E. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.
  - Define time interval between each control action between 0 to 3600 seconds.
  - 2. Output may be analog value.
  - 3. Provide for "skip" logic.
  - 4. Verify completion of one action before proceeding to next action. When not verified, program capable of skipping to next action.
- F. Direct Digital Control: Furnish with each control unit Direct Digital Control software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.
  - Control loops: Defined using "modules" are analogous to standard control devices.
  - Output: Paired or individual digital outputs for pulse width modulation, and analog outputs.
  - Firmware:
    - a. PID with analog or pulse-width modulation output.
    - b. Floating control with pulse-width modulated outputs.
    - c. Two-position control.
    - d. Primary and secondary reset schedule selector.
    - e. Hi/Low signal selector.
    - f. Single pole double-throw relay.
    - g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.

- 4. Direct Digital Control loop: Downloaded upon creation or on operator request. On sensor failure, program executes user defined failsafe output.
- 5. Display: Value or state of each of lines interconnecting DDC modules.

# G. Fine Tuning Direct Digital Control PID or floating loops:

- 1. Display information:
  - a. Control loop being tuned.
  - b. Input (process) variable.
  - c. Output (control) variable.
  - d. Set-point of loop.
  - e. Proportional band.
  - f. Integral (reset) Interval.
  - g. Derivative (rate) Interval.
- 2. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" versus "variable".

# H. Trend logging:

- 1. Each control unit capable of storing samples of control unit's data points.
- 2. Update file continuously at operator assigned intervals.
- 3. Automatically initiate upload requests and then stores data on hard disk.
- 4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
- 5. Co-ordinate sampling with specified on/off point- state.
- 6. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

### 2.5 HVAC CONTROL PROGRAMS

### A. General:

- 1. Support Inch-pounds and S.I. metric units of measurement.
- 2. Identify each HVAC Control system.

### B. Optimal Run Time:

- Control start-up and shutdown times of HVAC equipment for both heating and cooling.
- 2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
- 3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
- Use outside air temperature to determine early shut down with ventilation override.
- 5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
- 6. Operator commands:
  - a. Define term schedule.
  - b. Add/delete fan status point.
  - c. Add/delete outside air temperature point.
  - d. Add/delete mass temperature point.
  - e. Define heating/cooling parameters.
  - f. Define mass sensor heating/cooling parameters.

- g. Lock/unlock program.
- h. Request optimal run-time control summary.
- i. Request optimal run-time mass temperature summary.
- j. Request HVAC point summary.
- k. Request HVAC saving profile summary.

# 7. Control Summary:

- a. HVAC Control system begin/end status.
- b. Optimal run time lock/unlock control status.
- c. Optimal run time schedule.
- d. Start/Stop times.
- e. Selected mass temperature point ID.
- f. Optimal run-time system normal start-times.
- g. Occupancy and vacancy times.
- h. Optimal run time system heating/cooling mode parameters.
- 8. Mass temperature summary:
  - a. Mass temperature point type and ID.
  - b. Desired and current mass temperature values.
  - c. Calculated warm-up/cool-down time for each mass temperature.
  - d. Heating/cooling season limits.
  - e. Break point temperature for cooling mode analysis.

### 2.6 PROGRAMMING APPLICATION FEATURES

# A. Trend Point:

- 1. Sample up to points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.
- Output trend logs as line-graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

# B. Alarm Messages:

- Allow definition of minimum of messages, each having minimum length of characters for each individual message.
- Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, hardware elements advisories.
- 3. Output assigned alarm with "message requiring acknowledgment".
- 4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

# C. Weekly Scheduling:

- 1. Automatically initiate equipment or system commands, based on selected time schedule for points specified.
- 2. Program times for each day of week, for each point, with minute resolution.
- 3. Automatically generate alarm output for points not responding to command.
- 4. Allow for holidays, minimum of 366 consecutive holidays.
- 5. Operator commands:
  - a. System logs and summaries.
  - b. Start of stop point.
  - c. Lock or unlock control or alarm input.

- d. Add, delete, or modify analog limits and differentials.
- e. Adjust point operation position.
- f. Change point operational mode.
- g. Open or close point.
- h. Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
- i. Begin or end point totals.
- j. Modify total values and limits.
- k. Access or secure point.
- I. Begin or end HVAC or load control system.
- m. Modify load parameter.
- n. Modify demand limiting and duty cycle targets.
- 6. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

# PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Verify conditioned power supply is available to control units and to operator workstation.
- C. Verify field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

# 3.2 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.
- C. Install with 120 volts alternating current, 15 amp dedicated emergency power circuit to each programmable control unit.
- D. Install conduit and electrical wiring in accordance with Section 26 05 03.
- E. Install electrical material and installation in accordance with appropriate requirements of Division 26.

### 3.3 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers' field services.

- B. Start and commission systems. Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation.
- C. Furnish service technician employed by system installer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

# 3.4 DEMONSTRATION AND TRAINING

- A. Section 01 70 00 Execution and Closeout Requirements:Requirements for demonstration and training.
- B. Furnish basic operator training for persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 40 hours instructor time.
- C. Demonstrate complete and operating system to Owner.

**END OF SECTION** 

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### **SECTION 23 11 23**

### **FACILITY NATURAL-GAS PIPING**

### 1.1 GENERAL

# A. Summary:

- Section Includes:
  - a. Natural gas piping buried within 5 feet of building.
  - b. Natural gas piping above grade.
  - c. Unions and flanges.
  - d. Valves
  - e. Pipe hangers and supports.
  - f. Strainers
  - g. Natural gas pressure regulators.
  - h. Natural gas pressure relief valves.
  - i. Underground pipe markers.
  - j. Bedding and cover materials.

### B. References:

- American National Standards Institute:
  - a. ANSI Z21.15 Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
- 2. American Society of Mechanical Engineers:
  - a. ASME B16.3 Malleable Iron Threaded Fittings.
  - b. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes.
  - c. ASME B16.33 Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 2).
  - d. ASME B31.9 Building Services Piping.
  - e. ASME Section IX Boiler and Pressure Vessel Code Welding and Brazing Qualifications.

### ASTM International:

- a. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- b. ASTM A234/A234M Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- c. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- d. ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- e. ASTM B749 Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- f. ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers.
- American Welding Society:
  - a. AWS D1.1 Structural Welding Code Steel.
- 5. American Water Works Association:
  - AWWA C105 American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

- 6. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - a. MSS SP 58 Pipe Hangers and Supports Materials, Design and Manufacturer.
  - b. MSS SP 67 Butterfly Valves.
  - c. MSS SP 69 Pipe Hangers and Supports Selection and Application.
  - d. MSS SP 78 Cast Iron Plug Valves, Flanged and Threaded Ends.
  - e. MSS SP 89 Pipe Hangers and Supports Fabrication and Installation Practices.
  - f. MSS SP 110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- 7. National Fire Protection Association:
  - NFPA 54 National Fuel Gas Code.
- 8. Underwriters Laboratories Inc.:
  - UL 842 Valves for Flammable Fluids.

# C. System Description:

- 1. 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.
- 2. 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.
- 3. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- Use plug, valves for shut-off and to isolate equipment, part of systems, or vertical risers.

### D. Submittals:

- 1. Section 01 33 00 Submittal Procedures: Submittal procedures.
- 2. Product Data:
  - a. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
  - b. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
  - c. Hangers and Supports: Submit manufacturers catalog information including load capacity.
  - d. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
    - 1) Strainers.
    - 2) Natural gas pressure regulators.
    - 3) Natural gas pressure relief valves.
- 3. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- 4. Test Reports: Indicate results of.
- 5. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- 6. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

### E. Closeout Submittals:

- 1. Section 01 70 00 Execution and Closeout Requirements: Closeout procedures.
- 2. Project Record Documents: Record actual locations of valves, piping system, and system components.

3. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists.

#### F. **Quality Assurance:**

- Perform natural gas Work in accordance with NFPA 54.
- 2. Perform work in accordance with applicable code and local gas company requirements.
- 3. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- Perform Work in accordance with applicable code authority having jurisdiction for 4. welding hanger and support attachments to building structure.
- Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15. 5.

#### G. Qualifications:

- Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- 2. Installer: Company specializing in performing Work of this section with minimum three years experience.

#### Η. Delivery, Storage, and Handling:

- Section 01 60 00 Product Requirements: Product storage and handling requirements.
- 2. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- 3. 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.

#### I. **Environmental Requirements:**

- Section 01 60 00 Product Requirements. 1.
- 2. Do not install underground piping when bedding is wet or frozen.
- J. Field Measurements: Verify field measurements prior to fabrication.

#### K. Coordination:

- 1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- 2. Coordinate of buried piping systems with requirements of Section.

#### L. Warrantv:

- Section 01 70 00 Execution and Closeout Requirements: Product warranties 1. and product bonds.
- 2. Furnish one year manufacturer warranty for valves excluding packing.

#### 1.2. **PRODUCTS**

- Natural Gas Piping, Above Grade: Α.
  - Steel Pipe: ASTM A53/A53M Schedule 40 black.
    - Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel a. welding type.
    - Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 b. inches and larger.
  - 2. Copper Tubing: ASTM B88, Type or L.
    - Fittings: ASME B16.26 cast bronze, compression type.

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- b. Joints: Flared.
- 3. Corrugated Stainless Steel Tubing: ANSI LC 1.
- B. Regulator Vent Piping, Above Grade:
  - Indoors: Same as natural gas piping, above grade.
  - Outdoors: PVC pipe, tubing, and fittings, UL 651. 2.
- C. Unions and Flanges:
  - Unions for Pipe 2 inches and Smaller:
    - Ferrous Piping: Class 150, malleable iron, threaded.
    - b. Copper Piping: Class 150, bronze unions with soldered.
    - Dielectric Connections: Union with galvanized or plated steel threaded C. end, copper solder end, water impervious isolation barrier.
  - 2. Flanges for Pipe 2-1/2 inches and Larger:
    - Ferrous Piping: Class 150, forged steel, slip-on flanges.
    - Copper Piping: Class 150, slip-on bronze flanges. b.
    - Gaskets: 1/16 inch thick preformed neoprene gaskets. C.
- D. Plug Valves:
  - Manufacturers:
    - a. Refer to section 23 00 01 for approved manufacturer.
  - 2. 2 inches and Smaller: MSS SP 78, Class 150, construction, rectangular port, regular opening, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
  - 2-1/2 inches and Larger: MSS SP 78, Class 150, construction, rectangular port, 3. regular opening, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.
- E. Pipe Hangers and Supports:
  - Manufacturers:
    - Refer to section 23 00 01 for approved manufacturer.
  - 2. Conform to NFPA 54, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
  - 3. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split
  - Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis. 4.
  - 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 6. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.
  - 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: Carbon steel ring, adjustable, copper plated.
- F. Strainers:
  - 1. Manufacturers:
    - Refer to section 23 00 01 for approved manufacturer.
  - 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y 2. pattern with 1/32 inch stainless steel perforated screen.

- 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern 3. with 3/64 inch stainless steel perforated screen.
- 4. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

#### G. Natural Gas Pressure Regulators:

- 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.
  - Comply with ANSI Z21.80. a.
  - Temperatures: minus 20 degrees F to 150 degrees F. b.
  - Body: Cast iron. C.
  - Spring case, lower diaphragm casing, union ring, seat ring and disk d. holder: Aluminum.
  - Disk, diaphragm, and O-ring: Nitrile. e.
  - Maximum inlet pressure: 150 psig. f.
  - Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2g. 1/2 inches and larger with flanged ends.

#### Η. Natural Gas Pressure Relief Valves:

- Product Description: Spring loaded type relief valve.
  - Body: Aluminum a.
  - Diaphragm: Nitrile b.
  - Orifice: Brass C.
  - d. Maximum operating temperature: 150 degrees F.
  - Inlet Connections: Threaded e.
  - f. Outlet or Vent Connection: Same size as inlet connection.

#### 1.3. **EXECUTION**

#### A. **Examination:**

- 01300 Administrative Requirements: Coordination and project conditions.
- 2. Verify excavations are to required grade, dry, and not over-excavated.

#### B. Preparation:

- Ream pipe and tube ends. Remove burrs.
- 2. Remove scale and dirt, on inside and outside, before assembly.
- Prepare piping connections to equipment with flanges or unions. 3.

#### C. Installation – Inserts:

- Provide inserts for placement in concrete forms. 1.
- 2. Provide 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 4 inches and larger.
- 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- Where inserts are omitted, drill through concrete slab from below and provide 5. through-bolt with recessed square steel plate and nut slab.

#### D. Installation – Pipe Hangers and Supports:

- Install hangers and supports in accordance with ASME B31.9 ASTM F708 and 1. MSS SP 89.
- 2. Support horizontal piping hangers as scheduled.
- 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

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- 4. Place hangers within 12 inches of each horizontal elbow.
- 5. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- Support vertical piping at every other floor. Support riser piping independently of 6. connected horizontal piping.
- 7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
- 8. Provide copper plated hangers and supports for copper piping.
- 9. Prime coat exposed steel hangers and supports in accordance with Section 09 90 00. Finish paint exposed steel hangers and supports in accordance with Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- 10. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

#### E. Installation – Above Ground Piping Systems:

- Install natural gas piping in accordance with NFPA 54.
- 2. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- 3. Route piping in orderly manner and maintain gradient.
- Where required, bend pipe with pipe bending tools in accordance with 4. procedures intended for that purpose.
- 5. Install piping to conserve building space and not interfere with use of space.
- Size and install gas piping to provide sufficient gas to supply maximum appliance 6. demand at pressure higher than appliance minimum inlet pressure.
- 7. Group piping whenever practical at common elevations.
- Install piping to allow for expansion and contraction without stressing pipe, joints, 8. or connected equipment.
- 9. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section.
- Provide clearance for installation of insulation and access to valves and fittings. 10.
- Provide access where valves and fittings are not exposed. 11.
- 12. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer. Refer to Section.
- 13. Provide support for utility meters in accordance with requirements of utility company.
- 14. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood. Protect vent against entry of insects and foreign material.
  - Minimum Vent Size: Connection size at regulator vent connection.
  - Run individual vent line from each relief device, independent of breather b.
  - Breather vents may be manifolded together with piping sized for C. combined appliance vent requirements.
- 15. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting, Refer to Section 09 90 00.
- Install identification on piping systems including underground piping. Refer to 16. Section 23 05 53.
- 17. Install valves with stems upright or horizontal, not inverted.
- 18. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- 19. Install gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.
- Install gas pressure regulator with tee fitting not less than 10 pipe diameters 20. down stream of regulator. Cap or plug one opening of tee fitting.

- 21. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.
- 22. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 2 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

### F. Field Quality Control:

- Section 01 70 00 Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- 2. 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.
- 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.
- 4. Pressure test natural gas piping in accordance with NFPA 54.Inspect, test and purge gas piping in accordance with applicable code.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.
- 5. When pressure tests do not meet specified requirements, remove defective work, replace and retest.
- 6. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.
  - a. Where leakage is detected, shut off gas supply until necessary repairs are complete.
- 7. Do not place appliances in service until leak testing and repairs are complete.

### G. Schedules:

Pipe Hanger Spacing:

	Copper	Steel	Copper Tubing	Steel Pipe
	Tubing	Pipe	Minimum	Minimum
	Maximum	Maximum	Hanger Rod	Hanger Rod
Pipe Size	Hanger	Hanger	Diameter	Diameter
(Inches)	Spacing	Spacing	(Inches)	(Inches)
	(Feet)	(Feet)		

1/2	4	6	3/8	3/8
3/4	6	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	8	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2	8	10	1/2	1/2
3	8	10	1/2	1/2
4	8	10	1/2	5/8
5	8	10	1/2	5/8
6	8	10	5/8	3/4
8	8	10	3/4	3/4

# **END OF SECTION**

# **SECTION 23 23 00 REFRIGERANT PIPING**

#### 1.1 **RELATED DOCUMENTS**

Α. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 **SUMMARY**

This Section includes refrigerant piping used for air-conditioning applications. Α.

#### 1.3 **SUBMITTALS**

- Α. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Α. Code: Section IX; "Welding and Brazing Qualifications."
- ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration." В.
- C. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- Provide products complying with UL 207, "Refrigerant-Containing D. Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

#### 1.5 COORDINATION

- Coordinate layout and installation of refrigerant piping and suspension system components Α. with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- В. Coordinate pipe sleeve installations for foundation wall penetrations.
- Coordinate installation of roof curbs, equipment supports, and roof penetrations. C.

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- D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies.
- E. Coordinate pipe fitting pressure classes with products specified in related Sections.

### PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Refrigerants:
    - Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
    - b. DuPont Company; Fluorochemicals Div.
    - c. Elf Atochem North America, Inc.; Fluorocarbon Div.
    - d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.
  - 2. Refrigerant Valves and Specialties:
    - Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
    - b. Danfoss Electronics, Inc.
    - c. Emerson Electric Company; Alco Controls Div.
    - d. Henry Valve Company.
    - e. Sporlan Valve Company.

# 2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR or ASTM B 88, Type L.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver) or BAg-2 (silver)

# 2.3 VALVES

- A. Service Valves: 500-psig (3450-kPa) pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.
- B. Solenoid Valves: Comply with ARI 760; 250 deg F (121 deg C) temperature rating and 400-psig (2760-kPa) working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosures of type required by location, with 1/2-inch (16-GRC) conduit adapter and [24] [120]-V, normally [closed] [open] holding coil.

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Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel C. parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

#### 2.4 REFRIGERANT PIPING SPECIALITIES

- Α. Straight- or Angle-Type Strainers: 500-psig (3450-kPa) working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches (30 mm), 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.
- B. Moisture/Liquid Indicators: 500-psig (3450-kPa) maximum working pressure and 200 deg F (93 deg C) operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.
- C. Replaceable-Core Filter-Dryers: 500-psig (3450-kPa) maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductileiron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:
  - 1. Filter Cartridge: Pleated media with integral end rings, stainless-steel support, ARI 730 rated for capacity.
  - 2. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.
  - 3. Wax Removal Cartridge: Molded, bonded core of activated charcoal and desiccant with integral gaskets.
- D. Permanent Filter-Dryer: 350-psig (2410-kPa) maximum operating pressure and 225 deg F (107 deg C) maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.
- Mufflers: 500-psig (3450-kPa) operating pressure, welded-steel construction with fusible E. plug; sized for refrigeration capacity.

#### 2.5 **REFRIGERANTS**

Α. **ASHRAE 34, R-410A** 

PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS

Α. Aboveground, within Building: Type K or type ACR drawn-copper tubing. Follow manufactures direction.

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#### 3.2 **VALVE APPLICATIONS**

Install valves in accordance with condensing unit manufacturers recommendations.

#### 3.3 SPECIALTY APPLICATIONS

Α. Follow manufactures direction.

#### 3.4 PIPING INSTALLATION

- Α. Install refrigerant piping according to ASHRAE and manufacturer's directions.
- B. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- C. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- D. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- E. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- F. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - Install traps and double risers to entrain oil in vertical runs. 3.
  - Liquid lines may be installed level.
- G. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.
- H. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.
- Ι. Hanger, support, and anchor products are specified in Division Section "Hangers and Supports."
- J. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6.0 m)
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6.0 m) or
  - 3. Pipe rollers for multiple horizontal runs 20 feet (6.0 m) or longer, supported by a trapeze.

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- 4. Spring hangers to support vertical runs.
- K. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
  - 5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
  - 6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
- L. Support vertical runs at each floor.

#### 3.5 PIPE JOINT CONSTRUCTION

Α. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

#### 3.6 FIELD QUALITY CONTROL

- Α. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
  - 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
  - 2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
    - System shall maintain test pressure at the manifold gage throughout duration of a. test.
    - Test joints and fittings by brushing a small amount of soap and glycerine b. solution over joint.
    - Fill system with nitrogen to raise a test pressure of 150 psig (1035 kPa) or C. higher as required by authorities having jurisdiction.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

#### 3.7 **ADJUSTING**

Α. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Check compressor oil level above center of sight glass.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves, except bypass valves that are used for other purposes.
  - 5. Check compressor-motor alignment, and lubricate motors and bearings.

#### 3.8 **CLEANING**

- Α. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.
- В. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

#### 3.9 SYSTEM CHARGING

- Α. Charge system using the following procedures:
  - 1. Install core in filter-dryer after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
  - 4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

**END OF SECTION 15183** 

### **SECTION 23 33 00**

### **AIR DUCT ACCESSORIES**

### **PART 1 - GENERAL**

- 1.1 Summary:
  - A. Section Includes:
    - 1.Back-draft dampers.
    - 2. Combination fire-and-smoke dampers.
    - 3. Duct access doors.
    - 4. Dynamic fire dampers.
    - 5. Static fire dampers.
    - 6. Ceiling fire dampers.
    - 7. Smoke dampers.
    - 8. Volume control dampers.
    - 9. Flexible duct connections.
    - 10. Duct test holes.
    - 11. Dial thermometers.
    - 12. Static pressure gages.

### 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. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data for shop fabricated assemblies and hardware used.
- C. 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.
- D. Product Data: For fire dampers smoke dampers combination fire and smoke dampers submit the following:

- 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.
- E. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.
- F.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 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.
- C. 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.

### 1.7 Delivery, Storage, and Handling:

- A. Section 01 60 00 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.
- 1.8 Field Measurements: Verify field measurements prior to fabrication.

### 1.9 Coordination:

- A. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work where appropriate with building control Work.

### 1.10 Warranty:

- A. Section 01 70 00 Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish one year manufacturer warranty for duct accessories.

# **PART 2 - PRODUCTS**

# 2.1 Back-Draft Dampers:

A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel. Blades, maximum 6 inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure. 2.2 Static Fire Dampers: Product description. Multi Blade steel shutter gravity actuated, fusible link held. rated assembly.

### **PART 3 - EXECUTION**

# 3.1 Examination:

- A. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Verify rated walls are ready for fire damper installation.
- C. Verify ducts and equipment installation are ready for accessories.
- D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

### 3.2 Installation:

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside.
- C. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and. 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/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.
- D. Install temporary duct test holes 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.

**END OF SECTION** 

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### **SECTION 23 34 00**

#### **HVAC FANS**

### Part 1 GENERAL

#### **SUMMARY** 1.1

- Section Includes: Α.
  - 1. Centrifugal fans.
  - Propeller fans.d
  - Downblast centrifugal roof fans. 3.
  - 4. Upblast centrifugal roof fans.
  - 5. Centrifugal wall fans.
  - 6. Ceiling fans.

#### 1.2 **REFERENCES**

- A. American Bearing Manufacturers Association:
  - ABMA 9 Load Ratings and Fatigue Life for Ball Bearings.
  - 2. ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.
- Air Movement and Control Association International, Inc.:
  - 1. AMCA 99 Standards Handbook.
  - AMCA 204 Balance Quality and Vibration Levels for Fans.
  - 3. AMCA 210 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - 4. AMCA 300 Reverberant Room Method for Sound Testing of Fans.
  - 5. AMCA 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- American Refrigeration Institute:
  - ARI 1060 Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.
- D. ASTM International:
  - ASTM E1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
- National Electrical Manufacturers Association:
  - NEMA MG 1 Motors and Generators.
  - NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. Underwriters Laboratories Inc.:
  - 1. UL 705 Power Ventilators.

#### PERFORMANCE REQUIREMENTS 1.3

A. Wind-Borne Debris Loads: Design louvers located within 30 feet of grade to withstand ASTM E1996; large missile impact test.

#### 1.4 **SUBMITTALS**

Section 01 33 00 - Submittal Procedures: Submittal procedures.

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- Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
- C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit fan manufacturers instructions.
- Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.5 **CLOSEOUT SUBMITTALS**

- Section 01 70 00 Execution and Closeout Requirements: Closeout procedures. A.
- Operation and Maintenance Data: Submit instructions for lubrication, motor and drive В. replacement, spare parts list, and wiring diagrams.

#### 1.6 **QUALITY ASSURANCE**

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal. В.
- UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- Balance Quality: Conform to AMCA 204. D.
- Maintain one copy of each document on site.

#### 1.7 **QUALIFICATIONS**

- Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- Installer: Company specializing in performing Work of this section with minimum 3 years experience.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- Section 01 60 00 Product Requirements: Product storage and handling requirements.
- Protect motors, shafts, and bearings from weather and construction dust.

#### 1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

### 1.10 WARRANTY

- Section 01 70 00 Execution and Closeout Requirements: Product warranties and product
- Furnish one year manufacturer's warranty for fans.

### 1.11 MAINTENANCE SERVICE

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for maintenance service.
- B. Furnish service and maintenance of fans for one years from Date of Substantial Completion.
- C. Examine components bi-monthly. Clean, adjust, and lubricate equipment.
- Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
- Perform work without removing fans from service during building normal occupied hours.
- F. Provide emergency call back service during working hours for this maintenance period.
- G. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
- H. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.
- I. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

### **PART 2 PRODUCTS**

#### 2.1 **CENTRIFUGAL FANS**

#### A. Manufacturers:

Refer to section 23 00 01 for approved manufacturer.

#### В. Performance:

- Performance Base: Sea level conditions.
- 2. Temperature Limit: Maximum 300 degrees F.
- Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas. 3.

### Wheel and Inlet:

- Backward Inclined: Steel construction with smooth curved inlet flange, back plate, backward curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
- Forward Curved: Black enamel steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
- Airfoil Wheel: Steel construction with smooth curved inlet flange, back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron hub riveted to back plate and keved to shaft with set screws.
- Radial: Steel construction with back plate, plate blades welded or riveted to back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

#### Housing: D.

- Steel, spot welded, braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- 2. Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers.
- Bolted construction with horizontal flanged split housing.
- Fabricate plug fans without volute housing, in lined steel cabinet.

#### Bearings and Sleeves: E.

- Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-10 life at 50,000 hours .
- Shafts: Hot rolled steel, ground and polished, with key way, protectively coated with 2. lubricating oil, and shaft quard.
- V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.
- Belt Guard: Fabricate to SMACNA Standard; 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

#### 2.2 **PROPELLER FANS**

#### Manufacturers: A.

Refer to section 23 00 01 for approved manufacturer.

#### Construction: R

- Impeller: Shaped steel or steel reinforced aluminum blade with hubs, statically and dynamically balanced, locked to shaft, directly connected to motor.
- Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.
- Accessories: refer to drawings.
  - Back-draft Damper: Multiple blade with offset hinge pin, blades linked.
  - Safety Screens: Expanded galvanized metal over inlet, motor, and drive; to comply with OSHA regulations.
  - Hood: Weather shield, to exclude rain and snow. 3.

#### DOWNBLAST CENTRIFUGAL ROOF FANS 2.3

#### A. Manufacturers:

- Refer to section 23 00 01 for approved manufacturer.
- Fan Unit: Downblast type. V-belt drive, with galvanized steel with baked-on enamel housing: resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at midposition; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Motor: Open drip proof or Totally enclosed fan cooled.

- E. Roof Curb: 16 inch high of galvanized steel construction with continuously welded seams, 1 inch insulation and curb bottom, and factory installed nailer strip.
- Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 3R enclosure.

#### G. Accessories:

Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return.

#### 2.4 **UPBLAST CENTRIFUGAL ROOF FANS**

#### Manufacturers:

- Refer to section 23 00 01 for approved manufacturer.
- Fan Unit: Upblast type. V-belt direct drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at midposition; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Motor: Open drip proof.
- Roof Curb: 16 inch high of galvanized steel construction with continuously welded seams, and factory installed nailer strip.
- Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 Type 3R enclosure.
- G. Accessories:
  - refer to drawings.

#### 2.5 **CEILING FANS**

- Manufacturers:
  - Refer to section 23 00 01 for approved manufacturer.
- Centrifugal Fan Unit: Direct driven with galvanized steel housing, resilient mounted motor. gravity backdraft damper in discharge opening, integral outlet duct collar. Discharge position convertible by moving interchangeable panels.
- C. Disconnect Switch: Cord and plug in housing Fan mounted toggle switch for thermal overload protected motor.
- D. Grille: Molded white plastic.
- Wheel: Centrifugal forward curved type constructed of injection molded or polypropylene resin. Ε.
- F. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.
- G. Accessories:

- Rubber-in-shear vibration isolator. 1.
- 2. Fan speed controller.

### **PART 3 EXECUTION**

#### 3.1 **EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- Verify roof curbs are installed and dimensions are as instructed by manufacturer.

#### 3.2 **PREPARATION**

Furnish roof curbsfor installation.

#### **INSTALLATION** 3.3

- Secure roof wall fans with stainless steel lag screws to roof curb structure.
- Suspended Fans: Install flexible connections specified in Section between fan and ductwork. B. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- Install backdraft dampers on inlet to roof and wall exhaust fans.
- Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
- E. Install safety screen where inlet or outlet is exposed.
- Pipe scroll drains to nearest floor drain. F.
- G. Install backdraft dampers on discharge of exhaust fans and as indicated on Drawings. Refer to Section 23 33 00.
- H. Provide sheaves required for final air balance.

#### 3.4 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Requirements for manufacturer's field services.

#### 3.5 **CLEANING**

- Section 01 70 00 Execution and Closeout Requirements: Requirements for cleaning. A.
- Vacuum clean coils and inside of fan cabinet.

#### 3.6 **DEMONSTRATION**

- Section 01 70 00 Execution and Closeout Requirements: Requirements for demonstration and training.
- Demonstrate fan operation and maintenance procedures.

February 6, 2024 23 34 00 - 6 **HVAC FANS** 

# 3.7 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

**END OF SECTION** 

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# **SECTION 23 55 00** Make Up Air Unit

### Part 1- General

# 1.1 Administrative

### A. General

1. This section includes MUA-direct-fired make-up air unit as well as, other options described herein.

# B. Quality Assurance

1. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of nonrecirculating direct-fired make-up air equipment of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Manufacturer equipment must be listed by an NRTL in compliance with ANSI Z83.4.

# C. Delivery, Storage and Handling

1. Handle units and components carefully to prevent damage, breaking, denting and scoring. Store units in dry place with particular care given to ensure burner is covered from water entering and damaging gas train. Do not install damaged units. Comply with manufacturer's rigging and installation instructions.

# D. Summary

1. The contractor shall furnish and install make-up air unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform to the specified conditions as scheduled. Handle units and components carefully to prevent damage, breaking, denting and scoring.

### **Part 2- Products**

### 2.1 Manufactures:

- A. Titan Air
- B. Greenheck
- C. Reznor
- D. Modine
- E. Sterling
- F. Rupp

### A. General

- Make-up air unit. Packaged units shall have an ETL Laboratories, Inc. label certifying compliance with ANSI Z83.4, Standard for Non-Recirculating Direct Gas-Fired Industrial Air Heaters.
- 2. All units shall be manufactured with control panels, motors and blower drives within unit.
- Manufacturer shall offer a 24 month parts warranty from date of shipment.
- 4. Unit shall be factory wired, tested and assembled to the extent that shipping will allow.
- 5. Remote control panel to be field wired to unit control panel.

# B. Unit Construction

- 1. Base and frame shall be fabricated from heavy duty welded structural steel channel, tubing, and or angle. Heavy duty lifting provisions shall be included on all units. Floor shall be fabricated from 16ga, sheet steel, galvanealled-paintlock. Each sheet shall have a base structural support centered under all seams and additional supports for adequate support of the unit material and components. Base and floor weldment shall be cleaned and primed before assembly of unit.
- Formed sheet metal base floor shall be fabricated from 16ga. sheet steel. galvanealled-

- paintlock for painted exterior or G-90 galvanized for un-painted exterior. Each sheet shall have a base structural support centered under all seams and additional supports for adequate support of the unit material and components. All sheets shall be fastened to the base structure and each other using driller screws. Base and floor structure shall be cleaned and primed before assembly for painted units.
- 3. Floor liner on welded base shall be fabricated from 14 Ga galvanealled- paintlock for painted interior or G-90 galvanized for un-painted interior. Each sheet shall have a base structural support centered under all seams and additional supports for adequate support of the unit material and components. All sheets shall be fastened to the base structure using rivets or self-drilling screws.
- 4. Welded base floor shall have insulation
- Formed base floor shall have insulation with liner.
- 6. Casing walls and roof panels to be 16 ga. galvanealled- paintlock steel for painted units or G-90 galvanized for un-painted units. Panels shall be attached to each other using driller screws on internal and exterior seams. Each seam shall be sealed with an acrylic latex caulk before and after assembling the panels.
- 7. Casing walls and roof shall have insulation All additional shipped loose accessories shall have the same interior construction and finish.
- 8. Casing exterior finish shall be All additional shipped loose accessories shall have the same interior construction and finish.
- 9. Access door will be construction made with the same material as the rest of the air handler with a continuous bulb type weather-strip seal. Handles shall feature tool access locking mechanism independent of latch operation. Once unlocked and prior to locking with a tool, subsequent latching or unlatching will not require a tool or key. Access doors opening with positive pressure shall be in-swing to prevent injury.

# C. Direct-Fired Burner Section

- 1. Burner to be natural gas direct-fired line burner type as manufactured by Midco International or Eclipse Combustion. Stainless steel air baffles on the burner will ensure proper gas-air mixture at varying gas input levels. Gas manifold casting shall be corrosion resistant - aluminum, cast iron is not acceptable. Burner to be designed to provide 100% thermal efficiency throughout the life of the burner. Burner shall be of a design that produces less than 5 PPM CO and 0.5 PPM nitrogen dioxide throughout its modulating range. Burner manufacturer's published turn down ratio shall be a minimum of 25:1. All air moving across the burner shall come from an outdoor source. Recirculating room air across the burner shall not be permitted.
- 2. All gas train components shall be selected to operate at 2psi gas pressure.
- 3. Air flow switch(s), high temperature limit, ignition transformer, main and pilot pressure regulators, control voltage transformer, electronic flame supervision, manual main and pilot gas shut off valve, main gas automatic safety shut-off valves, and modulating gas valve with discharge air temperature controls shall be provided. If room temperature control is desired, control system shall reset discharge temperature set-point based upon room temperature deviation from room temperature set-point.
- 4. Interrupted ignition system and flame supervision will be provided. Diagnostic lights on flame safeguard with fault mode information for troubleshooting.
- 5. High manifold gas pressure switch shall be provided.

### D. Blower/Motors/Drives/Base:

1. Blower(s) shall be DWDI centrifugal forward curved type mounted on a solid turned, ground and polished steel shaft with self-aligning bearings. Pillow block or flange mount bearings mounted on welded, structural steel supports will be standard on all welded

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bases. Formed sheet metal base shall have formed 16 Ga sheet steel, blower cheeks with pillow block or self-aligning bearings. Fan wheel shall be statically and dynamically balanced. Variable pitch blower drive shall be included up to 30 HP without VFD. Units furnished with a VFD will typically not have a variable pitch blower drive. Motors shall comply with NEMA premium efficiency rating. Motors shall have a NEMA frame with a 1.15 service factor.

#### E. Controls:

- All controls shall be factory mounted inside the equipment. Components to include motors, disconnects, fuses, circuit breakers, actuators, temperature controls, flame safeties, thermostats, sensors, safeties, alarms, and all other electrical components.
  - All electrical wiring shall be completed to NEC electrical codes. Local electrical code requirements are the responsibility of the installing contractor.
  - All electrical wiring shall terminate at a marked terminal strip and shall be separated for high voltage, control voltage, and signals. Wire duct, wire wrap, and tie wraps shall also be used to organize the wiring and provide a tidy electrical vestibule.
  - c. All exposed high voltage terminals shall have a protective cover to provide additional safety for service personal.
  - d. Control vestibule, remote panel, and shipped loose electrical components shall be tagged with installation instructions and wiring diagrams if applicable.
  - Air pressure tubing shall include additional ports for taking measurements.
- Temperature control shall be accomplished by (select one of the following):
  - a. MRTC Solutions electronic discharge temperature control components optional room override stat. Status and alarm lights shall be provided on the remote control panel.
    - i. temperature is sensed for selected duration (typically 3 minutes) shall be provided.
  - b. Macarel (DDC) components with digital user interface and optional compatibility for interoperability with multiple types of equipment and building management systems. Status and alarm lights shall be provided on the remote control panel.
    - Low temperature limit w/ bypass timer to shutdown unit if cold discharge temperature is sensed for selected duration (typically 3 minutes) shall be provided.
    - Inlet ductstat function to disable the burner when warm inlet air temperature is sensed shall be provided.
    - iii. Time clock shall be provided.
    - iv. Unoccupied setpoint shall be provided.
    - v. Audible alarm shall be provided and sound on critical operation alarms.

# F. Options and Accessories:

- All accessories shipped loose or attached to the equipment shall match the exterior. material and finish. Unless otherwise stated, all birdscreen shall be steel wire mesh with a square 1" x 1" opening with a wire diameter of .07".
- Options and accessories shall include (Check desired options and accessories):
  - a. 
     □Outside air V-bank pre-filter section with selection required filters mounted in a slide-in rack accessed on the side of the unit.
  - b. □45 degree outside air hood with birdscreen.

- d. 
   □Full turndown outside air hood with birdscreen.
- f. NRoof curb, 14" high for roof.
- G. Factory start-up shall be provided with MUA including operation, maintenance, and service training. A minimum of two-week notice is required for scheduling and a start-up authorization form is required to ensure jobsite is ready for start-up.

### Part 3- Execution

- 3.1 Examination:
  - A. Contractor shall verify that site is ready to receive work and opening dimensions are as indicated on shop drawings.
  - B. Contractor shall verify that proper power supply, gas pressure and other utilities are available.
- 3.2 Installation:
  - A. Contractor shall install in accordance with manufacturer's instructions.
  - B. Refer to Division 26
    - Power supply wiring from power source to power connection on make-up air units including required electrical devices. Unit disconnect and starter is included with make-up air unit. Control wiring between field installed controls and remote control station shall also comply with Division 26.

End of Section

# **SECTION 23 55 23 GAS FIRED RADIANT HEATERS**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This section specifies gas-fired tubular infrared radiant heaters.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

### 1.2 RELATED WORK

- A. Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 23 05 00, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items which are common to more than one section of Division 23.
- c. Section 23 11 23, FACILITY NATURAL-GAS PIPING.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

# 1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI): Z83.20b/CSA 2.34-2011 (R2013)Gas-Fired Low Intensity Infrared Heaters
- c. National Fire Protection Association (NFPA): 54-2015 National Fuel Gas Code

#### 1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
- c. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
- D. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Location and size of each field connection.

- 2. Location and arrangement of integral controls.
- 3. Enclosure joints, corner pieces, access doors, and other accessories.
- 4. Wiring Diagrams: Power, signal, and control wiring.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
  - 1. Include complete list indicating all components of the systems.
  - Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

### 1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE, in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

# 1.6 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be //in electronic version on CD or DVD// inserted into a three ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD provided on CD or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

### PART 2 - PRODUCTS

### 2.1 TUBULAR INFRARED HEATERS

- A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20b/CSA 2.34, UL Listed.
- B. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- Combustion Tubing: 100 mm (4 inch) diameter aluminized steel with high-emissivity, high-temperature, corrosion-resistant external finish.
- D. Tubing Connections:
  - 1. Stainless steel couplings or flared joints with stainless steel draw bolts.
  - 2. 90 or 180 degree-bend emitter steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
- E. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree tilt from vertical.
  - Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees from vertical.
  - 2. Include hanger kit.

# F. Accessories:

- Protective grilles mounted to reflectors to protect emitter tubing.
- 2. Stainless steel flexible connector with manual valve for gas supply.
- 3. Hanger chain with "S" hooks.
- 4. 5 mm (3/16 inch) diameter aluminized steel wire tubing hanger and reflective supports.

# G. Burner Safety Controls:

- 1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
- 2. Failure Safeguards: 100 percent shutoff of gas flow in the event of flue or power failure.
- 3. Safety lockout of burner after three consecutive ignition failures.
- 4. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
- 5. Control Panel Interlock: Stops burner if panel is open.
- 6. Indicator Lights: Burner-on indicator light.
- H. Burner and Emitter Type: Gravity-vented power burner, with the following features:
  - 1. Emitter Tube: 100 mm (4 inch) diameter, aluminized tubing with sight glass for burner and pilot flame observation.
  - 2. Venting: Connector at exit end of emitter tubing for vent-pipe connection.
    - a. Vent Terminal: Vertical or Horizontal as shown by drawings.
  - 3. Burner: Stainless steel.
  - 4. Ignition System: Direct spark with flame rod sensing capabilities.
  - 5. Combustion Blower Fan: Dynamically balanced, direct driven, forward-curved fan with stainless steel impeller and aluminized steel housing, with a minimum temperature rating of 232 degrees C (450 degrees F).
  - 6. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outdoors by burner fan if shown by drawing

### 2.2 CONTROLS

- A. Thermostat: Single-stage, wall-mounting type.
  - 1. Control Transformer: Integrally mounted.

# PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.
- B. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

- Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
- D. Maintain manufacturers' recommended clearances to combustibles.

### 3.2 CONNECTIONS

- Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.
- B. Gas Piping: Comply with Section 23 11 23, FACILITY NATURAL-GAS PIPING. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- c. Ground electric convection heating units according to Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

### 3.3 FIELD QUALITY CONTROL

- Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

# 3.4 ADJUSTING

- A. Adjust initial temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

# 3.5 STARTUP AND TESTING

- A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- . //The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.//
- D. Components provided under this section of the specification will be tested as part of a larger system.

### 3.6 DEMONSTRATION AND TRAINING

 A. Provide services of manufacturer's technical representative for 2 hours to instruct each VA personnel responsible in the operation and maintenance of units.

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# **SECTION 23 74 33** PACKAGED DEDICATED OUTDOOR AIR UNITS

# **PART 1 GENERAL**

#### 1.1 SUMMARY

A. Section includes factory-packaged units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

# 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.

#### B. **Shop Drawings:**

- 1. Include plans, elevations, sections, and attachment details.
- Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 3. Prepare the following by or under the supervision of a qualified professional engineer:
  - a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
  - b. Include diagrams for power, signal and control wiring.
- C. Submit wind load calculations and connection details for the rooftop package unit, framework, casing support and foundations, signed and sealed by a Florida registered engineer, demonstrating compliance with the Florida Building Code (FBC) - American Society of Civil Engineers (ASCE) 7.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof-curb mounting details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - Size and location of unit-mounted rails and anchor points and methods for anchoring units to roof curb.
  - Required roof penetrations for ducts, pipes and electrical raceways, including size and location of each penetration.
- B. Startup service reports.

#### 1.4 **CLOSEOUT SUBMITTALS**

A. Operation and Maintenance Data: For units to include in emergency, operation February 6, 2024

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and maintenance manuals.

#### 1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Compressors: Five years from date of Substantial Completion.

### **PART 2 PRODUCTS**

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AAON.
  - 2. Addison.
  - 3. Munters Corporation, Dehumidification Division; Des Champs Products.
  - 4. Greenheck.
  - 5. Lennox.
  - 6. Petra.
  - 7. Renewaire

### 2.2 PERFORMANCE REQUIREMENTS

- A. General Fabrication Requirements: Comply with requirements in ASHRAE 62.1, Section
  - "Systems and Equipment," and Section 7 "Construction and System Start-up."
- B. Delegated Design: Engage a Professional Engineer registered in the State of Florida to design wind restraints.
- C. Wind-Restraint Performance: Roof mounted equipment shall be restrained against overturning and uplift forces in accordance with ASCE 7. Design requirements and factors shall be as per FBC and SREF requirements.
- D. Cabinet Thermal Performance:
  - 1. Maximum Overall U-Value: 0.08 Btu/h per sq. ft. per deg F (nominal R=13).
  - 2. Include effects of metal-to-metal contact and thermal bridges in the calculations.

# E Cabinet Surface Condensation:

1. Cabinet shall have additional insulation and vapor seals if required to prevent condensation on the interior and exterior of the cabinet.

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- Portions of cabinet located downstream from the cooling coil shall have a thermal break at each thermal bridge between the exterior and interior casing to prevent condensation from occurring on the interior and exterior surfaces. The thermal break shall not compromise the structural integrity of the cabinet.
- F. Maximum Cabinet Leakage: 0.5 percent of the total supply-air flow at a pressure rating equal to the fan shut-off pressure.
- G. Cabinet Deflection Performance:
  - 1. Walls and roof deflection shall be within 1/240 of the span at the design working pressure equal to the fan shut-off pressure. Deflection limits shall be measured at any point on the surface.
  - 2. Floor deflections shall be within 1/360 of the span considering the worst-case condition caused by the following:
    - a. Service personnel.
    - b. Internal components.
    - c. Design working pressure defined for the walls and roof.
- H. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Capacities and Characteristics shall be as scheduled on drawings.
- 2.3 CABINET
  - A. Construction: double wall.
  - B. Exterior Casing Material: Galvanized steel with paint finish.
  - C. Interior Casing Material: Galvanized steel.
  - D. Lifting and Handling Provisions: Factory-installed shipping skids and lifting lugs.
  - E Base Rails: Galvanized steel rails for mounting on roof curb or mounting on grade as indicated.
  - F. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
    - 1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.
  - G. Roof: Standing seam or membrane; sloped to drain water.
- H. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by
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service personnel. Insulation shall be below metal walking surface.

#### I. Cabinet Insulation:

- 1. Type: Closed cell foam insulation.
- 2. Thickness: 2 inches.
- 3. Insulation Adhesive: Comply with ASTM C 916, Type I.
- 4. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage or thermal bridging when applied as recommended by manufacturer.
- Insulation shall not be in contact with air stream.

### Condensate Drain Pans:

- Shape: Rectangular, with 2 percent slope in at least two planes to direct water toward drain connection.
- Size: Large enough to collect condensate from cooling coils including coil piping connections, coil headers, and return bends.
  - a. Length: Extend drain pan downstream from leaving face 8 inches.
  - b. Depth: A minimum of 2 inches deep.
- Configuration: Double wall, with space between walls filled with foam insulation. and moisture-tight seal.
- Material: Stainless-steel sheet.
- 5. Drain Connection:
  - a. Located at lowest point of pan.
  - b. Terminated with threaded nipple.
  - c. Minimum Connection Size: as indicated on drawings.
- 6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
- K. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1 for resistance to mold and erosion.
- Roof Curb: Full-perimeter curb of sheet metal, height shall be as required to provide a minimum of 12 inches above the roofing membrane. Roof curb shall meet the structural performance requirements specified herein.

### 2.4 FANS

- A. Forward-Curved or Backward Inclined Fan Type: Centrifugal; statically and dynamically balanced.
  - 1. Fan Wheel Material: Galvanized steel, mounted on solid-steel shaft.
  - Bearings: Pillow-block bearings rated L<sub>50</sub> for 200,000 hours and having external grease fittings.

February 6, 2024 23 74 33 - 4 B. Service Factor for Belt Drive Applications: Multiple V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.5 service factor.

### C. Motors:

- Suitable for variable speed service, complying with NEMA designation, temperature rating, service factor, and efficiency.
- 2. Enclosure: Totally enclosed.
- 3. Enclosure Materials: Cast iron.
- 4. Motor Bearings: Ball bearing type.
- 5. Efficiency: Premium efficient.
- 6. NEMA Design: NEMA "B".
- 7. Service Factor: 1.15.
- D. Mounting: Fan wheel, motor, and drives shall be mounted to fan casing with spring isolators.
- E Provide variable frequency drives.
- 2.5 COOLING COILS
  - A. Capacity Ratings: Comply with ASHRAE 33 and ARI 410 and coil bearing the ARI label.
  - B. Coil Casing Material: Galvanized steel.
  - C. Tube Material: Copper.
  - D. Tube Header Material: Copper.
  - E Fin Material: Aluminum.
  - F. Fin and Tube Joints: Mechanical bond.
  - G. Leak Test: Coils shall be leak tested at 300 psig with air underwater.
  - H. Refrigerant Coil Capacity Reduction: Circuit coils for row interleaved control.
  - I. Refrigerant Coil Suction and Distributor Header Materials: Seamless copper tube with brazed joints.
  - J. Coating: Phenolic epoxy corrosion-protection coating after assembly.
- 2.6 REFRIGERATION SYSTEM
  - A. Comply with requirements in ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - B. Refrigerant Charge: Factory charged with refrigerant and filled with oil.
- C. Compressors: Reciprocating or scroll compressors with integral vibration isolators,

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internal overcurrent and over-temperature protection, internal pressure relief and crankcase heater.

# D. Refrigerant: R-134a, R-410A HFC refrigerant.

- Classified as Safety Group A1 according to ASHRAE 34.
- 2. Provide unit with operating charge of refrigerant.

# E Refrigeration System Specialties:

- 1. Expansion valve with replaceable thermostatic element.
- 2. Refrigerant dryer.
- 3. High-pressure switch.
- 4. Low-pressure switch.
- 5. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
- 6. Brass service valves installed in discharge and liquid lines.

# F. Capacity Control:

- Capacity control with continuous dehumidification on a single compressor. (Evaporator coil shall be continuously active for dehumidification).
- 2. Single compressor with evaporator and condenser coil within the air handling unit cooling section to provide cooling and to reheat for humidity control.
- 3. Units 6 Tons capacity and above shall be provided with multiple compressors. Units 6 to 20 Tons capacity will be capable of 100% 75% 50% 25% and 0% capacity steps. Units 21 to 50 Tons capacity will be capable of operating 100%, 87.5%, 75%, 67.5% 50%, 37.5%, 25%, 0% capacity steps. Capacity reduction maybe accomplished by shutting down compressors, unloading cylinders, varying speed, hot gas bypass, or a combination of the above. Evaporator coils shall be intertwined, split by rows and maintain a full energized face at all times. Coils split by face are not acceptable.

# G. Condenser, evaporator and reheat coils:

- 1. Capacity Ratings: Complying with ASHRAE 33 and ARI 410 and coil bearing the ARI label.
- Tube Material: Copper.
- 3. Fin Material: Aluminum.
- 4. Fin and Tube Joint: Mechanical bond.
- 5. Leak Test: Coils shall be leak tested with air underwater.
- Coating: Phenolic epoxy corrosion-protection coating after assembly.
- 7. Louvered hail guard shall be provided over condenser coil surfaces.

# H. Condenser Fan Assembly:

- 1. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades.
- 2. Fan Motors:

- a. Comply with NEMA designation, temperature rating, service factor, and efficiency.
- b. Motor Enclosure: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure.
- c. Enclosure Materials: Cast iron.
- d. Motor Bearings: Permanently lubricated bearings.
- e. Unusual Service Conditions: Ambient Temperature: 40 deg C.
- f. Built-in overcurrent and thermal-overload protection.
- g. Efficiency: Premium efficient.
- h. NEMA Design: NEMA "B".
- i. Service Factor: 1.15.
- 3. Fan Safety Guards: Steel with corrosion-resistant coating.
- I. Safety Controls:
  - 1. Compressor motor and condenser coil fan motor low ambient lockout.
  - 2. Overcurrent protection for compressor motor.
  - 3. Condensate overflow safety switch shall automatically shut down the system.

### 2.7 ELECTRIC-RESISTANCE HEATING COIL

- A. UL Compliance: Comply with requirements in UL 1995, "Heating and Cooling Equipment."
- B. Electric-Resistance Heating Elements:
  - 1. Open-Coil Resistance Wire: 80 percent nickel and 20 percent chromium.
  - Supports and Insulation: Floating ceramic bushings recessed into casing openings; fastened to supporting brackets and mounted in galvanized-steel frame.
  - Heating Capacity: Low density 35 W per sq. in. factory wired for single-point wiring connection; with time delay for element staging and overcurrent- and overheat- protection devices.
  - 4. Safety Controls:
    - a. Blower-motor interlock, air-pressure switch.
    - b. Quiet mercury contactors.
    - c. Time delay between steps.
    - d. Integral, non-fused power disconnect switch.

# 2.8 OUTDOOR-AIR INTAKE HOOD

- A. Type: Manufacturer's standard hood or louver.
- B. Materials: Match cabinet.
- C. Bird Screen: Comply with requirements in ASHRAE 62.1.

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D. Configuration: Designed to inhibit wind-driven rain from entering unit.

# 2.9 FILTERS

- A. Extended-Surface, Disposable Panel Filters:
  - 1. Comply with NFPA 90A.
  - Factory-fabricated, dry, extended-surface type.
  - 3. Thickness: 2 inches.
  - 4. Provide minimum filtration efficiency of MERV 6, in accordance with ASHRAE 52.2.
  - 5. Media: Fiberglass free, formed into deep-V-shaped pleats with antimicrobial agent and held by self-supporting wire grid.

# B. Mounting Frames:

- Filters arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from both sides.
- Galvanized or stainless steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

### 2.10 ELECTRICAL POWER CONNECTIONS

- A. General Electrical Power Connection Requirements: Factory installed and wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.
- B. Enclosure: NEMA 250, Type 3R, mounted in unit with hinged access door in unit cabinet having a lock and key or padlock and key.
- C. Wiring: Numbered and color-coded to match wiring diagram.
- D. Wiring Location: Install factory wiring outside an enclosure in a raceway.
- E Power Interface: Field power interface shall be to wire lugs.
- F. Factory Wiring: Branch power circuit to each motor and to controls with one of the following disconnecting means:
  - NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
  - 2. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- G. Factory-Mounted, Overcurrent-Protection Service: For each motor.
- H. Transformer: Factory mounted with primary and secondary fuses and sized with enough capacity to operate electrical load plus 20% spare capacity.

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- I. Controls: Factory wire unit-mounted controls where indicated.
- J. Receptacle: Factory wire unit-mounted, ground fault interrupt (GFI) duplex receptacle.
- K. Control Relays: Auxiliary and adjustable time-delay relays.

### 2.11 CONTROLS

- A. Control Wiring: Factory wire connection for control and power supply.
- B. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.
- C. Unit Mounted Status Panel: Capable of communicating with and connected to the school EMS system.
  - 1. Cooling/Off/Heating Controls: Control operational mode.
  - 2. Fan Speed: Indication of percentage of fan speed.
  - 3. Status Lights:
    - a. Filter dirty.
    - b. Fan operating.
    - c. Cooling operating.
    - d. Heating operating.
    - e. Smoke alarm.
    - f. General alarm.
  - 4. Digital Numeric Display:
    - a. Outdoor airflow.
    - b. Supply airflow.
    - c. Outdoor dry-bulb temperature.
    - d. Outdoor dew point temperature.
    - e. Space temperature.
    - f. Supply temperature.
    - g. Space relative humidity.
    - h. Space carbon dioxide level.

# D. Control Dampers:

- 1. Damper Location: Factory installed in air inlet section and provided with ease of blade axle and bushing service.
- Damper Leakage: Comply with requirements in AMCA 500-D. Leakage shall not exceed 6.5 cfm per sq. ft. at a static-pressure differential of 4.0 inches water column when a torque of 5 inch-pounds per sq. ft. is applied to the damper iackshaft.
- 3. Damper Rating: Rated for close-off pressure equal to the fan shutoff pressure.

- 4. Damper Label: Bear the AMCA seal for both air leakage and performance.
- 5. Blade Configuration: Unless otherwise indicated, use parallel blade configuration for two-position control and equipment isolation service. For other applications, use an opposed-blade configuration.
- 6. Damper Frame Material: Galvanized steel.
- 7. Blade Type: Single-thickness metal reinforced with multiple V-grooves.
- 8. Blade Material: Galvanized steel.
- 9. Maximum Blade Width: 6 inches.
- 10. Maximum Blade Length: 48 inches.
- 11. Blade Seals: Replaceable, continuous perimeter vinyl seals and jambs with stainless steel compression-type seals.
- 12. Bearings: Thrust bearings for vertical blade axles.
- 13. Airflow Measurement:
  - Monitoring System: Complete and functioning system of outdoor airflow monitoring as an integral part of the damper assembly where indicated.
  - b. Remote Monitoring Signal: 0-10 volt or 4-20 mA scaled signal.
  - c. Accuracy of flow measurement: Within 5 percent of the actual flow rate between the range of the scheduled minimum and maximum airflow. For units with a large range between minimum and maximum airflow, configure the damper sections and flow measurement assembly as necessary to comply with accuracy.
  - d. Straightening Device: Integral to the flow measurement assembly if required to achieve the specified accuracy as installed.
  - e. Flow measuring device: Suitable for operation in untreated and unfiltered outdoor air. If necessary, include temperature and altitude compensation and correction to maintain the accuracy.

# E Damper Operators:

- 1. Factory-installed electric operator for each damper assembly with one operator for each damper assembly mounted to the damper frame.
- Operator capable of shutoff against fan pressure and able to operate the damper with sufficient reserve power to achieve smooth modulating action and proper speed of response at the velocity and pressure conditions to which the damper is subjected.
- 3. Maximum Operating Time: Open or close damper 90 degrees in 60 seconds.
- 4. Adjustable Stops: For both maximum and minimum positions.
- 5. Position Indicator and Graduated Scale: Factory installed on each actuator with words "OPEN" and "CLOSED," or similar identification, at travel limits.
- 6. Spring-return operator to fail-safe; either closed or open as required by application.
- 7. Operator Type: Direct coupled, designed for minimum 60,000 full-stroke cycles at rated torque.
- 8. Position feedback Signal: For remote monitoring of damper position.
- 9. Coupling: V-bolt and V-shaped, toothed cradle.
- 10. Circuitry: Electronic overload or digital rotation-sensing circuitry.

# F. Refrigeration System Controls:

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- 1. Outdoor-air sensor de-energizes dehumidifier operation when outdoor air temperature is less than 60 deg F (15 deg C)
- 2. Relative humidity sensor energizes dehumidifier operation when relative humidity is more than 50 percent.

### G. Electric-Resistance Heat Controls:

- 1. Wall-mounted, space-temperature sensor with adjustment on remote control panel to control space temperature.
- 2. Capacity Controls: On/off Multiple steps Modulating SCR.
- H. Damper Controls: Two position.
- I. Space Pressure and CO<sub>2</sub> Control:
  - Supply and exhaust Fan speed shall modulate air volumes to maintain the space CO<sub>2</sub> level setpoint, except that the minimum air volumes shall be as required to maintain the space at 0.10 in. wg. positive pressure with respect to an outdoor air reference.
- J. Integral Smoke Alarm: Smoke detector installed as per FBC, Mechanical. Detector shall be compatible with fire alarm system installed under Division 28.

#### 2.12 ENERGY RECOVERY WHEEL

A. Shall include drive system, energy transfer segments removable for cleaning and replacement. Wheel segments shall rotate between exhaust and outside air streams to transfer both sensible and latent heat. Intake and exhaust sections shall be separate and sealed to minimize air transfer between sections. Wheel drive motor shall have permanently lubricated bearings. Belt drive shall rotate wheel without slippage. Wheel surface shall be coated with a desiccant material to absorb and desorb moisture.

### 2.13 ACCESSORIES

A. Duplex Receptacle: Factory mounted in unit supply-fan section, with 20 amp 120 V GFI duplex receptacle and weatherproof cover.

### PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where units will

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be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.
- B. Curb Support: Install roof curb on roof structure as follows:
  - Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction. Installation shall comply with FBC wind load design requirements.
  - Coordinate size, installation and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7.
  - 3. Coordinate size, location and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

# C. Equipment Mounted on Grade:

- Install air units on cast-in-place concrete equipment bases. Comply with concrete requirements for equipment bases and foundations specified in Division 3.
- D. Install sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.
- E Install separate devices furnished by manufacturer and not factory installed.
- F. Install new filters at completion of equipment installation and before testing, adjusting and balancing.
- G. Install drain pipes from unit drain pans to drain.

# 3.3 CONNECTIONS

- A. Where installing piping adjacent to units, allow space for service and maintenance.
- B. Duct Connections:
  - 1. Comply with requirements in Division 23
  - Drawings indicate the general arrangement of ducts.
  - 3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Division 23.
- C. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Division 26

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Install electrical devices furnished by unit manufacturer but not factory mounted.

# 3.4 STARTUP SERVICE

- A. Perform startup service.
  - Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
  - 3. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
    - a. Cooling coil leaving-air, dry and wet-bulb temperatures.
    - b. Cooling coil entering-air, dry and wet-bulb temperatures.
    - c. Condenser coil entering-air dry-bulb temperature.
    - d. Condenser coil leaving-air dry-bulb temperature.
  - 4. Simulate maximum cooling demand and inspect the following:
    - a. Compressor refrigerant suction and hot-gas pressures.
    - b. Short-circuiting of air through outside coil or from outside coil to outdoorair intake.
  - 5. Inspect casing insulation for integrity, moisture content and adhesion.
  - 6. Verify that clearances have been provided for servicing.
  - 7. Verify that controls are connected and operable.
  - 8. Verify that filters are installed.
  - 9. Clean coils and inspect for construction debris.
  - 10. Inspect and adjust vibration isolators.
  - 11. Verify bearing lubrication.
  - 12. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  - 13. Adjust fan belts to proper alignment and tension.
  - 14. Start unit.
  - 15. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
  - 16. Operate unit for run-in period.
  - 17. Calibrate controls.
  - 18. Adjust and inspect high-temperature limits.
  - 19. Inspect outdoor-air dampers for proper stroke.
  - 20. Verify operational sequence of controls.
  - 21. Measure and record the following airflows. Plot fan volumes on fan curve.
    - a. Supply-air volume.
    - b. Outdoor-air flow.
- B. After startup, change filters, verify bearing lubrication and adjust belt tension.

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- C. Remove and replace components that do not properly operate, and repeat startup procedures as specified above.
- D. Prepare written report of the results of startup services.

# 3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to four visits to Project during other-than-normal occupancy hours for this purpose.

# 3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate and maintain units.

**END OF SECTION** 

# **SECTION 23 81 30** VRF AIR CONDITIONING UNITS

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

#### 1.2 **SUMMARY**

- Provide all equipment, controls, materials, supervision, training, start-up and Α. commissioning services necessary for a complete and operating refrigeration and air handling system as indicated on the drawings and as specified.
- B. **Contractors Qualifications** 
  - The system must be installed by a factory trained contractor/installer. The bidders shall be required to submit training certifications and a list of installations prior to award of contract. If the installing contractor has less than 3 years of multi-zone VRV installation experience with at least 100 tons of installed systems, that installer shall be deemed unqualified. In this case, the submittals will be rejected unless the contractor is trained and vouched for by Manufacture's Representative who will provide written documentation that they will oversee the training of the contractor and perform the necessary periodic Quality Control (QC) checks of the installation as well as on-site start-up and commissioning servies. Installation of one-to-one mini-splits, or multi-splits is not considered equal to the experience of installing multi-zone VRV systems.
  - 2. Contractor shall employ Manufacture approved factory trained start-up and commissioning technicians to oversee and certify all start-up activities.
  - 3. Alternate manufacturers who do not have 7 years of documented installations within the United States that utilized inverter driven compressors in their condensing units shall not be approved. Experience with digital scroll compressors is not considered equal to inverter driven compressors.

#### C. Submittals:

- Provide submittals as required in Section 23 05 00, "Common Work 1. for HVAC".
- Equipment and total system capacities shall show the actual Total And 2. Sensible capacities of all equipment after the following design considerations have been taken into account:
  - 1. Outdoor Ambient Conditions
  - 2. Altitude
  - 3. Entering Air Temperature into the FCU
  - 4. Refrigerant line diameters and length

#### D. Installation and Commissioning

Manufacturer software shall be used to produce piping tree and shall be submitted (1) before ordering material, (2) confirmed/revised for actual field dimensions before welding/pressure testing, and (3) submitted after pressure testing to document final pipe sizes and lengths and shall be included as "As-Builts".

#### 2. Refrigerant Piping Requirements

Provide a refrigerant piping system that matches the factory generated piping diagram. Refrigerant piping shall be in accordance with the Installation Manual.

Brazing must occur in the presence of a Nitrogen Purge in accordance with the Installation Manual.

- After the final piping connection is made, confirm that all valves within the 3. refrigerant circuit are open, date/time stamped photos of the pressure gauge(s) at both the beginning and ending of a successful pressure test OR documented observation by a 3<sup>rd</sup> party along with ambient temperatures for the same period shall be submitted. The subcontractor shall be knowledgeable of the Ideal Gas Law to be able to judge a successful pressure test while ambient conditions vary. A pressure test shall be considered "successful" when it has held the manufacturer's stated PSI for the manufacturer's stated minimum duration. Additionally, the refrigerant circuit shall remain under pressure until the refrigerant circuit is prepared for start-up at which point it shall be measured and documented to match that of the original successful pressure test. THE INSTALLER IS CHARGED WITH NOTIFYING THE JOBSITE OF SAFETY REQUIREMENTS CONCERNING WORKING NEAR PIPING **UNDER PRESSURE.**
- 4. BEFORE START-UP, the installer shall purge the refrigerant circuit of nitrogen and pull a vacuum on the entire open circuit down to 500 microns and shall hold for 24 hour. It shall be measured and documented by Factory Authorized Commissioning Agent.
- 5. WARRANTY: The units shall have the manufacturer's parts warranty for a period of one (10) year from date of installation. All compressors shall have a parts warranty of seven (10) years (total) from date of installation.
  - Warranty includes parts only. Troubleshooting of and labor to remove and install defective parts is by others.
  - ii. Warranty shall be provided by the manufacturer, in writing. Due to potential changes in representation over the course of 10 years. extended warranties by the representative or other third parties shall not be accepted.

#### 1.3 **QUALITY ASSURANCE**

- A. All equipment shall meet or exceed the scheduled minimum EER and IEER/SHCR in accordance with ASHRAE 90.1 and shown on the schedule
- B. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
- All wiring shall be in accordance with the National Electric Code (NEC). C.

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- D. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
- Preference shall be given to systems that are built in the USA E.
- F. All VRV/VRF equipment shall be stored protected from weather, extreme temperature, etc. as suggested by the manufacturer. All VRV/VRF equipment shall be moved, lifted, etc. as suggested by the manufacturer.

### PART 2 - PRODUCTS

#### 2.1 VARIABLE CAPACITY, VARIABLE REFRIGERANT VOLUME (VRV) / VARIABLE REFRIGERANT FLOW SYSYEM

- System Description: The system shall be a Variable Refrigerant Volume (VRV) Series IV system with the components required by the plans and specifications so that once properly installed will create an operational Heat Pump (HP) or Heat Recovery (HR) as required by the plans and specifications. The system shall consist of the following from the same manufactuer:
  - a. R410A condensing units with inverter driven compressor(s)
  - b. Multiple evaporator Fan Coil Units (FCUs) for use in VRV systems
  - c. Refrigerant piping network "Y" branches (REFNET) as required.
  - d. Branch Selector (BS) heat/cool change over boxes, as required
  - e. DDC Control boards with PID loop, wall mounted FCU controllers, centralized touchscreen controller, as required.
  - The system may connect up to 200% the nameplate tonnage of FCUs to condensing unit nameplate tonnages without effecting the ability for the system to operate as scheduled.
- The outdoor unit shall be interconnected to indoor units in accordance B. with Manufacturer engineering data book detailing each available indoor unit. The indoor units shall be connected to the outdoor utilizing Manufacturer specified piping joints and headers.
- C. Heat Pump systems shall consist of one (1) liquid refrigerant line and one (1) gas refrigerant line.
- D. Heat Recovery system shall consist of (1) liquid refrigerant line and one (1) gas refrigerant line and (1) medium pressure gas line. System that attempt to use only 2 refrigerant lines in heat recovery mode shall NOT be accepted.

#### 2.2 CONDENSING (OUTDOOR) UNIT (R-410A)

- General: The outdoor unit is designed specifically for use with VRV/VRF A. series components.
  - 1. The outdoor unit shall be completely factory assembled, piped and wired. Dual and triple frame outdoor units will be field piped with factory designed and supplied Y-branch kits to manifold them together into a single refrigerant circuit.

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- 2. Outdoor unit shall come with a 10 year full parts warranty from the manufacture.
- 3. Outdoor unit shall meet the scheduled capacities and efficiencies
- Outdoor unit shall use ONLY inverter driven scroll compressors. 4. Combination of inverter driven and standard scroll compressors shall not be approved.
- The sum of connected nominal capacity of all indoor air handlers 5. shall range from 50% to 200% of outdoor unit nominal capacity and still meet scheduled FCU capacities at all possible operating conditions.
- 6. Condensing unit controls shall come standard with energy saving Variable Refrigerant Temperature (VRT) control with the following options
  - Static refrigerant temperatures from 39F 57F a.
  - Variable refrigerant temperatures based on changing b. ambient temperatures
  - Adjustable refrigerant temperature timing modes to C. ensure proper reaction to changing indoor and outdoor conditions
- 7. Outdoor unit shall have a tested sound rating no higher that is scheduled.
- 8. All refrigerant lines shall be field insulated IAW installation manual or local code or as otherwise specified
- 9. The outdoor unit shall have an accumulator.
- 10. The outdoor unit shall have a high pressure safety switch
- The outdoor unit shall have over-current protection. 11.
- The outdoor unit shall have refrigerant cooled inverter control 12. boards
- 13. The outdoor unit shall use a brazed plate subcooling heat exchanger.
- 14. The outdoor unit shall have an oil separator for each compressor and controls to ensure sufficient oil supply is maintained for the compressor.
- 15. Each outdoor unit frame shall have a removable inspection panel no greater than 6 inches tall or 12 inches wide to allow access to service tool connection, DIP switches, auto addressing and error codes.
- B. **Unit Cabinet:** 
  - 1. Shall be constructed with galvanized steel, bonderized and be finished with powder coat baked enamel paint.
- C. Fan:
  - 1. All outdoor unit frames shall be furnished with two direct drive, variable speed propeller type fans.
  - 2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be variable speed with a maximum speed up to 950 rpm.
  - The outdoor unit shall have vertical discharge airflow. 3.
  - 4. The outdoor unit condenser fans shall be able to process an additional external static pressure .35" wc.

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#### D. Condenser Coil:

- The outdoor coil shall be of nonferrous construction with louvered fins on copper tubing.
- 2. The coil fins shall have a factory applied corrosion resistant material with hydrophilic coating.
- The coil shall be protected with an integral metal guard. 3.
- Refrigerant flow from the outdoor unit shall be controlled by 4. means of a master DDC controller using PID loop technology

#### Compressor: E.

- A crankcase heater shall be factory mounted on all compressors. 1.
- The outdoor unit compressor shall have an inverter to modulate 2. capacity. The frequency of the inverter compressor shall be completely variable from 25 to 105Hz.
- 3. The compressor shall be equipped with an internal thermal overload.
- 4. The compressor shall be mounted to avoid the transmission of vibration.

#### F. Electrical:.

- The outdoor unit shall be capable of operation within voltage limits 1. of +/- 10% rated voltage.
- 2. The outdoor unit shall be controlled by integral microprocessors.
- 3. The control circuit between the indoor units, heat recovery box and the outdoor unit shall be 24VDC completed using a 18-2 conductor, stranded, and shielded cable for the RS485 daisy chain communication.

#### 2.3 REFRIGERANT PIPING:

- Refrigerant piping shall comply with all other project specifications. Α.
- B. Refrigerant piping shall be installed in a neat and orderly fashion taking care to avoid to unnecessary traps, bends, elbows, kinks, etc.
- C. Refrigerant piping shall be supported and secured at proper intervals as determined by code and saddled or otherwise installed such that the pipe insulation is protected from compressing by more than 50% of its original dimension.
- D. The installer is responsible for strictly following the manufacturer's guidelines for piping; including the angle and direction of manufacturer supplied fittings. observing rules pertaining to bends before and after manufacturer supplied fittings, and keeping within line length limitations between all equipment and manufacturer supplied fittings.
- E. Pipe sizes, lengths, and elbows shall match exactly to the final piping tree produced by the manufacturer's software.
- F. Piping shall be brazed while maintaining at least 2 psi of flowing nitrogen.
- G. Flaring shall be performed as stated by the manufacturer and produced with tools

recommended by the manufacturer.

Н. Pipe insulation shall be a thickness as determined by the applicable code, but never less than the manufacturer's stated guideline and shall be installed completely and without air gaps. Insulation shall be installed on ALL refrigerant pipes. Insulation on pipes exposed to weather shall be protected against UV radiation by coating or jacketing.

#### 2.4 SIMULTANEOUS HEATING AND COOLING CHANGEOVER BRANCH SELECTOR (BS) BOX

- Α. Install Branch Selector box per Installation Manual
- Branch Selector Box (BS) Heat Recovery Unit Construction: B.
  - 1. The heat recovery BS box shall be capable of supplying from 1 thru 12 FCUs as shown on the plans
    - a. BS Box shall allow of multiple inactive ports for use in future expansions
    - b. BS Box shall allow for multiple ports to be combined to create a larger capacity system
  - The BS Box housing shall be galvanized steel. 2.
  - 3. Each BS Box shall contain piping, valves and controls to divert refrigerant for optimum efficiency.
  - The unit shall house one double spiral tube-in-tube heat 4. exchanger per port of the heat recovery unit.
  - 5. Heat recovery units shall be internally insulated and not require installation of any condensate drain.
- C. Drainage:
  - 1. The unit shall not require drainage.
- D. Location:
  - 1. Place BS box as shown on drawings
  - 2. Consult with manuacturer If the BS box must be relocated

#### E. Electrical:

- 1. The heat recovery box electrical power shall be 208/230V, 1 phase, 60 Hz.
- All units shall be capable of satisfactory operation within +/-10% of 2. nominal voltage.
- The BS box shall be controlled by integral microprocessors from 3. the main control in the outdoor unit.
- The control circuit between the indoor units, heat recovery box 4. and the outdoor unit shall be 24VDC completed using a 2conductor, stranded and shielded cable for the RS485 daisy chain communication.

# 2.5 FXMQ PA - CONCEALED CEILING DUCTED UNIT (Med. Static)

A. General: Indoor unit shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, directdrive DC (ECM) type fan with auto CFM adjustment at commissioning, for

installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Manufacturer's remote control. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8" from the drain pipe opening. The indoor units sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

B. Performance: Each unit's performance is based on Total and Sensible capacities listed in the schedule using the scheduled Entering Air Temperatures (EAT)

# C. Indoor Unit:

- 1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
- 2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
- 3. Both refrigerant lines shall be insulated from the outdoor unit.
- 4. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
- 5. The indoor units shall be equipped with a return air thermistor.
- 6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
- 7. The voltage range will be 253 volts maximum and 187 volts minimum.

# D. Unit Cabinet:

- 1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
- 2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

# E. Fan:

- 1. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
- 2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
- 3. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.
- 4. The airflow rate shall be available in three settings.
- 5. The fan motor shall be thermally protected.

- 6. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
- 7. Fan motor external static pressure range for nominal airflow:

#### F. Coil:

- 1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
- 2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
- 3. The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
- 4. The refrigerant connections shall be flare connections and the condensate will be 1-1/4" outside diameter PVC.
- 5. A condensate pan shall be located under the coil.
- 6. A condensate pump with an 18-3/8" lift shall be located below the coil in the condensate pan with a built in safety alarm.
- 7. A thermistor will be located on the liquid and gas line.

# G. Electrical:

- 1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
- 2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
- 3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

## H. Control:

- 1. The unit shall have controls provided by Manufacturer to perform input functions necessary to operate the system.
- 2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
- 3. The unit shall be compatible with a Intelligent Touch Manager advanced multi-zone controller.
- I. Optional Accessories Available (If called for in Schedule notes)
  - 1. Remote "in-room" sensor kit (recommended).
    - i. The wall mounted, hard wired remote sensor kit is recommended for when a controller is not used or when the controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
  - 2. MERV 13 Filter kit. Can be configured for right or left access. Filters replaceable without tools.
  - 3. Air side Economizer designed for connection to the rear of FXMQ30-54PAVJU.

#### 2.6 FXFQ T - ROUND FLOW SENSING CEILING CASSETTE UNIT

A. General: Indoor unit model FXFQ T shall be a round flow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, direct drive DC (ECM) type fan, for installation into the ceiling cavity equipped with an air panel grill. It shall be a round flow air distribution type, fresh white, impact resistant decoration

panel, or optional self-cleaning filter panel. The supply air is distributed via four individually motorized louvers. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with remote control. The indoor units sound pressure shall range from 30 dB(A) to 45 dB(A) at High speed measured at 5 feet below the unit.

B. Performance: Each unit's performance shall match the Total and Sensible capacities as shown in the Schedule based on scheduled Entering Air Temperatures (EAT) and air flow.

#### C. CEILING-CONCEALED DUCTED INDOOR UNIT

General: High static ceiling concealed duct indoor unit shall mount fully concealed within the ceiling. Shall be designed for use with R410a refrigerant. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRV/VRF systems of the same manufacturer. The indoor unit shall communicate with the outdoor unit via RS485 daisy Field installed ductwork shall not exceed the external static chain communication. pressure limitation of the high static ducted indoor unit.

#### D. Indoor Unit:

- a. The indoor unit shall be factory assembled, wired and run tested.
- b. The indoor unit shall be factory wired and piped with its own electronic expansion device, control circuit board, fan and motor.
- c. The indoor unit shall have
  - i. self-diagnostic function
  - ii. auto restart function
- d. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

# E. Unit Cabinet:

a. The cabinet shall be ceiling-concealed and ducted.

## F. Fan:

- a. The indoor unit fan shall be no more than one assembly with two Sirocco fans direct driven by a single motor.
- b. The indoor fan shall be statically and dynamically balanced.
- c. Motor shall have permanently lubricated bearings.
- d. In cooling mode, the indoor fan shall have the following settings; Low, Med, and High.
- heating mode, the indoor fan shall have the following settings; Low, Med, and High.

# G. Filter:

a. Return air shall be filtered with a factory supplied removable, 2" MERV 8 filter and filter rack, shipped loose for field installation

# H. Coil:

- a. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
- b. The tubing shall have inner grooves for high efficiency heat exchange.
- c. The coils shall be pressure tested at the factory.
- d. A condensate drain pan shall be factory installed below the coil.

- e. All refrigerant lines to the indoor units shall be field insulated.
- I. Condensate Pump:
  - a. The unit shall include a factory installed condensate pump that will be able to raise drain water a minimum of 20 inches above the ceiling cassette face.
- J. Electrical:
  - a. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hz.
- K. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.
- L. Control:
  - a. The unit shall have controls provided by Manufactuer to perform input functions necessary to operate the system.
  - b. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

#### 2.7 FXTQ TA - MULTI-POSITION AIR HANDLING UNIT

A. General: Indoor unit shall be a floor mounted vertical, horizontal left, horizontal right, or downflow air handling unit, operable with refrigerant R-410A, equipped with an electronic expansion valve and direct-drive ECM type fan with constant CFM programming, for installation within a conditioned space. When installed in a vertical configuration it shall have top discharge air and bottom return air. When installed in a horizontal right or horizontal left configuration, it shall have a horizontal discharge air and horizontal return air. When installed in a downflow configuration it shall have bottom discharge and top return air. A remote temperature sensor kit shall be required for all indoor units not utilizing the thermistor in the remote controller. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with remote control.

#### B. Indoor Unit:

- 1. The indoor unit components shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, brazed connections, self-diagnostics, auto-restart function, 3minute fused time delay, and test run switch.
- 2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
- 3. Both refrigerant lines shall be insulated from the outdoor unit.
- 4. Return air shall be through an optional or field supplied filter.
- 5. Condensate draining shall be made via gravity or external condensate pump.
- 6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
- 7. The voltage range will be 253 volts maximum and 187 volts minimum.

#### D. Unit Cabinet:

- 1. The cabinet shall be constructed with sound absorbing, foil-faced insulation to control air leakage.
- 2. Select an installation location with adequate structural support, space for service access and clearance for air return and supply duct connections.

3. A field supplied secondary drain pan shall be installed where required by national, state, or local code.

#### E. Fan:

- The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
- 2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.2 to 1.0. HP.
- 3. The airflow rate shall be available in high setting.
- 4. The fan motor shall be thermally protected.
- 5. Fan motor external static pressure for nominal airflow up to 0.9" w.c.

#### F. Filter:

 The return air shall be filtered by means of an optional or field supplied filter.

# G. Coil:

- 1. Coils shall be of the direct expansion type constructed from aluminum tubes expanded into aluminum fins to form a mechanical bond.
- 2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
- 3. The coils shall be a 2- to 4-row cross fin copper evaporator coil with 14 to 16 fpi design completely factory tested.
- 4. The refrigerant connections shall be brazed connections and the condensate will be 3/4 inch outside diameter PVC.
- 5. A thermistor will be located on the liquid and gas line.

# H. Electrical:

- 1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
- 2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
- 3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

# I. Control:

- 1. The unit shall have controls provided by manufactuer to perform input functions necessary to operate the system.
- 2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
- 3. The unit shall be compatible with a Touch Manager advanced multi-zone controller.
- J. Optional Accessories Available:
  - 1. Field installed 3-25kW electric heaters
  - 2. Air filter
  - 3. Downflow kit:
  - 4. wireless controller.

# 2.8 CONTROLS

#### A. General

1. Communication daisy chain wiring to be 18 gauge 2 conductor, stranded

copper, non-shielded rated control wire throughout the system

- B. Central Control – Touch Screen Controller (If noted on schedule)
  - Can address up to 128 indoor units and 16 outdoor units 1.
  - 2. **Available Functions**
  - 3. On/Off Control
  - 4. **Mode Selection**
  - 5. Lock Mode
  - 6. Setpoint Control
  - 7. Adjustable temperature range control
  - Fan Speed Control 8.
  - **Custom Scheduling** 9.
  - 10. **Indoor Unit Operational Status**
  - 11. Device setpoint data display status
  - 12. Provide with system battery backup and USB Port for software updates
  - 13. Ability to turn on/off third party devices through the application of a digital expansion kit (accessory) ie. lighting, ventilation units, exhaust fans
  - 14. **Emergency Stop**
  - 15. 7 inch touchscreen LCD with stylus pen and storage slot
  - 16. Ability to customize names in a zone/group/unit
  - Provide malfunction notification via email 17.
  - Shall have ability to be web-based and can schedule, change setpoints 18. and turn equipment on/off via the web
  - User and Administrator Levels with password protection 19.
- Individual Indoor Unit Controller Wired Wall Mounted Controller (Thermostat) C.
  - Each indoor unit will be provided with its own wired wall mounted controller.
  - 2. Provided with 30' of 22 gauge 3 conductor, stranded, shield control wiring with controller (thermostat)
  - 3. **Available Functions** 
    - On/Off Control a.
    - b. Temperature Setting
    - Fan Speed C.
    - Air Flow Direction d.
    - Child Lock e.
    - f. Mode Selection
    - Ability to allow up to 2 controllers per indoor unit g.
    - h. Ability to control a group of 16 indoor units with 1 controller
    - Auto addressable i.
    - Provide with Display, Fan Speed Selection switch, and Temp j. Setting Adjust

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- Equipment shall be installed as shown or indicated on the drawings and as Α. by the manufacturer. recommended
- В. Variable Refrigerant Flow (VRV/VRF) systems use a high pressure refrigerant and have unique installation procedures and requirements. It is imperative that the installation of these systems meet factory specifications in order for the

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systems to meet the expected performance and efficiency.

- Factory training for installing technicians. Prior to installation, the installing mechanical contractor must provide written proof that all installing technicians have received adequate training by the equipment manufacturer or approved alternate. Approved contractors who are awarded this project may contact the manufacturer to arrange training prior to installation for any unqualified technicians. The mechanical contractor's installation price shall be inclusive of the manufacturer's installation requirements including the cost of training, specialty tools, and cost charged by the manufacturer for technical assistance.
- 2. Job installation support and certification. - In order to assure properly installed system components and approved installation procedures, the specified manufacturer or approved alternate must provide installation technical support for the installing contractor via telephone and the internet, and job site supervision. Upon completion of installation and prior to factory startup, a factory authorized commissioning agent must inspect the installation of each system to verify proper installation. Upon verification of proper installation, the manufacturer is to submit a letter of certification approving the installation of their respective systems.
- Factory Startup and Warranty Approval Upon verification and written 3. receipt of proper installation, a factory authorized commissioning agent is to perform a factory approved initial startup of all system components. Such that the requirements to receive the maximum manufacturer's warranty are met and confirmed with the manufacturer.

#### 3.2 PRODUCT SUPPORT

- Maintain a fully staffed service office within 400 miles (1 day drive) of the job site. A. Fully staffed means a full time secretary, complete service library, at least 2 factory trained service technicians and the factory recommended spare parts inventory.
- B. Provide a 24 hour/7 day technical support phone number to factory service office. Support shall be for all components including controls, mechanical components, system operation and alarm codes, etc.
- The Manufacturer or local representative shall maintain a complete parts C. inventory for all systems that will allow for 24 hour receipt of any necessary part.
- D. Provide owner/operator and service training both on line and at designated training centers.

#### 3.3 **OPERATING RANGE**

The operating range for the VRV/VRF system in cooling will be 23°F DB ~ 115°F A. DB. The operating range in heating will be 0°F DB - 64°F DB / -5°F WB - 60°F WB.

#### 3.4 **EQUIPMENT START-UP**

- Α. The VRV/VRF system must be installed by factory trained contractor/dealer.
- В. Equipment start up shall be by factory trained personnel. The startup shall be attended by the controls contractor and Test and Balance contractor.

**END OF SECTION** 

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# **SECTION 23 82 39 UNIT HEATER**

# PART 1 - GENERAL

## 1.1 DESCRIPTION

- A. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.
- B. Propeller unit heaters with electric-resistance heating coils.
- c. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.
- A complete listing of common acronyms and abbreviations are included in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

# 1.2 **RELATED WORK**

- A. Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 23 05 00, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items which are common to more than one section of Division 23.
- c. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

# 1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):

70-2014	National Electrical Code (NEC)
90A-2015	Standard for the Installation of Air-Conditioning and
	Ventilating Systems

c. Underwriters Laboratories (UL):

499-2014 ..... Electric Heating Appliances

#### 1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 82 39, UNIT HEATERS", with applicable paragraph identification.
- c. Manufacturer's Literature and Data including Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

- Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
  - 1. Include complete list indicating all components of the systems.
  - Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

# 1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE, in Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

#### 1.6 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

## PART 2 - PRODUCTS

## 2.1 CABINET UNIT HEATERS

A. Description: Factory-packaged units constructed according to UL 499.

- B. Cabinet: Steel with baked-enamel finish in color selected by Architect.
  - 1. Vertical Unit, Exposed Front Panels: Minimum 1.35 mm (0.053 inch) thick, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
  - 2. Horizontal Unit, Exposed Bottom Panels: Minimum 1.35 mm (0.053 inch) sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
  - 3. Recessing Flanges: Steel, finished to match cabinet.
  - 4. Control Access Door: Key operated.
  - 5. Base: Minimum 1.35 mm (0.053 inch) thick steel, finished to match cabinet, 100 mm (4 inches) high with leveling bolts.
- c. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless steel machine-staked terminals secured with stainless steel hardware.
- D. Fan and Motor Board: Removable.
  - Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted steel wheels, and aluminum, painted steel, or galvanized steel fan scrolls.
  - 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board.
  - 3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- E. Basic Unit Controls:
  - 1. Control voltage transformer.
  - Wall-mounted thermostat.

## 2.2 PROPELLER UNIT HEATERS

- A. Description: Factory-packaged units constructed according to UL 499. An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- B. Cabinet: Removable panels for maintenance access to controls.
- c. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and factory-tested propeller unit heater before shipping.
- D. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

- E. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 4 mm (0.16 inch). Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 288 degrees C (550 degrees F) at any point during normal operation.
  - Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
  - 2. Wiring Terminations: Stainless steel or corrosion-resistant material.
- F. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- G. Control Devices:
  - Wall-mounted thermostat.

#### 2.3 WALL AND CEILING HEATERS

- A. Description: Factory-packaged units constructed according to UL 499. An assembly including chassis, electric heating coil, fan, motor, and controls.
- B. Cabinet:
  - Front Panel: Stamped steel louver, with removable panels fastened with tamperproof fasteners.
  - 2. Finish: Baked enamel over baked-on primer with color selected by Architect, applied to factory-assembled and factory-tested wall and ceiling heaters before shipping.
- Surface Mounted Cabinet Enclosure: Steel with finish to match cabinet.
- D. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosionresistant metallic sheath. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.
- E. Fan: Aluminum propeller directly connected to motor.
- F. Controls: Low-voltage relay with transformer kit.
- G. Electrical Connection: Factory wire motors and controls with disconnect switch.

#### PART 3 - EXECUTION

#### 3.1 **EXAMINATION**

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

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- B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.
- c. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.
- B. Install wall boxes in finished wall assembly; seal and weatherproof.
- c. Install cabinet unit heaters to comply with NFPA 90A.
- D. Install propeller unit heaters level and plumb.
- E. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers.

# 3.3 CONNECTIONS

A. Connect wiring according to Division 26.

# 3.4 STARTUP AND TESTING

- A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the owner.

# 3.5 DEMONSTRATION AND TRAINING

 Provide services of manufacturer's technical representative for two hours to instruct owner personnel responsible in the operation and maintenance of units.

**END OF SECTION** 

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#### **SECTION 23 89 00**

#### **METAL DUCTS**

#### PART 1 - GENERAL

- 1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 Summary: This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.

#### 1.3 Definitions:

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.
  - 1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.
- 1.4 System Description: Duct system design, as indicated, has been used to select and size airmoving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

#### 1.5 Submittals:

- A. Product Data: For duct liner and sealing materials.
- Indicate and interpret test results for compliance with B. Field Test Reports: performance requirements.
- C. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

## 1.6 Quality Assurance:

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- B. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

#### 1.7 Delivery, Storage, and Handling:

- A. Deliver sealant materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant materials according to manufacturer's written recommendations.

## PART 2 - PRODUCTS

## 2.1 Sheet Metal Materials:

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

- B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts: compatible materials for aluminum and stainlesssteel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).
- D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14, sheet form with standard, one-side bright finish for ducts exposed to view and with mill finish for concealed ducts.
- E. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
- F. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.

#### 2.2 Duct Liner: not allowed

#### 2.3 Sealant Materials:

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric
  - 1. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
  - 2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
  - 3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
  - 4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

#### 2.4 Hangers and Supports:

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structuralsteel fasteners appropriate for building materials.
  - Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 2. Exception: Do not use powder-actuated concrete fasteners for lightweightaggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
  - 2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
  - 1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  - 3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

## 2.5 Rectangular Duct Fabrication:

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct

Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

- 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
- 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Fabricate range hood exhaust ducts with 0.0598-inch- (1.5-mm-) thick, carbon-steel sheet for concealed ducts and 0.0500-inch- (1.3-mm-) thick stainless steel for exposed ducts. Weld and flange seams and joints. Comply with NFPA 96.
- C. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
  - 1. Supply Ducts: 3-inch wg.
  - 2. Return Ducts: 2-inch wg, negative pressure.
  - 3. Exhaust Ducts: 2-inch wg, negative pressure.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.
- 2.6 Round and Flat-Oval Supply and Exhaust Fitting Fabrication:
  - A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
  - B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

# PART 3 - EXECUTION

#### 3.1 Duct Installation, General:

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than eight feet, unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

# 3.2 Ductwork Material Application:

A. Unless noted otherwise, galvanized ductwork shall be used. Refer to the drawings for rectangular, spiral round or other types.

B. Exhaust ductwork in locker room areas (concealed and exposed) shall be fabricated from aluminum materials, in accordance with current Smacna standards. Refer to the drawings for rectangular, spiral round or other types.

## 3.3 Seam and Joint Sealing:

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and

# 3.4 Hanging and Supporting:

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding onefourth of failure (proof-test) load.
- E. Install concrete inserts before placing concrete.
- F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

#### 3.5 Connections:

- A. Connect equipment with flexible connectors.
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

# 3.6 Field Quality Control:

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-
- C. Remake leaking joints and retest until leakage is less than maximum allowable.
- D. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

#### 3.7 Adjusting:

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Section "Testing, Adjusting, and Balancing" for detailed procedures.
- 3.8 Cleaning: After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

#### **END OF SECTION**

#### **SECTION 23 93 00**

## **DIFFUSERS, REGISTERS, AND GRILLES**

#### PART 1 - GENERAL

- 1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 Summary: This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

#### 1.3 Definitions:

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

#### 1.4 Submittals:

- A. Product Data: For each model indicated, include the following:
  - a. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
  - b. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.

## 1.5 Quality Assurance:

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

# **PART 2 - PRODUCTS**

- 2.1 Manufactured Units: Diffusers, registers, and grilles are scheduled on Drawings.
- 2.2 Source Quality Control:
  - A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

#### PART 3 - EXECUTION

- 3.1 Examination: Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.2 Installation:

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- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- 3.3 Adjusting: After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- 3.4 Cleaning: After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

**END OF SECTION** 

# SECTION 26 00 00 PENETRATION FIRESTOPPING FOR ELECTRICAL

#### **PART 1 - GENERAL**

## 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

## 1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of firerated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

# 1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

Penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

# 1.04 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
  - 1. Section 03300 Cast-In-Place Concrete
  - 2. Section 04200 Masonry Work
  - 3. Section 07840 Firestopping
  - 4. Section 09290 Gypson Dry Wall Systems

#### 1.05 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Firestop Devices (XHJI)
    - b. Fire Resistance Ratings (BXRH)
    - c. Through-Penetration Firestop Systems (XHEZ)
    - d. Fill, Voids, or Cavity Material (XHHW)

- e. Forming Materials (XHKU)
- D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- G. All major building codes: ICBO, SBCCI, BOCA, and IBC.
- H. NFPA 101 Life Safety Code
- I. NFPA 70 National Electric Code

#### 1.06 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

# 1.07 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.
- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must

include both project name and contractor's name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

## 1.08 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.
- C. The work is to be installed by a contractor with at least one of the following qualifications:

FM 4991 Approved Contractor
UL Approved Contractor
Hilti Accredited Fire Stop Specialty Contractor

- D. Firm with not less than 3 years experience with fire stop installation.
- E. Successfully completed not less than 3 comparable scale projects using similar systems.

# 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

#### 1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

# B. Scheduling

- Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

# **PART 2 - PRODUCTS**

# 2.01 FIRESTOPPING, GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

# 2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
  - 1. Hilti, Inc., Tulsa, Oklahoma 800-879-8000 www.us.hilti.com
  - 2. Provide products from the above acceptable manufacturer; *no substitutions will be accepted.*

#### 2.03 MATERIALS

- A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
  - 1. Hilti Cast-In Place Firestop Device (CP 680-P) for use with combustible penetrants.
  - 2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
  - 3. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
  - 4. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
- C. Sealants, foams or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Flexible Firestop Sealant (CP 606)

- D. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles, and plastic pipe, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- E. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Flexible Firestop Sealant (CP 606)
- F. Non curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Firestop Putty Stick (CP 618)
  - 2. Hilti Firestop Plug (CFS-PL)
- G. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
  - 1. Hilti Firestop Putty Pad (CP 617)
  - 2. Hilti Firestop Box Insert
- H. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Mortar (CP 637)
  - 2. Hilti Firestop Block (CFS-BL)
  - 3. Hilti Fire Foam (CP 620)
  - 4. Hilti Firestop Board (CP 675T)
- I. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Board (CP 675T)
- J. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Plug (CFS-PL)
- K. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

#### **PART 3 - EXECUTION**

# 3.01 PREPARATION

- 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. Verify penetrations are properly sized and in suitable condition for application of materials.
  - Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

## 3.02 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

# 3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
  - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
  - 3. Protect materials from damage on surfaces subjected to traffic.

#### 3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.

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- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

# 3.06 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- A. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

# 3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

**END OF SECTION** 

#### **SECTION 26 05 00**

#### COMMON WORK RESULTS FOR ELECTRICAL

#### PART 1 - GENERAL

- 1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 Summary: This Section includes the following:
  - A. Supporting devices for electrical components.
  - B. Electrical identification.
  - C. Electricity-metering components.
  - D. Concrete equipment bases.
  - E. Electrical demolition.
  - F. Cutting and patching for electrical construction.
  - G. Touchup painting.
- 1.3 Definitions:
  - A. EMT: Electrical metallic tubing.
  - B. FMC: Flexible metal conduit.
  - C. IMC: Intermediate metal conduit.
  - D. LFMC: Liquid tight flexible metal conduit.
  - E. RNC: Rigid nonmetallic conduit.
  - F. RGSC: Rigid, heavy wall, galvanized steel conduct.
- 1.4 Submittals:
  - A. Product Data: For electricity-metering equipment.
  - B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
  - C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- 1.5 Quality Assurance:
  - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - B. Comply with NFPA 70.
- 1.6 Coordination:
  - A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
    - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
  - B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
  - C. Coordinate electrical service connections to components furnished by utility companies.
    - Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.

- 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- Coordinate location of access panels and doors for electrical items that are D. concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

#### PART 2 - PRODUCTS

#### 2.1 Supporting Devices:

- Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel. В.
- Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-C. inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
- D. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.
  - 1. Channel Thickness: Selected to suit structural loading.
  - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels, and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least one surface.
  - Fittings and Accessories: Products of the same manufacturer as channels and angles.
  - 2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, G.
- Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of Н. threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- ١. Expansion Anchors: Carbon-steel wedge or sleeve type.
- J. Toggle Bolts: All-steel springhead type.
- K. Powder-Driven Threaded Studs: Heat-treated steel.

#### 2.2 **Electrical Identification:**

- Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

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- Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
- 2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminate with a clear, weather- and chemical-resistant coating.
- 3. Color: Black letters on orange background.
- 4. Legend: Indicates voltage.
- C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).
- D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinvl tape with the following features:
  - 1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend that indicates type of underground line.
- E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
- H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.
- J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws, or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- 2.3 Equipment for Utility Company's Electricity Metering:
  - A. not used
- 2.4 Equipment for Electricity Metering by Owner: Not used.
- 2.5 Concrete Bases:
  - A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
  - B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."
- 2.6 Touch-up Paint:
  - A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
  - B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

# 3.1 Electrical Equipment Installation:

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange, and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

# 3.2 Electrical Supporting Device Application:

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

# 3.3 Support Installation:

- A. Install support devices to fasten and support electrical components securely and permanently.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

- Securely fasten electrical items and their supports to the building structure, M. unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - Wood: Fasten with wood screws or screw-type nails. 1.
  - Masonry: Toggle bolts on hollow masonry units and expansion bolts on 2. solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - Existing Concrete: Expansion bolts. 4.
  - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
  - Steel: Welded threaded studs or spring-tension clamps on steel. 6.
    - Field Welding: Comply with AWS D1.1.
  - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
  - 8. Light Steel: Sheet-metal screws.
  - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.
- 3.4 **Identification Materials and Devices:** 
  - Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
  - Coordinate names, abbreviations, colors, and other designations used for B. electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
  - C. Self-Adhesive Identification Products: Clean surfaces before applying.
  - D. Identify raceways and cables with color banding as follows:
    - Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
    - Band Locations: At changes in direction, at penetrations of walls and 2. floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8m) maximum intervals in congested areas.
    - 3. Colors: As follows:
      - Fire Alarm System: Red a.
      - Security System: Blue and yellow. b.
      - Telecommunication System: Green and yellow.
  - E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Colorcoding may be used for voltage and phase identification.
  - F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
  - Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
    - Phase A: Black 1.
    - 2. Phase B: Red
    - Phase C: Blue 3.
    - 4. Neutral: White
    - 5. Ground: Green

- H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
  - 1. Phase A: Yellow
  - 2. Phase B: Brown
  - 3. Phase C: Orange
  - 4. Neutral: Grey
  - Ground: Green with white trace.
- Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- 3.5 Utility Company Electricity-Metering Equipment: refer to drawings
- 3.6 Firestopping: Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."
- 3.7 Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- 3.8 Cutting and Patching:
  - A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
  - B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.
- 3.9 Field Quality Control: Inspect installed components for damage and faulty work, including the following:
  - A. Raceways
  - B. Building wire and connectors.
  - C. Supporting devices for electrical components.
  - D. Electrical identification.
  - E. Electricity-metering components.
  - F. Concrete bases.
  - G. Electrical demolition.
  - H. Cutting and patching for electrical construction.
  - I. Touchup painting.
- 3.10 Refinishing and Touchup Painting: Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
  - A. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.

- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
- C. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- D. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

## 3.11 Cleaning and Protection:

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

**END OF SECTION** 

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# SECTION 26 05 03 EQUIPMENT WIRING CONNECTIONS

## **PART 1 GENERAL**

## A. SUMMARY

- 1. Section includes electrical connections to equipment.
- 2. Related Sections:
  - a. Section 26 05 33 Raceway and Boxes for Electrical Systems.

## B. REFERENCES

- 1. National Electrical Manufacturers Association:
  - 1. NEMA WD 1 General Requirements for Wiring Devices.
  - 2. NEMA WD 6 Wiring Devices-Dimensional Requirements.

## C. SUBMITTALS

- 1. Section 01 33 00 Submittal Procedures: Submittal procedures.
- 2. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- 3. Manufacturer's installation instructions.

## D. CLOSEOUT SUBMITTALS

- 1. Section 01 70 00 Execution and Closeout Requirements: Submittal procedures.
- 2. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

## E. COORDINATION

- 1. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- 2. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- 3. Determine connection locations and requirements.
- Sequence rough-in of electrical connections to coordinate with installation of equipment.
- 5. Sequence electrical connections to coordinate with start-up of equipment.

## **PART 2 PRODUCTS**

#### **CORD AND PLUGS** Α.

- Attachment Plug Construction: Conform to NEMA WD 1. 1.
- 2. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
- Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

## **PART 3 EXECUTION**

#### **EXAMINATION** A.

Verify equipment is ready for electrical connection, for wiring, and to be energized.

#### В. **INSTALLATION**

- Make electrical connections. 1.
- Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- Install receptacle outlet to accommodate connection with attachment plug. 4.
- Install cord and cap for field-supplied attachment plug.
- Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- Install terminal block jumpers to complete equipment wiring requirements. 8.
- Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

#### C. **ADJUSTING**

Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup

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operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

**END OF SECTION** 

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## **SECTION 26 05 19**

## LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## **PART 1 GENERAL**

## 1.1 SUMMARY

 Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

## 1.2 REFERENCES

- A. International Electrical Testing Association:
  - NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
  - 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.:
  - UL 1277 Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

## 1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
  - 1. Conductor not smaller than 12 AWG for power and lighting circuits.
  - 2. Conductor not smaller than 14 AWG for control circuits.
  - 3. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods: Provide the following wiring methods:
  - 1. Concealed Dry Interior Locations: Use only building wire in raceway.
  - 2. Exposed Dry Interior Locations: Use only building wire in raceway.
  - 3. Above Accessible Ceilings: Use only building wire in raceway.
  - 4. Wet or Damp Interior Locations: Use only building wire in raceway.
  - 5. Exterior Locations: Use only building wire in raceway.

## 1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper unless indicated as aluminum or "AL".
- B. When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop.

## 1.5 SUBMITTALS

- Section 01 33 00 Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit for building wire and each cable assembly type.

- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- D. Test Reports: Indicate procedures and values obtained.

## 1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

## 1.7 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.
- B. Perform Work in accordance with
- Maintain one copy of each document on site.

## 1.8 QUALIFICATIONS

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

## 1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

## 1.10 COORDINATION

- A. Section 01 30 00 Administrative Requirements: Requirements for coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
- C. Wire and cable routing indicated is approximate unless dimensioned.

## **PART 2 PRODUCTS**

## 2.1 BUILDING WIRE

- A. Manufacturers:
  - Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 75 degrees C.

F. Insulation Material: Thermoplastic.

## 2.2 SERVICE ENTRANCE CABLE

- A. Manufacturers:
  - Refer to section 26 00 01 for electrical approved manufacturers.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: Type.

## 2.3 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. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- 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 EXISTING WORK

- A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.
- B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
- C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- D. Extend existing circuits using materials and methods as specified.
- E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

## 3.4 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. 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.
- D. Special Techniques-Building Wire in Raceway:
  - Pull conductors into raceway at same time.
  - 2. Install building wire 4 AWG and larger with pulling equipment.
- E. Special Techniques Cable:
  - 1. Protect exposed cable from damage.
  - 2. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
  - 3. Use suitable cable fittings and connectors.
- F. Special Techniques Wiring Connections:
  - 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. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- G. 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.
- H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- I. 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.
- J. 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.

## 3.5 WIRE COLOR

- A. General:
  - 1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
    - a. Black and red for single phase circuits at 120/240 volts.
    - b. Black, red, and blue for circuits at 120/208 volts single or three phase.

- Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
  - a. Black and red for single phase circuits at 120/240 volts.
  - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
  - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground 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.

## 3.6 FIELD QUALITY CONTROL

- A. Section: 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 7.3.1.

## **END OF SECTION**

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## **SECTION 26 05 26**

## **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

## **PART 1 - GENERAL**

- 1.1 Summary: This Section includes:
  - A. Rod electrodes.
  - B. Mechanical connectors.
  - C. Exothermic connections.

## 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. Concrete-encased electrode.
  - 3. Rod electrode.

## 1.4 Performance Requirements:

A. Grounding System Resistance: 5 ohms maximum.

## 1.5 Submittals:

- A. Product Data: Submit data on grounding electrodes and connections.
- B. Test Reports: Indicate overall resistance to ground.

## 1.6 Closeout Submittals:

- A. Section 01 70 00 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.
- B. Perform Work in accordance with

## 1.8 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 years experience.

## 1.9 Delivery, Storage, and Handling:

- A. Section 01 60 00 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. Section 01 30 00 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. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description:
  - 1. Material: Copper-clad steel or Copper.
  - 2. Diameter: 3/4 inch.
  - 3. Length: 10 feet.
- C. Connector: Connector for exothermic welded connection. or U-bolt clamp.

## 2.2 Wire:

- A. Material: Stranded copper.
- B. Foundation Electrodes: 4 AWG.
- C. Grounding Electrode Conductor: Copper conductor bare.
- D. Bonding Conductor: Copper conductor insulated.

## 2.3 Mechanical Connectors:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

## 2.4 Exothermic Connections:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

## **PART 3 - EXECUTION**

## 3.1 Examination:

- A. Section 01 30 00 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: 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.

## 3.4 Installation:

- A. Install in accordance with IEEE 142
- B. Install rod electrodes at indicated
- C. Install grounding and bonding conductors concealed from view.
- D. Install grounding well pipe with cover at. Install well pipe top flush with finished grade.
- E. Install 4 AWG bare copper wire in foundation footing.
- Bond together metal siding not attached to grounded structure; bond to ground.
- G. Bond together reinforcing steel and metal accessories in structures.
- H. Bond together each metallic raceway, pipe, duct and other metal object entering. Install AWG bare copper bonding conductor.
- Install isolated grounding conductor for circuits supplying in accordance with IEEE I. 1100.
- Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- K. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.
- L. 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 noncurrent carrying metal parts of electrical equipment.
- M. 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.
- N. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. 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. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.
- O. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.
- P. Permanently attach equipment and grounding conductors prior to energizing equipment.

## 3.5 Field Quality Control:

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground resistance testing in accordance with IEEE 142.

- D. Perform leakage current tests in accordance with NFPA 99.
- E. Perform continuity testing in accordance with IEEE 142.
- F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

**END OF SECTION** 

## **SECTION 26 05 29**

## HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## **PART 1 GENERAL**

## 1.1 SUMMARY

- A. Section Includes:
  - Conduit supports.
  - 2. Formed steel channel.
  - 3. Spring steel clips.
  - 4. Sleeves.
  - 5. Mechanical sleeve seals.
  - 6. Fire stopping relating to electrical work.
  - 7. fire stopping accessories.
  - 8. Equipment bases and supports.
- B. Related Sections:
  - 1. Section 03 30 00 Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
  - 2. Section 27 05 29 Hangers and Supports for Communications Systems.
  - 3. Section 28 05 29 Hangers and Supports for Electronic Safety and Security.

## 1.2 REFERENCES

- A. ASTM International:
  - ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  - ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
  - ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
  - ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems.
- B. FM Global:
  - 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):
  - WH Certification Listings.

#### 1.3 **DEFINITIONS**

Fire stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly A. 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. Fire stopping Materials: ASTM E119, ASTM E814, to achieve fire ratings
- B. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Fire stopping: Conform to applicable code FM for fire resistance ratings and surface burning characteristics.
- В. Fire stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

#### **SUBMITTALS** 1.6

- Section 01 33 00 Submittal Procedures: Requirements for submittals. A.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. **Product Data:** 
  - Hangers and Supports: Submit manufacturers catalog data including load capacity. 1.
  - 2. Fire stopping: Submit data on product characteristics, performance and limitation criteria.
- D. Fire stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- F. Manufacturer's Installation Instructions:
  - 1. Hangers and Supports: Submit special procedures and assembly of components.
  - 2. Fire stopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

#### 1.7 **QUALITY ASSURANCE**

- A. Through Penetration Fire stopping of Fire Rated Assemblies: 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.
  - Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour. 1.
  - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

- a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Fire stopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
  - Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
  - Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with
- G. Maintain one copy of each document on site.

## 1.8 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 years' experience.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 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.

## 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply fire stopping 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 fire stopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

## **PART 2 PRODUCTS**

## 2.1 CONDUIT SUPPORTS

- A. Manufacturers:
  - Refer to section 26 00 01 for electrical approved manufacturers.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- 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. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. 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 SLEEVES

- A. Furnish materials in accordance with
- B. Sleeves for Through Non-Fire Rated Floors: 18 gage thick galvanized steel.
- C. Sleeves for Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- E. Stuffing Insulation: Glass fiber type, non-combustible.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for approved electrical manufacturers.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

## 2.6 FIRESTOPPING

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for approved electrical manufacturers.

- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
  - Silicone fire stopping Elastomeric fire stopping: Single component silicone elastomeric compound and compatible silicone sealant.
  - 2. Foam Fire stopping Compounds: Single component foam compound.
  - 3. Formulated Fire stopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
  - 4. Fiber Stuffing and Sealant Fire stopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
  - Mechanical fire stopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
  - 6. Intumescent fire stopping: Intumescent putty compound which expands on exposure to surface heat gain.
  - 7. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: Dark gray.

## 2.7 FIRESTOPPING ACCESSORIES

- Primer: Type recommended by fire stopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
  - 1. Mineral fiberboard.
  - 2. Mineral fiber matting.
  - 3. Sheet metal.
  - Plywood or particle board.
  - 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
  - Furnish UL listed products.
  - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
  - Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
  - For exterior wall openings below grade, furnish modular mechanical type seal consisting
    of interlocking synthetic rubber links shaped to continuously fill annular space between
    conduit and cored opening or water-stop type wall sleeve.

## **PART 3 EXECUTION**

## 3.1 EXAMINATION

- Section 01 30 00 Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive fire stopping.

#### 3.2 **PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of fire stopping material.
- В. Remove incompatible materials affecting bond.
- C. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

#### **INSTALLATION - HANGERS AND SUPPORTS** 3.3

- A. Anchors and Fasteners:
  - Concrete Structural Elements: Provide precast inserts, powder actuated anchors and preset inserts.
  - 2. Steel Structural Elements: Provide beam clamps.
  - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide hollow wall fasteners.
  - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
  - Sheet Metal: Provide sheet metal screws. 6.
  - 7. Wood Elements: Provide wood screws.

#### В. Inserts:

- Install inserts for placement in concrete forms. 1.
- 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
- 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 above 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:

- Fabricate supports from structural steel or formed steel channel. Install hexagon head 1. 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.
- Support vertical conduit at every other floor. 4.
- G. Install Work in accordance with

#### 3.4 **INSTALLATION - FIRESTOPPING**

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring fire stopping.
- B. Apply primer where recommended by manufacturer for type of fire stopping material and substrate involved, and as required for compliance with required fire ratings.

- C. Apply fire stopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- E. Place intumescent coating in sufficient coats to achieve rating required.
- F. Remove dam material after fire stopping material has cured.

#### G. Fire Rated Surface:

- Seal opening at floor, ceiling, as follows:
  - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
  - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
  - Pack void with backing material. C.
  - Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire d. rating of structure penetrated.
- 2. Where cable tray, bus, cable bus, conduit, wireway, trough, penetrates fire rated surface, install fire stopping product in accordance with manufacturer's instructions.

#### H. Non-Rated Surfaces:

- Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
  - Install sleeve through opening and extending beyond minimum of 1 inch on both a. sides of building element.
  - Size sleeve allowing minimum of 1-inch void between sleeve and building b. element.
  - Install type of fire stopping material recommended by manufacturer.
- 2. Install escutcheons floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
- Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of 3. conduit and tighten in place, in accordance with manufacturer's instructions.
- 4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

#### 3.5 **INSTALLATION - EQUIPMENT BASES AND SUPPORTS**

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.
- В. 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 1 inch 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 stuffing insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install chrome plated steel escutcheons at finished surfaces.

## 3.7 FIELD QUALITY CONTROL

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed fire stopping for compliance with specifications and submitted schedule.

## 3.8 CLEANING

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of fire stopping materials.

## 3.9 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 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: Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

## 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.

## 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 or non-metallic conduit. Provide cast metal boxes or nonmetallic handhole.
- C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit, or nonmetallic conduit. Provide cast metal or nonmetallic boxes.
- D. In or Under Slab on Grade: Provide rigid steel conduit, thickwall nonmetallic conduit. Provide cast or nonmetallic metal boxes.
- E. Outdoor Locations, Above Grade: Provide, intermediate metal conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- F. In Slab Above Grade: Provide, intermediate metal conduit, or electrical metallic tubing. Provide cast boxes.
- G. Wet and Damp Locations: Provide rigid steel conduit, or thickwall nonmetallic conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- H. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- Exposed Dry Locations: Provide, electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

## 1.4 Design Requirements:

A. Minimum Raceway Size: 1/2 inch unless otherwise specified.

## 1.5 Submittals:

- A. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
  - 1. Flexible metal conduit.
  - 2. Liquidtight 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. Section 01 70 00 Execution and Closeout Requirements: Closeout procedures.
- **B. Project Record Documents:** 
  - 1. Record actual routing of conduits larger than 2 inch.
  - Record actual locations and mounting heights of outlet, pull, and junction boxes.

## 1.7 Delivery, Storage, and Handling:

- A. Section 01 60 00 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. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

## **PART 2 - PRODUCTS**

## 2.1 Metal Conduit:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Rigid Aluminum Conduit: ANSI C80.5.
- D. Intermediate Metal Conduit (IMC): Rigid steel.
- E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

## 2.2 Flexible Metal Conduit

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.

- B. Product Description: Interlocked steel construction.
- C. Fittings: NEMA FB 1.

## 2.3 Liquidtight Flexible Metal Conduit:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufactures.
- B. Fittings: NEMA FB 1.

## 2.4 Electrical Metallic Tubing (EMT):

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.

## 2.5 Nonmetallic Conduit:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

## 2.6 Surface Metal Raceway:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- C. Finish: Gray enamel.
- D. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

## 2.7 Surface Nonmetal Raceway:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.
- C. Finish: Gray.
- D. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

## 2.8 Wireway:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: General purpose type wireway.
- C. Knockouts: Manufacturer's standard.
- D. Size: 6 x 6 inch 8 x 8 inch; length as indicated on Drawings.
- E. Cover: Screw cover
- F. Connector: Slip-in.
- G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
- H. Finish: Rust inhibiting primer coating with gray enamel finish.

## 2.9 Outlet Boxes:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized 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.
- C. Nonmetallic Outlet Boxes: NEMA OS 2.
- D. Cast Boxes: NEMA FB 1, Type FD. Furnish gasketed cover by box manufacturer.
- E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

#### 2.10 Pull and Junction Boxes:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- C. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

## **PART 3 - EXECUTION**

- 3.1 Adjusting:
  - A. Section 01 70 00 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.

## 3.2 Cleaning:

- A. Section 01 70 00 Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

## **END OF SECTION**

# SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

## **PART 1 GENERAL**

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Nameplates.
  - Labels.
  - 3. Wire markers.
  - 4. Conduit markers.
  - 5. Stencils.
  - 6. Underground Warning Tape.
  - 7. Lockout Devices.

## 1.2 **SUBMITTALS**

- A. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Product Data:
  - 1. Submit manufacturer's catalog literature for each product required.
  - Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
- C. Samples:
  - 1. Submit two tags, actual size.
  - 2. Submit two labels, actual size.
  - 3. Submit samples of each type of identification products applicable to project.
  - 4. Submit nameplates, 4 x 4 inch ( mm) in size illustrating materials and engraving quality.
- Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

## 1.3 **CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

## 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with

## 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 three years' experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 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.
- Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 Product Requirements: Environmental conditions affecting products on site.
- B. Install labels only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

## **PART 2 PRODUCTS**

## 2.1 NAMEPLATES

- Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- B. Letter Size:
  - 1. 1/8 inch (3 mm) high letters for identifying individual equipment and loads.
  - 2. 1/4 inch (6 mm) high letters for identifying grouped equipment and loads.
- C. Minimum nameplate thickness: 1/8 inch (3 mm).

## 2.2 LABELS

- 1. Substitutions.
- B. Furnish materials in accordance with of standards.
- C. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background.

## 2.3 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.
  - 2.

## 2.4 CONDUIT AND RACEWAY MARKERS

- A. Description: Nameplate fastened with adhesive Labels fastened with adhesive.
- B. Color:
  - 1. Medium Voltage System:
  - 2. 480 Volt System: Black lettering on white background.

- 3. 208 Volt System: Black lettering on white background.
- C. Legend:
  - Medium Voltage System: HIGH VOLTAGE. 1.
  - 2. 480 Volt System: 480 VOLTS.
  - 3. 208 Volt System: 208 VOLTS.
  - 4. System:

#### 2.5 **STENCILS**

- A. Stencils: With clean cut symbols and letters of following size:
  - Up to 2 inches (50 mm) Outside Diameter of Raceway: 1/2 inch (13 mm) high letters.
  - 2. 2-1/2 to 6 inches (64 to 150 mm) Outside Diameter of Raceway: 1 inch (25 mm) high
- В. Stencil Paint: As specified in Section, semi-gloss enamel, colors conforming to the following:
  - Black lettering on white background.

#### 2.6 **UNDERGROUND WARNING TAPE**

Description: 4 inch (100 mm) wide plastic tape, detectable type, colored red with suitable warning A. legend describing buried electrical lines.

## **PART 3 EXECUTION**

#### 3.1 **PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- В. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

#### 3.2 **EXISTING WORK**

- A. Install identification on existing equipment to remain in accordance with this section.
- B. Install identification on unmarked existing equipment.
- C. Replace lost nameplates markers.
- D. Re-stencil existing equipment.

#### 3.3 INSTALLATION

- A. Install identifying devices after completion of painting.
- В. Nameplate Installation:
  - Install nameplate parallel to equipment lines. 1.
  - 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 screws, rivets, or adhesive.
  - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
  - Install nameplates for the following: 6.

- a. Switchboards.
- b. Panelboards.
- c. Transformers.
- d. Service Disconnects.
- e.

## C. Label Installation:

- 1. Install label parallel to equipment lines.
- 2. Install label for identification of individual control device stations, and.
- 3. Install labels for permanent adhesion and seal with clear lacquer.

## D. Wire Marker Installation:

- Install wire marker for each conductor at each load connection.
- 2. Mark data cabling at each end. Install additional marking at accessible locations along the
- Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

## E. Conduit Raceway Marker Installation:

- Install conduit raceway marker for each conduit raceway longer than 6 feet (2000 mm).
- 2. Conduit Raceway Marker Spacing: 20 feet (6000 mm) on center.

## F. Underground Warning Tape Installation:

 Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried conduit, raceway, or cable.

## **END OF SECTION**

## **SECTION 26 05 73**

### ARC FLASH HAZARD ANALYSIS/SHORT-CIRCUIT/COORDINATION STUDY

## **PART 1 GENERAL**

## **1.01 SCOPE**

- A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical gear supplier.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 2002, the IEEE Guide for Performing Arc-Flash Calculations.
- C. The scope of the studies shall include new distribution equipment supplied nder this contract.

## 1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract.

## 1.03 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - IEEE 141 Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  - IEEE 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  - 3. IEEE 399 Recommended Practice for Industrial and Commercial Power System Analysis
  - 4. IEEE 241 Recommended Practice for Electric Power Systems in Commercial Buildings
  - IEEE 1015 Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
  - 6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
  - ANSI C57.12.00 Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  - 2. ANSI C37.13 Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  - ANSI C37.010 Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  - ANSI C 37.41 Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. The National Fire Protection Association (NFPA)
  - 1. NFPA 70 -National Electrical Code, latest edition
  - 2. NFPA 70E Standard for Electrical Safety in the Workplace

## 1.04 SUBMITTALS FOR REVIEW/APPROVAL

A. The studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

## 1.05 SUBMITTALS FOR CONSTRUCTION

- A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Electronic PDF copies of the report shall be provided upon request.
- B. The report shall include the following sections:
  - 1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
  - 2. Short-Circuit Methodology Analysis Results and Recommendations
  - 3. Short-Circuit Device Evaluation Table
  - 4. Protective Device Coordination Methodology Analysis Results and Recommendations
  - 5. Protective Device Settings Table
  - 6. Time-Current Coordination Graphs and Recommendations
  - Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
  - Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
  - 9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

## 1.06 QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be an employee of the equipment manufacturer or an approved engineering firm.

### **PART 2 PRODUCT**

## **2.01 STUDIES**

A. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies.

## 2.02 **DATA**

- A. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future motors and generators.
- Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
- D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

#### 2.03 SHORT-CIRCUIT ANALYSIS

- A. Transformer design impedances shall be used when test impedances are not available.
- B. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
  - 4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
  - Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
  - Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
- C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.
- D. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to short circuit ratings
  - Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
  - Square D shall notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

### 2.04 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

- A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title with descriptive device names.

- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
  - Electric utility's overcurrent protective device
  - 2. Medium voltage equipment overcurrent relays
  - Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  - 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  - 5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
  - 6. Medium voltage conductor damage curves
  - 7. Ground fault protective devices, as applicable
  - Pertinent motor starting characteristics and motor damage points, where applicable
  - 9. Pertinent generator short-circuit decrement curve and generator damage point
  - 10. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
- G. Provide the following:
  - 1. A One-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
  - A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
  - Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
  - 4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram
  - A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
  - 6. Square D shall notify Owner in writing of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

## 2.05 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D. The arc flash hazard analysis shall be performed in conjunction with the shortcircuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)
- B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. Circuits 240V or less where available bolted short circuit current is less than 10 kA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E Table 130.7(C)(9)(a),

including footnote 3.

- D. Circuits 240V or less fed by transformers 112.5 kVA or less may be omitted from the computer model and will be assumed to have a hazard risk category 0 per IEEE 1584.
- E. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
- F. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- G. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

- H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 5 cycles.
- I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically

possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## M. Provide the following:

- Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
- 2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
- 3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

### **PART 3 EXECUTION**

### 3.01 FIELD ADJUSTMENT

- A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

### 3.02 ARC FLASH LABELS

- A. Contractor shall provide a 4.0 in. x 4.0 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
  - 1. UL969 Standard for Marking and Labeling Systems
  - 2. ANSI Z535.4 Product Safety Signs and Labels
  - 3. NFPA 70 (National Electric Code) Article 110.16
- C. The label shall include the following information:
  - 1. System Voltage
  - 2. Flash protection boundary
  - 3. Personal Protective Equipment category
  - Arc Flash Incident energy value (cal/cm²)
  - 5. Limited, restricted, and prohibited Approach Boundaries
  - 6. Study report number and issue date
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.
- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

- Floor Standing Equipment Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
- 2. Wall Mounted Equipment Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
- 3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

### **Label Installation**

F. Labels shall be field installed by the contractor.

**END OF SECTION** 

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## **SECTION 26 09 23**

### LIGHTING CONTROL DEVICES

### **PART 1 - GENERAL**

- 1.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 Summary: Section includes photoelectric sensors, and occupancy sensors.
- 1.3 Submittals:
  - A. Product Data: Include dimensions and data on features, components, and ratings for lighting control devices.
  - B. Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 1.

# 1.4 Quality Assurance:

- A. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.
- C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.
- 1.5 Coordination: Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

## **PART 2 - PRODUCTS**

- 2.1 Manufacturers:
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Photoelectric Sensors:
      - a. Refer to section 26 00 01 for electrical approved manufacturers.
    - 2. Occupancy Sensors:
      - a. Refer to section 26 00 01 for electrical approved manufacturers.
    - 3. Time Clocks:
      - a. Refer to section 26 00 01 for electrical approved manufacturers.
- 2.2 General Lighting Control Device Requirements:
  - A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.
- 2.3 Photoelectric Sensors:
  - A. Description: Solid state, complying with UL 773A.
  - B. Light-Level Monitoring Range: 0 to 3500 fc (0 to 37 673 lx).
  - C. Indoor Ceiling- or Wall-Mounting Units: Semiflush, calibrated to detect adequacy of daylighting in perimeter locations, and arranged to turn artificial illumination on and off to suit varying intensities of available daylighting.

D. Outdoor Sealed Units: Weathertight housing, resistant to high temperatures and equipped with sun-glare shield and ice preventer.

## 2.4 Occupancy Sensors:

- A. Ceiling-Mounting Units: Unit receives 24-V dc power from a remote source and, on sensing occupancy, closes contacts that provide signal input to a remote microprocessor-based lighting control system.
- B. Switch-Box-Mounting Units: Unit receives power directly from switch leg of the 120-or 277-V ac circuit it controls and operates integral power switching contacts rated 800 W at 120-V ac, and 1000 W at 277-V ac, minimum.
- C. Operation: Refer to lighting control scope of work on drawings.
- D. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in the field by operating controls on unit.

### **PART 3 - EXECUTION**

### 3.1 Installation:

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Mount lighting control devices according to manufacturer's written instructions and requirements in Division 26 Section "Common Work Results for Electrical."
- C. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

# 3.2 Control Wiring Installation:

- A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Division 26 Section "Conductors and Cables" for low-voltage connections and Division 26 Section "Voice and Data Systems" for digital circuits.
- B. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes."
- C. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes," unless run in accessible ceiling space and gypsum board partitions.
- D. Bundle, train, and support wiring in enclosures.
- E. Ground equipment.
- F. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

## 3.3 Identification:

- A. Identify components and power and control wiring according to Division 26 Section "Common Work Results for Electrical."
- B. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."

## 3.4 Field Quality Control:

- A. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.
- B. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
- C. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.

- D. Verify settings of photoelectric devices with photometer calibrated within previous six months.
- E. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
  - 1. Continuity tests of circuits.
  - 2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
    - a. Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
- 3.5 Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.
- 3.6 Demonstration: Train Owner's maintenance personnel as specified below:
  - A. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of three hours' training.
  - B. Training Aid: Use the approved final version of maintenance manuals as a training aid.
  - C. Schedule training with Owner, through Architect, with at least seven days' advance notice.

**END OF SECTION** 

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## **SECTION 26 14 10**

### WIRING DEVICES

### **PART 1 - GENERAL**

- 1.1 Work Includes:
  - A. Base Bid:
    - 1. Electrical Contractor:
      - a. Receptacles, connectors, switches, and finish plates.
- 1.2 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.3 Definitions:
  - A. GFCI: Ground-fault circuit interrupter.
  - B. TVSS: Transient voltage surge suppressor.
- 1.4 Submittals:
  - A. See Section 01 33 00 Shop Drawings, Product Data and Samples, for submittal procedures.
  - B. Product Data: For each product specified.
  - C. Shop Drawings: Legends for receptacles and switch plates.
  - D. Samples: For devices and device plates for color selection and evaluation of technical features.
  - E. Maintenance Data: For materials and products to include in maintenance manuals specified in Section 01 73 00.
- 1.5 Quality Assurance:
  - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
  - B. Comply with NEMA WD 1.
  - C. Comply with NFPA 70.
- 1.6 Coordination:
  - A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
    - 1. Cord and Plug Sets: Match equipment requirements.

### **PART 2 - PRODUCTS**

- 2.1 Manufacturers:
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Wiring Devices:
      - a. Refer to section 26 00 01 for electrical approved manfacturers.
    - 2. Wiring Devices for Hazardous (Classified) Locations:
      - a. Refer to section 26 00 01 for electrical approved manufacturers.

### 3. Multi-outlet Assemblies:

a. Refer to section 26 00 01 for electrical approved manufacturers.

## 2.2 Receptacles:

- A. Straight-Blade and Locking Receptacles: Specification grade.
- B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.
- C. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.
  - 1. Devices: Listed and labeled as isolated-ground receptacles.
  - 2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
- D. TVSS Receptacles: Duplex type, NEMA WD 6, Configuration 5-20R, with integral TVSS in line to ground, line to neutral, and neutral to ground.
  - 1. TVSS Components: Multiple metal-oxide varistors; rated a nominal clamp level of 500 transient-suppression voltage and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.
  - 2. Active TVSS Indication: Light visible in face of device to indicate device as "active" or "no longer active."
  - 3. Identification: Distinctive marking on face of device denotes TVSS-type unit.
- E. Industrial Heavy-Duty Receptacle: Comply with IEC 309-1.
- F. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

## 2.3 Cord and Plug Sets:

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

### 2.4 Switches:

- A. Snap Switches: Specification grade, quiet type.
- B. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
  - 1. Switch: 20 A, 120/277-V ac.
  - 2. Receptacle: NEMA WD 6, Configuration 5-20R.
- C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.
  - 1. Control: Continuously adjustable slide, toggle, or rotary knob. Single-pole or three-way switch to suit connections.
  - 2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle, or slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads.

- 3. Fluorescent Lamp Dimmers: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness.
- 2.5 Wall Plates: Single and combination types match corresponding wiring devices.
  - A. Plate-Securing Screws: Metal with head color to match plate finish.
  - B. Material for Finished Spaces: Heavy plastic, specification grade, ivory finish.
  - C. Material for Unfinished Spaces: Galvanized steel.

# 2.6 Floor Service Fittings:

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Type: Modular, above-floor, dual-service units suitable for wiring method used.
- C. Compartmentation: Barrier separates power and signal compartments.
- D. Housing Material: Die-cast aluminum, satin finished.
- E. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise
- F. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

# 2.7 Multioutlet Assemblies:

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Wire: as indicated by drawings. Refer to drawings for additional specification

## 2.8 Telephone/Power Service Poles:

- A. Poles: Nominal 2.5-inch- (65-mm-) square cross section with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and separate channels for power and signal wiring.
- B. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports, and pole foot with carpet pad attachment.
- C. Finishes: One of manufacturers standard finish and trim combinations, including painted and satin anodized-aluminum finishes and wood-grain-type trim.
- D. Wiring: as indicated by drawings.

### **PART 3 - EXECUTION**

## 3.1 Installation:

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- F. Protect devices and assemblies during painting.
- G. Adjust locations at which floor service outlets are installed to suit arrangement of partitions and furnishings.

# 3.2 Identification:

- A. Comply with Section 26 05 00 "Common Work Results for Electrical."
  - 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

### 3.3 Connections:

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

## 3.4 Field Quality Control:

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Check TVSS receptacle indicating lights for normal indication.
- C. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- D. Replace damaged or defective components.
- 3.5 Cleaning: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

**END OF SECTION** 

February 6, 2024 26 14 10 - 4

## **SECTION 26 24 16**

### **PANELBOARDS**

### 1 GENERAL

#### Summary: A.

- Section includes distribution and branch circuit panelboards, electronic grade 1. branch circuit panelboards.
- Related Sections: 2.
  - Section 26 05 26 Grounding and Bonding for Electrical Systems. a.
  - Section 26 05 53 Identification for Electrical Systems. b.

#### B. References:

- Institute of Electrical and Electronics Engineers:
  - IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- 2. National Electrical Manufacturers Association:
  - NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches. a.
  - NEMA FU 1 Low Voltage Cartridge Fuses. b.
  - NEMA ICS 2 Industrial Control and Systems: Controllers, Contactors, C. and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
  - d. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
  - NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment e. Switches (600 Volts Maximum).
  - f. NEMA PB 1 - Panelboards.
  - NEMA PB 1.1 General Instructions for Proper Installation, Operation, g. and Maintenance of Panelboards Rated 600 Volts or Less.
- 3. **International Electrical Testing Association:** 
  - NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- 4. National Fire Protection Association:
  - NFPA 70 National Electrical Code.
- 5. Underwriters Laboratories Inc.:
  - UL 67 Safety for Panelboards. a.
  - UL 1283 Electromagnetic Interference Filters. b.
  - UL 1449 Transient Voltage Surge Suppressors. C

#### C. Submittals:

- Section 01 33 00 Submittal Procedures: Requirements for submittals. 1.
- 2. 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.
- Product Data: Submit catalog data showing specified features of standard 3. products.

#### D. Closeout Submittals:

Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

- 2. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- 3. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

#### E. Qualifications:

- Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- F. Maintenance Materials: Furnish two of each panelboard key. Panelboards keyed alike.

### 2 PRODUCTS

- Distribution Panelboards: G.
  - Manufacturers:
    - Refer to section 26 00 01 for electrical approved manufacturers.
  - 2. Product Description: NEMA PB 1, circuit breaker type panelboard.
  - 3. Panelboard Bus: Aluminum, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
  - 4. Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 240 208 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
  - 5. 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.
  - 6. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated on
  - 7. Enclosure: NEMA PB 1, Type 1
  - Cabinet Front: Surface type, fastened with screws, finished in manufacturer's 8. standard gray enamel.

#### Η. **Branch Circuit Panelboards:**

- 1. Manufacturers:
  - Refer to section 26 00 01 for electrical approved manufacturers.
- 2. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- 3. Panelboard Bus: Aluminum, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard; furnish insulated ground bus as indicated on Drawings.
- 4. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
- 5. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
- Enclosure: NEMA PB 1, Type 1. 6.
- Cabinet Box: 6 inches deep, 20 inches wide. 7.
- 8. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge. metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

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#### 3 **EXECUTION**

### i. Installation:

- 1. Install panelboards in accordance with NEMA PB 1.1.
- 2. Install panelboards plumb.
- 3. Install recessed panelboards flush with wall finishes.
- 4. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- 5. Install filler plates for unused spaces in panelboards.
- 6. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.
- 7. Install engraved plastic nameplates in accordance with Section 26 05 53.
- 8. Install spare conduits out of each recessed panelboard to accessible location. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.
- Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

# ii. Field Quality Control:

- 1. Section: Field inspecting, testing, adjusting, and balancing.
- 2. Inspect and test in accordance with NETA ATS, except Section 4.
- 3. Perform circuit breaker inspections and tests listed in NETA ATS, Section
- 4. Perform switch inspections and tests listed in NETA ATS, Section 7.5.
- 5. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

## iii. Adjusting:

- 1. Section: Requirements for starting and adjusting.
- 2. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

**END OF SECTION** 

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## **SECTION 26 28 19**

### **ENCLOSED SWITCHES**

### **PART 1 - GENERAL**

### 1.1 Summary:

A. Section includes fusible and non-fusible 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 Qualifications:

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

# **PART 2 - PRODUCTS**

## 2.1 Fusible Switch Assemblies:

- A. Manufacturers:
  - 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: NEMA KS 1, Type GD, enclosed load interrupter knife switch. Handle lockable in OFF position.
- C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
- D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
  - 1. Interior Dry Locations: Type 1.
  - 2. Exterior Locations: Type 3R.
  - 3. Industrial Locations: Type.
  - 4. Locations: Type.
- E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- F. Furnish switches with entirely copper current carrying parts.

# 2.2 Non-Fusible Switch Assemblies:

A. Manufacturers:

- 1. Refer to section 26 00 01 for electrical approved manufacturers.
- B. Product Description: NEMA KS 1, Type GD enclosed load interrupter knife switch. Handle lockable in OFF position.
- C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
  - 1. Interior Dry Locations: Type 1.
  - 2. Exterior Locations: Type 3R.
  - 3. Industrial Locations: Type.
  - 4. Locations: Type.
- D. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- E. Furnish switches with entirely copper current carrying parts.

## 2.3 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 00.
- B. Height: 5 feet to operating handle.
- C. Install fuses for fusible disconnect switches.
- D. Install engraved plastic nameplates in accordance with Section 26 05 00.
- 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: 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 26 28 19.

# **SECTION 26 28 26**

### TRANSFER SWITHCES

#### 1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Α. Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 **SUMMARY**

- This Section includes transfer switches rated 600 V and less, including the following: Α.
  - Automatic transfer switch. 1.

#### 1.3 **SUBMITTALS**

- Include ratings and dimensioned plans, sections, and elevations Α. showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- Detail wiring for transfer switches and differentiate between B. Wiring Diagrams: manufacturer-installed and field-installed wiring. Show both power and control wiring.
- C. Product Certificates: Signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for load ratings and short-circuit closing and withstand ratings applicable to units for Project.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Maintenance Data: For each type of product to include in maintenance manuals specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay-setting and calibration instructions, including software, where applicable.

#### 1.4 **QUALITY ASSURANCE**

- Α. Manufacturer Qualifications: Maintain a service center capable of providing emergency maintenance and repairs at Project site with an eight-hour maximum response time.
- В. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction.
- C. Comply with NEMA ICS 1.
- D. Comply with NFPA 70.

- E. Comply with NFPA 99.
- Comply with NFPA 110. F.
- G. Comply with UL 1008, unless requirements of these Specifications are stricter.

# **PART 2 - PRODUCTS**

#### 2.1 **MANUFACTURERS**

- Manufacturers: Subject to compliance with requirements, provide products by one of Α. the following:
  - 1. Conventional Automatic Transfer Switches:
    - Caterpillar, Inc.; Engine Division.
    - b. Cummins
    - Emerson Electric Co.; Automatic Switch Co. Subsidiary. C.
    - Generac Corp. d.
    - Kohler Co. e.
    - Onan Corp.; Electrical Products Division. f.
    - Spectrum Detroit Diesel. g.
    - Russelectric, Inc. h.
    - Zenith Controls, Inc. i.

#### 2.2 **GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS**

- Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and Α. total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- В. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Where Transfer Switch Includes Internal Fault-Current Protection: Rating of switch and trip unit combination exceeds indicated fault-current value at installation location.
- C. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels have communications capability matched with remote device.
- D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

- E. Resistance to Damage by Voltage Transients: Components meet or exceed voltagesurge withstand capability requirements when tested according to IEEE C62.41. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- G. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508, unless otherwise indicated.
- H. Heater: Equip switches exposed to outdoor temperature and humidity conditions, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- I. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
  - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- K. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
  - 2. Switch Action: Double throw; mechanically held in both directions.
  - Contacts: Silver composition or silver alloy for load-current switching.
     Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

## 2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

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TRANSFER SWITCHES

- E. Signal-before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- F. Digital Communications Interface: Matched to capability of remote annunciator or annunciator and control panel.
- G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- H. Automatic Open-Transition Transfer Switches: Functions and characteristics:
  - 1. Failure of the power source serving the load initiates automatic open transfer.

## 2.4 FINISHES

A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

# 2.5 SOURCE QUALITY CONTROL

A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

## **PART 3 - EXECUTION**

# 3.1 INSTALLATION

- A. Wall-Mounted Switch: Level and anchor unit to wall.
- B. Install according to manufacturer's written direction
- C. Identify components according to Division 26 Section "Basic Electrical Materials and Methods."

## 3.2 CONNECTIONS

A. Ground equipment as indicated and as required by NFPA 70.

# 3.3 FIELD QUALITY CONTROL

A. Testing: Test transfer-switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory-

- authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.
- B. Coordinate tests with tests of generator plant and run them concurrently.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

#### 3.4 **CLEANING**

- After completing equipment installation, inspect unit components. Α. splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean equipment internally, on completion of installation, according to manufacturer's written instructions.

# **END OF SECTION**

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# **26 29 13 ENCLOSED CONTROLLERS**

## 1.1 GENERAL

Α. Summary: Section includes manual and magnetic motor controllers in individual enclosures.

#### B. References:

- National Electrical Manufacturers Association:
  - NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches.
  - NEMA FU 1 Low Voltage Cartridge Fuses. b.
  - NEMA ICS 2 Industrial Control and Systems: Controllers, Contactors, and C. Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
  - d. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
  - NEMA ICS 6 Industrial Control and Systems: Enclosures. e.
  - NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches f. (600 Volts Maximum).
- 2. **International Electrical Testing Association:** 
  - NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

#### C. Submittals:

- Section 01 33 00 Submittal Procedures: Submittal procedures.
- Product Data: Submit catalog sheets showing voltage, controller size, ratings and 2. size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- 3. Test Reports: Indicate field test and inspection procedures and test results.

#### D. **Closeout Submittals:**

- Section 01 70 00 Execution and Closeout Requirements: Closeout procedures.
- 2. Project Record Documents: Record actual locations and ratings of enclosed controllers.
- 3. Operation and Maintenance Data: Submit Replacement parts list for controllers.

#### E. Qualifications:

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

## 1.2 **PRODUCTS**

- Full-Voltage Non-Reversing Controllers: Α.
  - Manufacturers: 1.
    - Square D a.
    - Cutler Hammer b.
    - General Electric
  - 2. Product Description: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

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- Control Voltage: 120 volts, 60 Hertz. 3.
- 4. Overload Relay: NEMA ICS 2; bimetal.
- 5. Product Features:
  - Auxiliary Contacts: NEMA ICS 2, each field convertible contacts in addition to seal-in contact.
  - b. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty type.
  - C. Pilot Device Contacts: NEMA ICS 5, Form Z, rated.
  - d. Pushbuttons: Unguarded type.
  - Indicating Lights: LED type. e.
  - f. Selector Switches: Rotary type.
  - Relays: NEMA ICS 2.
  - Control Power Transformers: 120 volt secondary, Furnish fused secondary, and h. bond unfused leg of secondary to enclosure.
- 6. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from galvanized steel.
  - Interior Dry Locations: Type 1. a.
  - b. Exterior Locations: Type 3r.

#### 1.3 **EXECUTION**

- **Existing Work:** A.
  - Disconnect and remove abandoned enclosed motor controllers.
  - 2. Maintain access to existing enclosed motor controllers and other installations to remain active and to require access. Modify installation or provide access panel.
  - 3. Clean and repair existing enclosed motor controllers to remain or to be reinstalled.

#### В. Installation:

- Install enclosed controllers plumb. Provide supports in accordance with Section 1. 26 05 00.
- Height: 5 feet to operating handle. 2.
- Install fuses for fusible switches. Refer to 3.
- 4. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- Install engraved plastic nameplates. Refer to Section 26 05 00 for product 5. requirements and location.
- 6. Neatly type label and place inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.
- C. Field Quality Control:
  - Section: Field inspecting, testing, adjusting, and balancing. 1.
  - 2. Inspect and test in accordance with NETA ATS, except Section 4.
  - 3. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

**END OF SECTION** 

# SECTION 26 29 23 VARIABLE FREQUENCY DRIVES

# 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

A. This Section includes solid-state, PWM, VFCs for speed control of three-phase, squirrel-cage induction motors.

## 1.3 DEFINITIONS

- A. BMS: Building management system.
- B. IGBT: Integrated gate bipolar transistor.
- C. LAN: Local area network.
- D. PID: Control action, proportional plus integral plus derivative.
- E. PWM: Pulse-width modulated.
- F. VFC: Variable frequency controller.

## 1.4 SUBMITTALS

- A. Product Data: For each type of VFC, provide dimensions; mounting arrangements; location for conduit entries; shipping and operating weights; and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.
- B. Shop Drawings: For each VFC.
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current ratings of integrated unit.
    - d. UL listing for series rating of overcurrent protective devices in combination controllers.
    - Features, characteristics, ratings, and factory settings of each motorcontrol center unit.

- 2. Wiring Diagrams: Power, signal, and control wiring for VFC. Provide schematic wiring diagram for each type of VFC.
- C. Field Test Reports: Written reports specified in Part 3.
- D. Manufacturer's field service report.
- E. Operation and Maintenance Data: For VFCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following:
  - 1. Routine maintenance requirements for VFCs and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- G. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

# 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain VFCs of a single type through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, minimum clearances between VFCs, and adjacent surfaces and other items. Comply with indicated dimensions and clearances.
- E. Comply with NFPA 70.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver VFCs in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.
- B. Store VFCs indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFCs from exposure to dirt, fumes, water, corrosive substances, and physical damage.

If stored in areas subject to weather, cover VFCs to protect them from weather, dirt, C. dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### 1.7 COORDINATION

- Coordinate layout and installation of VFCs with other construction including conduit, Α. piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate features of VFCs, installed units, and accessory devices with pilot devices and control circuits to which they connect.
- Coordinate features, accessories, and functions of each VFC and each installed unit C. with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

## PART 2 - PRODUCTS

#### 2.1 **MANUFACTURERS**

- Α. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
  - Baldor Electric Company (Graham). 2.
  - Danfoss Inc.; Danfoss Electronic Drives Div. 3.
  - Eaton Corp.: Cutler-Hammer Products.
  - 5. General Electrical Distribution & Control.
  - 6. MagneTek Drives and Systems.
  - Rockwell Automation Allen-Bradley Co.; Industrial Control Group. 7.
  - 8. Siemens Energy and Automation: Industrial Products Division.
  - 9. Square D Co.
  - Toshiba International Corporation. 10.

#### 2.2 VARIABLE FREQUENCY CONTROLLERS

- Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit Α. and arranged to provide variable speed of a NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a powertransmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

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# D. Unit Operating Requirements:

- 1. Input ac voltage tolerance of 200 to 222 V, plus or minus 10 percent.
- 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
- 3. Capable of driving full load, under the following conditions, without derating:
  - a. Ambient Temperature: 0 to 40 deg C.
  - b. Humidity: Less than 90 percent (non-condensing).
  - c. Altitude: 3300 feet (1000 m) or less.
- 4. Minimum Efficiency: 96 percent at 60 Hz, full load.
- 5. Minimum Displacement Primary-Side Power Factor: 96 percent.
- 6. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
- 7. Starting Torque: 100 percent of rated torque or as indicated.
- 8. Speed Regulation: Plus or minus 1 percent.
- 9. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

# E. Internal Adjustability Capabilities:

- 1. Minimum Speed: 5 to 25 percent of maximum rpm.
- 2. Maximum Speed: 100 percent of maximum rpm.
- 3. Acceleration: 2 to a minimum of 22 seconds.
- 4. Deceleration: 2 to a minimum of 22 seconds.
- 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.

# F. Self-Protection and Reliability Features:

- 1. Input transient protection by means of surge suppressors.
- 2. Snubber networks to protect against malfunction due to system voltage transients.
- 3. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
- 4. Motor Overload Relay: Adjustable and capable of NEMA 250, Class [10] [20] [30] performance.
- 5. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
- 6. Instantaneous line-to-line and line-to-ground overcurrent trips.
- 7. Loss-of-phase protection.
- 8. Reverse-phase protection.
- 9. Short-circuit protection.
- 10. Motor overtemperature fault.
- G. Automatic Reset and Restart: To attempt three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

- H. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- Torque Boost: Automatically vary starting and continuous torque to at least 1.5 times
  the minimum torque to insure high-starting torque and increased torque at slow
  speeds.
- J. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled fan-ventilated motors at slow speeds.
- K. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
  - 1. Power on.
  - 2. Run.
  - 3. Overvoltage.
  - 4. Line fault.
  - 5. Overcurrent.
  - External fault.
- L. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- M. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
  - 1. Output frequency (Hz).
  - 2. Motor speed (rpm).
  - 3. Motor status (running, stop, fault).
  - 4. Motor current (amperes).
  - 5. Motor torque (percent).
  - 6. Fault or alarming status (code).
  - 7. PID feedback signal (percent).
  - 8. DC-link voltage (VDC).
  - 9. Set-point frequency (Hz).
  - 10. Motor output voltage (V).
- N. Control Signal Interface: Provide VFC with the following:
  - 1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
  - 2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
    - a. 0 to 10-V dc.
    - b. 0-20 or 4-20 mA.
    - Potentiometer using up/down digital inputs.
    - d. Fixed frequencies using digital inputs.
    - e. RS485.
    - f. Keypad display for local hand operation.

- 3. Output Signal Interface:
  - A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
    - 1) Output frequency (Hz).
    - Output current (load).
    - 3) DC-link voltage (VDC).
    - 4) Motor torque (percent).
    - 5) Motor speed (rpm).
    - 6) Set-point frequency (Hz).
- 4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
  - a. Motor running.
  - b. Set-point speed reached.
  - c. Fault and warning indication (overtemperature or overcurrent).
  - d. PID high or low speed limits reached.
- O. Communications: Provide an RS485 interface allowing VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.
- P. Manual Bypass: Arrange magnetic contactor to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch sets mode, and indicator lights give indication of mode selected. Unit shall be capable of stable operation (starting, stopping, and running), with motor completely disconnected from controller (no load).
- Q. Isolating Switch: Non-load-break switch arranged to isolate VFC and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
- R. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.

# 2.3 ENCLOSURES

A. Nema 1

## 2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

# D. Standard Displays:

- 1. Output frequency (Hz).
- 2. Set-point frequency (Hz).
- 3. Motor current (amperes).
- 4. DC-link voltage (VDC).
- 5. Motor torque (percent).
- 6. Motor speed (rpm).
- 7. Motor output voltage (V).

# E. Historical Logging Information and Displays:

- 1. Real-time clock with current time and date.
- 2. Running log of total power versus time.
- Total run time.
- 4. Fault log, maintaining last four faults with time and date stamp for each.
- F. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

## 2.5 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested VFCs before shipping.

## PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFCs for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 APPLICATIONS

- A. Select features of each VFC to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, drive, and load.
- B. Select rating of controllers to suit motor controlled.

# 3.3 INSTALLATION

A. Anchor each VFC assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and grout sills flush with VFC mounting surface.

## 3.4 IDENTIFICATION

- A. Identify VFCs, components, and control wiring according to Division 26 Section Basic Electrical Materials and Methods."
- B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

# 3.5 CONTROL WIRING INSTALLATION

Install wiring between VFCs and remote devices according to Division 26 Section 26 05 19 Low Voltage Electrical Power Conductors and Cable.

- A. Bundle, train, and support wiring in enclosures.
- B. Connect hand-off-automatic switch and other automatic-control devices where available.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with control circuit in both hand automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

## 3.6 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

# 3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality-control testing:
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting VFCs.
- D. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

# 3.8 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

# 3.9 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

# 3.10 CLEANING

A. Clean VFCs internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

## 3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain VFCs.

**END OF SECTION** 

## **SECTION 26 32 13**

#### PACKAGED ENGINE GENERATORS

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes packaged generator sets with the following features and accessories:
  - 1. Battery charger.
  - 2. Engine generator set.
  - 3. Muffler.
  - 4. Outdoor enclosure.
  - 5. Remote stop switch.
  - 6. Starting battery.

### 1.3 DEFINITIONS

- A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.
- B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

### 1.4 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance. Include the following:
  - 1. Dimensioned outline plan and elevation drawings of engine generator set and other components specified.
  - 2. Thermal damage curve for generator.
  - 3. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Indicate fabrication details, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Detail wiring for power and control connections and differentiate between factory-installed and field-installed wiring.

- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test and Observation Reports: Indicate and interpret test results and inspection records relative to compliance with performance requirements.
- F. Certified summary of prototype-unit test report.
- F. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- G. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet performance criteria for sensitive loads.
- Н. Maintenance Data: For each packaged engine generator and accessories to include in maintenance manuals specified in Division 1. Include the following:
  - Detail operating instructions for both normal and abnormal conditions.

#### 1.5 **QUALITY ASSURANCE**

- Α. Manufacturer Qualifications: Maintain a service center capable of emergency maintenance and repairs at the Project with eight hours' maximum response time.
- B. Source Limitations: Obtain packaged engine generator and auxiliary components specified in this Section through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70. Article 100, by a testing agency acceptable to authorities having jurisdiction.
- D. Comply with NFPA 70.
- E. Comply with NFPA 99.
- F. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- G. Comply with NFPA 110 requirements for Level 2 emergency supply system.
- H. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver engine generator set and system components to their final locations in protective Α. wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

#### 1.7 WARRANTY

Α. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in

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1. Warranty Period: Three years from date of Substantial Completion

### **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Caterpillar, Inc.; Engine Div.
  - 2. Generac Corp.
  - 3. Kohler Co; Generator Division.
  - 4. MagneTek, Inc.
  - 5. Cummins.
  - 6. Detroit Diesel

### 2.2 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.
- B. Output Connections: Three phase, four wire.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.
- E. Limiting dimensions indicated for system components are not exceeded.
- F. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
- G. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.
- H. Rigging Diagram: Inscribed on a metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity. Select one of two articles below to match overall generator-set performance to basic load characteristics of Project. Edit performance to specific needs.

## 2.3 SERVICE CONDITIONS

- A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: Minus 15 to plus 40 deg C.
  - 2. Relative Humidity: 0 to 95 percent.
  - 3. Altitude: Sea level to 1000 feet (300 m).

## 2.4 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: refer to plans
- C. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
  - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  - 2. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.
- D. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment. Include any circuit/conduit/control requirements iaw the manufacturers requirements to support this heater.
- E. Diesel Engine: Engine shall be 4 cycle, turbocharged/aftercooled or normally aspirated engine, water-cooled with mounted water pump. Diesel Engine: Engine shall be 4 cycle, turbocharged/aftercooled or normally aspirated engine, water-cooled with mounted water pump. A complete fuel system, including day tank with full tank of fuel shall be included at system turnover.
- F. Natural Gas Engine: Engine shall be 4 cycle, spark ignited turbocharged/aftercooled or normally aspirated engine, water-cooled with mounted water pump. A complete fuel system with gas pipe, regulators, in accordance with manufacturer direction, complete and ready to use shall be included.

### 2.5 GOVERNOR

A. Type: electronic

### 2.6 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

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PACKAGED ENGINE GENERATORS

- D. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and petcock.
- E. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- F. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
  - 1. 50-psig (345-kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and noncollapsible under vacuum.
  - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

#### 2.7 **ENGINE EXHAUST SYSTEM**

- Muffler: Residential type, sized as recommended by engine manufacturer. Measured sound Α. level at a distance of 10 feet (3 m) from exhaust discharge, is 95 dBA or less.
- В. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- C. Furnish and install pipe connections and terminations thru roof as recommended by the manufacturer.

#### 2.8 **COMBUSTION-AIR-INTAKE**

A. Description: Standard-duty engine-mounted air cleaner with replaceable dry filter element and "blocked filter" indicator.

#### 2.9 STARTING SYSTEM

- Α. Description: 12-V electric, with negative ground and including the following items:
  - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
  - Cranking Motor: Heavy-duty unit that automatically engages and releases from engine 2. flywheel without binding.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - Adequate capacity within ambient temperature range specified in 4. "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging.
  - 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above 10

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- deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above. Include accessories required to support and fasten batteries in place.
- 7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:
  - a. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
  - Automatic Temperature Compensation: Adjusts float and equalizes voltages for b. variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
  - Automatic Voltage Regulation: Maintains output voltage constant regardless of C. input voltage variations up to plus or minus 10 percent.
  - Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates. d.
  - Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a batterycharger malfunction indication at system control and monitoring panel.
  - f. circuit/conduit/control requirements iaw the requirements to support this heater.

#### 2.10 **CONTROL AND MONITORING**

- Functional Description: When the mode-selector switch on the control and monitoring panel is Α. in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Functional Description: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.

C.

- D. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components are grouped in a combination control and power panel. Control and monitoring section of panel is isolated from power sections by steel barriers.
- E. Indicating and Protective Devices and Controls: Include the following:

- 1. AC voltmeter.
- 2. AC ammeter.
- 3. AC frequency meter.
- 4. DC voltmeter (alternator battery charging).
- 5. Engine-coolant temperature gage.
- 6. Engine lubricating-oil pressure gage.
- 7. Running-time meter.
- 8. Start-stop switch.
- 9. Overspeed shutdown device.
- 10. Coolant high-temperature shutdown device.
- 11. Coolant low-level shutdown device.
- 12. Oil low-pressure shutdown device.
- 13. Generator overload.
- F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
- G. Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.

### 2.11 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. type; 100 percent rated; complying with NEMA AB 1 and UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator rating.
  - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Generator Protector: Microprocessor-based unit that continuously monitors current level in each phase of generator output, integrates generator heating effect over time, and predicts when thermal damage of the alternator will occur. When signaled by the protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from the load circuits. Protector performs the following functions:
  - Initiates a generator overload alarm when the generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
  - 2. Under single or three-phase fault conditions, regulates the generator to 300 percent of rated full-load current for up to 10 seconds.
  - 3. As heating effect on the generator of overcurrent approaches the thermal damage point of the unit, the protector switches the excitation system off, opens the generator disconnect switch, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

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C. Ground-Fault Indication: Comply with NFPA 70, Article 700-7(d). Integrate ground-fault alarm indication with other generator-set alarm indications.

#### 2.12 **GENERATOR, EXCITER, AND VOLTAGE REGULATOR**

- Comply with NEMA MG 1 and specified performance requirements. Α.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
- G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  - Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent 1. adjustment of output- voltage operating band.

#### 2.13 **FINISHES**

Α. Indoor Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

#### 2.14 **OUTDOOR ENCLOSURE.**

- Manufacturer furnished sound attenuating type. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL 2200. The package shall comply with the requirements of NEC for wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100 °F (38 °C). The housing shall have hinged access doors as required to maintain easy access for operating and service functions. Doors shall be lockable. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. Electrical power and control interconnections shall be made within the perimeter of the enclosure.
- Sheet metal shall be primed for corrosion protection and finish-painted with the manufacturers standard color using a two-step electro-coating paint process, or equal, meeting the performance requirements specified below. Surfaces of metal parts shall be

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primed and painted. The painting process shall result in a coating that meets the following requirements:

- a. Primer thickness shall be 0.5 mil (0.13 mm) to 2.0 mils (0.51 mm). Top coat thickness shall be 0.8 mil (0.20 mm) to 1.2 mils (0.30 mm).
- b. Gloss, per ASTM D 523 shall be 80 percent, ±5 percent. Gloss retention after one year shall exceed 50 percent.
- c. Crosshatch adhesion, per ASTM D 3359, shall be 4B to 5B.
- d. Impact resistance, per ASTM D 2794, shall be 160 inch pounds (13.56 N·m) to 160 inch pounds (18.08 N·m).
- e. Salt spray, per ASTM B 117, shall be 1000+ hours.
- Humidity, per ASTM D 2247, shall be 1000+ hours.
- g. Water soak, per ASTM D 2247, 1000+ hours.
- Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion-resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
- Enclosure shall be constructed of minimum 12 gage steel for framework and 14 gage steel for panels. Hardware and hinges shall be stainless steel.
- A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
- The enclosure shall include, but shall not be limited to, the following maintenance provisions:
  - a. Flexible coolant and lubricating oil drain lines, that shall extend to the exterior of the enclosure, with internal drain valves.
- 7. Provide external radiator fill provision.
- The generator set shall be provided with a sound-attenuated housing which shall allow the generator set to operate at full rated load in an ambient temperature of up to 100 °F (38 °C). The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 72 dBA at any location 23 feet (7 m) from the generator set in a free field environment.
- The enclosure shall be insulated with non-hygroscopic materials.

#### 2.15 Day Tank. (for diesel engine units)

- A dual-wall sub-base fuel storage tank sized for 24 hours full load operation. The tank shall be B. constructed of corrosion-resistant steel and shall be UL-listed. The equipment, as installed, shall meet local and regional requirements for above ground tanks.
- C. Provide a sub-base fuel tank for the generator set, sized to allow for full load operation of the generator set for 24 hours. The sub-base fuel tank shall be UL 142-listed and labeled. Installation shall be in compliance to NFPA 37. The fuel tank shall be a double-walled, steel construction and shall include, but shall not be limited to, the following features:
  - 1. Emergency tank and basin vents.
  - Mechanical level gauge.
  - Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL 2200 and NFPA 37 requirements.
  - Leak detection provisions, wired to the generator set control for local and remote alarm indication.

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- 5. Continuous float level gauge. Wire gauge to generator control to be remote indication of fuel level and runtime when used with compatible ATS.
- 6. Basin drain.
- 7. Integral lifting provisions
- 8. Overfill catch basin with drain.

### **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. EC shall secure any necessary special permits for this work, including fuel tank.
- B. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
  - Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine roughing-in electrical connections. Verify actual locations of connections before packaged engine generator installation.

### 3.2 INSTALLATION

- A. Comply with packaged engine generator manufacturers' written installation and alignment instructions, and with NFPA 110.
- B. Set packaged engine generator set on slab / floor with vibration isolators.
- C. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- D. Furnish and install exterior grade, sound attenuating housing. Refer to drawing schedules.
- E. Install accessories, hangers and supports, and anchors for complete installation.
- F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
  - 1. Verify that electrical wiring is installed according to manufacturers' submittal. Proceed with equipment startup only after wiring installation is satisfactory.

## 3.3 CONNECTIONS

- A. Electrical wiring and connections as shown by drawings and as directed by manufacturer.
- B. Ground equipment.

- Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- C. Natural Gas. Follow manufacturers instructions and International gas code. Field verify system gas pressure. Place gas valves for convenient equipment isolation.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing.
- B. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.
- C. Tests: Include the following:
  - 1. Tests recommended by manufacturer.
  - InterNational Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for emergency engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.
  - 3. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
  - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  - 6. Exhaust Emissions Test: Comply with applicable government test criteria.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- G. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

## 3.5 CLEANING

A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

## 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:
  - 1. Coordinate this training with that for transfer switches.
  - 2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
  - 3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
  - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

**END OF SECTION** 

# SECTION 26 43 13 SURGE PROTECTIVE DEVICES. EXTERNALLY MOUTED

#### **PART 1 - GENERAL**

### 1.1 SCOPE

A. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all AC electrical circuits.

### 1.2 RELATED DOCUMENTS

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

### 1.3 SUBMITTALS

- A. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location, and customer order number.
- B. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- C. Submittals shall include UL 1449 4<sup>th</sup> Edition Listing documentation verifiable by visiting www.UL.com, clicking "Certifications" link, searching using UL Category Code: VZCA and VZCA2:
  - Short Circuit Current Rating (SCCR)
  - 2. Voltage Protection Ratings (VPRs) for all modes
  - 3. Maximum Continuous Operating Voltage rating (MCOV)
  - 4. I-nominal rating (I-n)
  - SPD shall be UL 1449 4th Edition as a Type 2 Component or Listed Assembly. When connected to supply or utility side of service SPD shall be labeled as Type 1.
- D. Upon request, an unencapsulated, complete SPD shall be presented for visual inspection.
- Minimum of ten (10) year warranty

### 1.4 RELATED STANDARDS

- A. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
- IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
- C. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- D. National Electrical Code: Articles 100, 285, 620, 670, 695, 700, and 708
- E. UL 1283 Electromagnetic Interference Filters (Type 2 only)
- F. UL 1449, Fourth Edition, effective March 26, 2015 Surge Protective Devices

### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm with at least 10 years' experience in manufacturing surge protective devices, formally known as transient voltage surge suppressors.
- B. Manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of

installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

#### 1.6 DELIVERY, STORAGE AND HANDLING

Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

## **PART 2 - PRODUCTS**

#### 2.1 **MANUFACTURERS**

- Provide Surge Protective Devices (SPD) formally known as Transient Voltage Suppressor (TVSS) from one of the following suppliers:
  - Siemens Industry

#### **ELECTRICAL DISTRIBUTION EQUIPMENT** 2.2

- Service Entrance, Emergency Power Switchboard, Meter Centers
  - Externally or wall mounted SPD shall be UL 1449 listed and labeled as Type 2. verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
  - 2. SPD shall be UL labeled with 20kA I-nominal (I-n) (verifiable at UL.com) as recommended for UL 96A Lightning Protection Master Labeling and NFPA 780.
  - SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR).
  - SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
  - SPD shall be connected to the electrical service via a dedicated breaker or with a 5. 200kA rated integral disconnect switch.
  - SPD shall meet or exceed the following criteria: 6.
    - Maximum surge current capability shall be 300kA per phase. a.
    - UL 1449 4th Edition Revision; effective March 26, 2015 Voltage Protection b. Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120 Grounded Wye	700V	700V	700V	1200V	150V
480Y/277 Grounded Wye	1200V	1200V	1200V	2000V	320V

7. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

- SPD, Type 2 only, shall incorporate a UL 1283 listed EMI/RFI filter with minimum 8. attenuation of - 50dB at 100 kHz.
- Suppression components shall be heavy duty 'large block' MOVs, each exceeding 9. 30mm diameter.
- SPD shall include a serviceable, replaceable module.
- SPD shall be equipped with the following diagnostics:
  - Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.

- Audible alarm with on/off silence function and diagnostic test function b. (excluding branch).
- C. Form C dry contacts
- **Surge Counter** d.

No other test equipment shall be required for SPD monitoring or testing before or after installation.

- 12. SPD shall have a response time no greater than 1/2 nanosecond.
- Unless otherwise noted, SPD enclosure type shall match or exceed NEMA enclosure rating of equipment to which it is connected. Minimum NEMA 1 for indoor installations and NEMA 3R for exterior locations.
- SPD shall have a 10 year warranty.
- В. Distribution, Branch and Emergency Panelboards, Motor Control Center and Busway
  - Externally or wall mounted SPD shall be UL 1449 listed and labeled as Type 2. verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
  - SPD shall be UL labeled with 20kA I-nominal (I-n) 2.
  - SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). 3.
  - SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and 4. N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
  - SPD shall be directly connected to the buss or through a dedicated 30A breaker. 5.
  - SPD shall meet or exceed the following criteria: 6.
    - Maximum surge current capability shall be 150kA per phase. a.
    - UL 1449 4th Edition Revision; effective March 26, 2015, Voltage Protection b. Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<b>MCOV</b>
208Y/120 Grounded Wye	700V	700V	700V	1200V	150V
480Y/277 Grounded Wve	1200V	1200V	1200V	2000V	320V

7. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) for L-N, L-G, and N-G modes of protection (verifiable at UL.com):

System Voltage	e Allowable System Voltage Fluctuation (%)	
208Y/120	25%	150V
480Y/277	15%	320V

- SPD, Type 2 only, shall incorporate a UL 1283 listed EMI/RFI filter with minimum 8. attenuation of - 50dB at 100 kHz.
- Suppression components shall be heavy duty 'large block' MOVs, each exceeding 9. 30mm diameter.
- SPD shall be equipped with the following diagnostics: 10.
  - Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
  - Audible alarm b.
  - Form C dry contacts

No other test equipment shall be required for SPD monitoring or testing before or after installation.

- 11. SPD shall have a response time no greater than 1/2 nanosecond.
- Unless otherwise noted, SPD enclosure type shall match or exceed NEMA enclosure rating of equipment to which it is connected. Minimum NEMA 1 for indoor installations and NEMA 3R for exterior locations.
- 13. SPD shall have a 10 year warranty.

- C. Emergency System Load Disconnects for Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lift, or Stairway Chairlifts
  - SPD shall be mounted external to electrical distribution equipment, and it shall be UL 1449 labeled as Type 1, verifiable at UL.com, without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
  - 2. SPD shall be UL labeled with 20kA I-nominal (I-n)
  - 3. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR).
  - SPD shall provide surge current paths for all modes of protection: L-N and N-G for Wye and split phase systems; L-G and L-L for Delta and impedance grounded Wye systems.
  - 5. SPD shall be directly connected to disconnect or through a dedicated 30A breaker.
  - 6. SPD shall meet or exceed the following criteria:
    - a. Maximum surge current capability shall be 50kA per phase.
    - b. UL 1449 4<sup>th</sup> Edition Revision; effective March 26, 2015, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120 Grounded Wye	600V	600V	1000V	150V
480Y/277 Grounded Wye	1200V	1000V	2000V	320V

7. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) for L-N, L-G, and N-G modes of protection (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	_MCOV_
208Y/120	25%	150V
480Y/277	15%	320V

- 8. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.
- 9. SPD shall be equipped with the following diagnostics:
  - a. Visual protection status LED diagnostic indicator
- Unless otherwise noted, SPD enclosure type shall match or exceed NEMA enclosure rating of equipment to which it is connected. Minimum NEMA 1 for indoor installations and NEMA 3R for exterior locations.

### **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Execution Requirements: Verification of existing conditions before starting work.
  - 1. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
  - 2. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
  - 3. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the owner.

## 3.2 INSTALLATION

- A. Power protection SPD installation shall meet the following criteria:
  - 1. Install per manufacturer's recommendations and contract documents.
  - 2. Install units plumb, level and rigid without distortion
  - 3. One primary suppressor shall be installed external to the service entrance in accordance with manufacturer instructions.

- Service Entrance SPD shall be installed on the line or load side of the main service disconnect.
- 5. Service Entrance SPD ground shall be bonded to the service entrance ground.
- 6. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.
- 7. One SPD shall be installed external to each designated distribution panelboard.
- 8. At Distribution, MCC and Branch, SPD shall have an independent means of servicing disconnect such that the protected panel remains energized. A 30A breaker (or larger) may serve this function.
- 9. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
- 10. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
- 11. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC 250.24(B) and 250.28.

#### 3.3 ADJUSTMENTS AND CLEANING

- A. Remove debris from SPD and wipe dust and dirt from all components.
  - 1. Repaint marred and scratched surfaces with touch up paint to match original finish.

### 3.4 TESTING

- A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.
  - 1. Check all installed panels for proper grounding, fastening and alignment.

## **END OF SECTION**

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#### **SECTION 26 51 00**

#### **INTERIOR LIGHTING**

### **PART 1 - GENERAL**

#### 1.1 Work Includes:

- A. Base Bid: Electrical contractor.
- Provide and install all interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.
- 1.2 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.3 Submittals:

- See Section 01 33 00 Shop Drawings, Product Data and Samples, for submittal procedures.
- B. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
  - 1. Dimensions of fixtures.
  - 2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
  - Certified results of laboratory tests for fixtures and lamps for photometric performance.
  - Emergency lighting unit battery and charger.
  - Fluorescent and high-intensity-discharge ballasts.
  - Air and Thermal Performance Data: For air-handling fixtures. Furnish data required in "Submittals" Article in Section 23 33 00 - "Diffusers, Registers, and Grilles."
  - Sound Performance Data: For air-handling fixtures. Indicate sound power level and sound transmission class in test reports certified according to ADC.
  - Types of lamps.
- C. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
  - Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

### 1.4 Quality Assurance:

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- Comply with NFPA 70.
- C. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
- NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

### 1.5 Coordination:

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

## 1.6 Warranty:

General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

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#### **PART 2 - PRODUCTS**

- 2.1 Manufacturers:
  - A. Refer to section 26 00 01 for electrical approved manufacturers.
  - B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule
- 2.2 Fixtures and Fixture Components, General:
  - A. Metal Parts: Free from burrs, sharp corners, and edges.
  - B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
  - C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
  - D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
    - 1. White Surfaces: 85 percent.
    - 2. Specular Surfaces: 83 percent.
    - 3. Diffusing Specular Surfaces: 75 percent.
    - 4. Laminated Silver Metallized Film: 90 percent.
  - E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
    - Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
    - 2. Lens Thickness: 0.125 inch (3mm) minimum, unless greater thickness is indicated.
- 2.3 Fluorescent Lamp Ballasts:
  - A. General Requirements: All ballasts shall comply with State of Illinois standards including the following:
    - 1. Designed for type and quantity of lamps indicated at full light output.
    - 2. Minimum power factor of 0.99
    - 3. Total Harmonic Distortion Rating: Less than 10 percent.
    - 4. Less than 6 percent third harmonic distortion.
    - 5. Five year manufacturers warranty.
    - 6. Compliance with applicable ANSI specifications.
    - 7. Polychlorinated biphenyls (PCB) are not allowed.
    - Sound Rating: A
  - B. Additional requirements: Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:
    - 1. Certified Ballast Manufacturer Certification: Indicated by label.
    - 2. Encapsulation: Without voids in potting compound.
    - Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
  - C. Additional requirements: Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:
    - 1. Type: Electronic or electromagnetic, fully encapsulated in potting compound.
    - 2. Operating Frequency: 20 kHz or higher.
    - 3. Flicker: Less than 5 percent.
    - 4. Lamp Current Crest Factor: Less than 1.7.
    - 5. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
  - D. Additional requirements: Ballasts for Compact Lamps in Nonrecessed Fixtures: Unless otherwise indicated, additional features include the following:
    - 1. Power Factor: 90 percent, minimum.
    - 2. Ballast Coil Temperature: 65 deg C, maximum.
    - 3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
- 2.4 Fluorescent Dimming Ballasts and Controls:
  - A. Manufacturers:
    - 1. Refer to section 26 00 01 for electrical approved manufacturers.

- B. Product Description: Electrical assembly of control unit and ballast to furnish smooth dimming of fluorescent lamps.
- Control Unit: Linear slide type, rated 600 watts at 120 volts.
- Ballast: Selected by dimming system manufacturer as suitable for operation with control unit and suitable for lamp type and quantity specified for luminaire.

#### 2.5 LED Fixtures

- A. Fixtures shall be UP or Intertek ETL listed.
- B. Drivers shall be capable of accepting the voltage indicated on the plans or schedule and capable of dimming if required. The driver shall be class A sound less than 20 percent, rated for operation between -40C to 40C. Driver shall contain no PCB's.
- C. All LED fixtures shall be tested to IES LM-79 and IES LM-80.
- D. Fixtures shall have efficacy of 60 lumens per watt or greater.
- E. Color Accuracy, CRI of 70 or greater. See schedule for light color. All fixtures shall have the same light color unless specifically called out otherwise.
- F. Outdoor fixtures shall be IP65 rated.
- G. LED driver and components shall have a system lifetime of 50000 hours or more at 25 Celsius.
- H. Fixture shall have a minimum of five year warranty on all components and finishes.

#### 2.6 Exit Signs:

- A. General Requirements: Comply with UL 924 and the following:
  - 1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
- B. Internally Lighted Signs: As follows:
  - 1. Lamps for AC Operation: LED
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  - Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
  - Charger: Fully automatic, solid-state type with sealed transfer relay.
  - Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

## 2.7 Emergency Lighting Units:

- General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
  - 1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
  - Charger: Fully automatic, solid-state type with sealed transfer relay. 2.
  - Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
  - 4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
  - Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

#### 2.8 Lamps:

- Fluorescent Color Temperature and Minimum Color-Rendering Index: 3000 K and 85 CRI, unless otherwise indicated.
- Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.

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#### 2.9 Fixture Support Components:

- A. Comply with Section 260500 "Basic Electrical Materials and Methods." for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (12mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

#### 2.10 Finishes:

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
  - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
  - 2. Metallic Finish: Corrosion resistant.

#### **PART 3 - EXECUTION**

#### 3.1 Installation:

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
  - Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
  - Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20mm) metal channels spanning and secured to ceiling tees.
- C. Suspended Fixture Support: As follows:
  - 1. Pendants and Rods: Where longer than 48 inches (1200), brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
  - Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.
- D. Air-Handling Fixtures: Install with dampers closed.

#### 3.2 Connections:

Ground Equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 Field Quality Control:

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: As follows:
  - 1. Verify normal operation of each fixture after installation.
  - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
  - Verify normal transfer to battery source and retransfer to normal.
  - Report results in writing.
- E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- Corrosive Fixtures: Replace during warranty period.

## 3.4 Cleaning and Adjusting:

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- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by
- Adjust aimable fixtures to provide required light intensities.
- 3.5 Interior Lighting Fixture Schedule: See contract drawings.

**END OF SECTION** 

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### **SECTION 26 56 00**

#### **EXTERIOR LIGHTING**

#### PART 1 - GENERAL

1.1 Summary: 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.
- D. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

#### 1.4 Qualifications:

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

### PART 2 - PRODUCTS

## 2.1 Luminaries:

A. Refer to section 26 00 01 for electrical approved manufacturers.

#### 2.2 LED Fixtures

- A. Fixtures shall be UP or Intertek ETL listed.
- B. Drivers shall be capable of accepting the voltage indicated on the plans or schedule and capable of dimming if required. The driver shall be class A sound less than 20 percent, rated for operation between -40C to 40C. Driver shall contain no PCB's.
- C. All LED fixtures shall be tested to IES LM-79 and IES LM-80.
- D. Fixtures shall have efficacy of 60 lumens per watt or greater.
- E. Color Accuracy, CRI of 70 or greater. See schedule for light color. All fixtures shall have the same light color unless specifically called out otherwise.

- F. Outdoor fixtures shall be IP65 rated.
- G. LED driver and components shall have a system lifetime of 50000 hours or more at 25 Celsius.
- H. Fixture shall have a minimum of five year warranty on all components and finishes.

#### PART 3 - EXECUTION

#### 3.1 Examination:

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

## 3.2 Existing Work:

- A. Disconnect and remove exterior luminaries directed by drawings.
- B. 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 to adjust plumb. Grout around each base.
- C. Install lamps in each luminaire.
- D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 26 05 26. Install supplementary grounding electrode at each pole.

### 3.4 Field Quality Control:

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for improper connections 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 luminaries having failed lamps at Substantial Completion.

### **SECTION 26 56 00**

#### **EXTERIOR LIGHTING**

#### PART 1 - GENERAL

1.1 Summary: 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.
- D. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

#### 1.4 Qualifications:

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

### PART 2 - PRODUCTS

## 2.1 Luminaries:

A. Refer to section 26 00 01 for electrical approved manufacturers.

#### 2.2 LED Fixtures

- A. Fixtures shall be UP or Intertek ETL listed.
- B. Drivers shall be capable of accepting the voltage indicated on the plans or schedule and capable of dimming if required. The driver shall be class A sound less than 20 percent, rated for operation between -40C to 40C. Driver shall contain no PCB's.
- C. All LED fixtures shall be tested to IES LM-79 and IES LM-80.
- D. Fixtures shall have efficacy of 60 lumens per watt or greater.
- E. Color Accuracy, CRI of 70 or greater. See schedule for light color. All fixtures shall have the same light color unless specifically called out otherwise.

- F. Outdoor fixtures shall be IP65 rated.
- G. LED driver and components shall have a system lifetime of 50000 hours or more at 25 Celsius.
- H. Fixture shall have a minimum of five year warranty on all components and finishes.

#### PART 3 - EXECUTION

#### 3.1 Examination:

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

## 3.2 Existing Work:

- A. Disconnect and remove exterior luminaries directed by drawings.
- B. 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 to adjust plumb. Grout around each base.
- C. Install lamps in each luminaire.
- D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 26 05 26. Install supplementary grounding electrode at each pole.

### 3.4 Field Quality Control:

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for improper connections 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 luminaries having failed lamps at Substantial Completion.

### **SECTION 26 56 13**

### **LIGHTING POLES**

### PART 1 - GENERAL

#### 1.1 **SUMMARY**

#### A. Section Includes:

- Poles, accessories, extra materials. 1.
- 2. Accessories for support of luminaires.

#### Related Documents & Sections: В.

- Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections apply to the work of this Section.
- 2. Division 26 "Exterior Lighting" section applies to the work in this Section.
- Division 26 Design Details 26 56 00 -1, -2, -3, -4 found at the UNL website. 3.

#### C. Coordination Requirements:

- Coordinate the installation of all light poles with the work of other trades. This includes but is not limited to placement of poles in conjunction with civil work such as sidewalks, roadways, parking lots, landscaping and building exteriors.
- 2. Coordinate pole installation, fuses in pole base, fixture circuiting, and fixture external surge protection device installation.

#### 1.2 **SUBMITTALS**

- Product Data: For each pole, accessory, luminaire-supporting and lowering device, arranged as A. indicated on the plans and as required.
  - Include data on construction details, profiles, effective projected area (EPA), cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
  - 2. Include finishes for lighting poles and luminaire-supporting devices.
  - Anchor bolts. 3.
  - 4. Manufactured pole foundations.
  - Manufacture cut sheets indicating pole catalog number selections with highlighted 5. selections. Include pole designations that match the project designations if applicable.
  - 6. All distinct poles required on the project shall be submitted in one single submittal so all poles can be reviewed at one time.

#### В. **Shop Drawings:**

- Anchor-bolt templates keyed to specific poles and certified by manufacturer. 1.
- 2. Include plans, elevations, sections, and mounting and attachment details.

- 3. Include details of equipment assemblies, indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 4. Detail fabrication and assembly of poles and pole accessories.
- Foundation construction details, including material descriptions, dimensions, anchor 5. bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of Nebraska.
- Method and procedure of pole installation. Include manufacturer's written installation 6. instructions.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.
- D. Qualification Data: For Installer.
- E. Material Test Reports:
  - For each foundation component, by a qualified testing agency. 1.
  - 2. For each pole, by a qualified testing agency.
- F. Source quality-control reports.
- G. Provide all applicable field quality-control reports.
- H. Soil test reports.
- I. Warranty: Copy of manufacturer's warranty.
- J. Project Record Documents: Record actual pole connections, configurations, locations, quantities and any associated accessories. Provide this information along with project 'as-builts' per the contract documents plans and specifications.
- K. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.
  - In addition to general requirements and items specified in the UNL Design Guidelines pertaining to operation and maintenance data, include pole inspection and repair procedures.

#### 1.3 **QUALITY ASSURANCE**

- Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, A. by a qualified testing agency, and marked for intended location and application.
- В. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- Comply with NFPA 70. D.

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- E. Manufacturers: Firms regularly engaged in the manufacturer of exterior light poles of types and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- F. Installer: Qualified with at least three (3) years of successful installation experience on projects with exterior lighting fixture and pole work similar to that required for this project.
- G. Provide poles from a single manufacturer for each project.

#### 1.4 **REFERENCES**

- A. NEC Compliance: Comply with the NEC (NFPA 70) as applicable to the installation and construction of lighting poles.
- В. NEMA Compliance: Comply with applicable requirements of NEMA Standard Pub. Nos. LE-1 and LE-2 pertaining to lighting equipment.
- C. ANSI/UL Compliance: Comply with ANSI/UL Standards pertaining to interior and exterior lighting fixtures for hazardous locations. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements.
- D. NECA 1 - Good Workmanship in Electrical Construction, latest edition.
- NECA/IESNA 501 Standard for Installing Exterior Lighting Systems, latest edition. E.
- F. Underwriter's Laboratories (UL) Listings. Provide fixtures that have been UL Listed and labeled to any or all of the following standards as applicable to the project:
  - UL 844 Luminaires for Use in Hazardous (Classified) Locations. 1.
  - 2. UL 924 - Emergency Lighting and Power Equipment.
  - UL 1598 Luminaires. 3.
  - UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products. 4.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- Store poles on decay-resistant skids at least 12 inches above grade and vegetation. Support A. poles to prevent distortion and arrange to provide free air circulation.
- В. Retain factory-applied pole wrappings on metal poles until immediately before pole installation. Handle poles with web fabric straps.
- C. Package aluminum poles for shipping according to ASTM B 660.
- D. Receive, handle, and store products according to NECA/IESNA 501 (exterior lighting), and all manufacturer's written instructions.
- E. Protect pole finishes prior and during install by applying a strippable, temporary protective covering as required.

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#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
  - 1. Warranty Period: Five (5) years from date of Substantial Completion.
  - Warranty Period for Corrosion Resistance: Five (5) years from date of Substantial 2. Completion.
  - 3. Warranty Period for Color Retention: Five (5) years from date of Substantial Completion

### **PART 2 - PRODUCTS**

#### 2.1 PERFORMANCE REQUIREMENTS

- Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by A. a qualified testing agency, and marked for intended location and application.
- В. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- F. Exposed Hardware Material: Stainless steel.
- G. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- H. Variations in Luminaire Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.
- I. Delegated Design: Engage a qualified professional engineer to design pole foundation and pole power system.
- J. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- K. Structural Characteristics:

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- 1. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- Ice Load: Load of 3lbf/sq. ft. applied according to AASHTO LTS-6-M for applicable 2. areas on the Ice Load Map.
- 3. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.
- Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, 4. permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
- 5. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- L. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- M. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  - 1. Materials: Shall not cause galvanic action at contact points.
  - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
  - 3. Anchor-Bolt Template: Plywood or steel. Provide shipped with poles from factory.
- N. Handhole: Oval-shaped, with minimum clear opening of 3 by 5 inches with cover secured by stainless-steel captive screws.
- O. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- P. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

#### 2.2 **MANUFACTURERS**

- A. Manufacturers: As noted on the drawings by notes and/or by the light fixture schedule dictated by this Section. Subject to compliance with requirements, provide products by one following:
  - Parking Lot Light Poles: Lithonia RTS Series or approved equal.

#### 2.3 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and A. supporting structure, applied as stated in AASHTO LTS-6-M.
- В. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-6-M.
- C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-6-M Ice Load Map.
- D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-6-M.

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- 1. Basic wind speed for calculating wind load for poles exceeding 49 feet in height or less is 100 mph (45 m/s).
  - Wind Importance Factor: 1.0 Minimum Design Life: 25 years b. Velocity Conversion Factors: 1.0 c.

#### 2.4 STEEL POLES

- A. Steel poles are standard for all parking lot, street, and roadway light poles.
- Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig B. (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
  - Shape: Round, tapered. 1.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Steel Mast Arms: single-arm or double-arm as required, davit type, continuously welded to pole attachment plate. Material and finish same as pole.
- Brackets for Luminaires: Detachable, cantilever, without underbrace. D.
  - Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted 1. adapter, then bolted together with stainless-steel bolts.
  - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
  - 3. Match pole material and finish.
- E. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with F. requirements in Section 260526 "Grounding System" listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable G. and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to 1. remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
  - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

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- 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
  - Color: Black unless otherwise specified by the project requirements.

#### 2.5 **ALUMINUM POLES**

- A. Poles: seamless, extruded structural tube complying with ASTM B 221, Alloy 6063-T6, with access handhole in pole wall.
  - 1. Shape: Round, tapered.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- В. Brackets for Luminaires: Detachable, cantilever, without underbrace.
  - Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with [stainless] [galvanized]-steel bolts.
  - Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. 2. Match pole material and finish.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding System" listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to 1. remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
  - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
  - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - Color: Black unless otherwise specified by the project requirements.

#### 2.6 POLE ACCESSORIES

- Duplex Receptacle: Only where required of particular project scope, a 120 V, 20 A, heavy duty Α. receptacle in a weatherproof assembly complying with Section 262726 "Wiring Devices" for ground-fault circuit-interrupter type.
  - Surface mounted, a minimum of 12 inches above finished grade.

- Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, 2. painted to match pole that when mounted results in NEMA 250, Type 3R enclosure.
- With cord opening allowing for use while the cover is pad locked. 3.
- 4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
- B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole. In split shell configuration for replacement or access to bolts below.
- C. Vibration Dampers: Factory installed system to reduce common pole vibration events and minimum vibrations at frequencies commonly found in light pole installations of similar setups.
- D. Decorative accessories, supplied by decorative pole manufacturer, include the following:
  - 1. Banner Arms: As specified by Project Architect.
  - 2. Flag Holders: As specified by Project Architect.
  - 3. Ladder Rests: As specified by Project Architect.

#### 2.7 MOUNTING HARDWARE

- Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of A. 55,000 psi (380,000 kPa).
  - Galvanizing: Hot dip galvanized according to ASTM A 153, Class C. 1.
  - 2. Bent rods, sized as required by manufacturer.
  - 3. Threading: Uniform National Coarse, Class 2A.
- В. Nuts: ASTM A 563, Grade A, Heavy-Hex
  - Galvanizing: Hot dip galvanized according to ASTM A 153, Class C. 1.
  - 2. Two nuts provided per anchor bolt.
- C. Washers: ASTM F 436, Type 1.
  - Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
  - One washers provided per anchor bolt. 2.

#### **PART 3 - EXECUTION**

#### 3.1 **EXAMINATION**

- Examine areas and conditions, with Installer present, for compliance with requirements for A. installation tolerances and other conditions affecting performance of the Work.
- Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before В. installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.
- C. Examine roughing-in for foundation and conduit to verify actual locations of installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

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#### 3.2 POLE FOUNDATION

- Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. A. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- В. Anchor Bolts: Install plumb using manufacturer-supplied plywood template, uniformly spaced.

#### 3.3 POLE INSTALLATION

- Alignment: Align pole foundations and poles for optimum directional alignment of luminaires A. and their mounting provisions on the pole.
- В. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
  - Fire Hydrants and Storm Drainage Piping: 60 inches. 1.
  - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
  - Trees: 15 feet from tree trunk. 3.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - Retain first subparagraph below if seismic restraint is required by local code or authorities having jurisdiction. See Evaluations.
  - 2. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
  - 3. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
  - Install base covers unless otherwise indicated. 4.
  - 5. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch-(150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab. See Design Details 26 50 00-1,-2,-3,-4 for more information.
- F. Raise and set poles using web fabric slings (not chain or cable) at locations indicated by manufacturer.

#### 3.4 CORROSION PREVENTION

Aluminum: Do not use in contact with earth or concrete. When in direct contact with a Α. dissimilar metal, protect aluminum by insulating fittings or treatment.

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B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

#### 3.5 **GROUNDING**

- A. Ground metal poles and support structures according to Section 260526 "Grounding System"
  - Install grounding electrode for each pole unless otherwise indicated.
  - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- В. Ground nonmetallic poles and support structures according to Section 260526 "Grounding System".
  - Install grounding conductor and conductor protector. 1.
  - 2. Ground metallic components of pole accessories and foundations.

**END OF SECTION 265600** 

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# **SECTION – 27 00 00 COMMUNICATION CABLE AND EQUIPMENT**

## **PART 1 – GENERAL**

#### **GENERAL**

Applicable provisions for Division 1 shall govern work of this section.

#### **DEFINITIONS**

Manufacturer: The Company that owns controlling interest in the factory actually producing the cable furnished for this project.

#### **WORK INCLUDED**

Furnishing and installing communication cable, raceway and provide various equipment including pulling, racking, terminating, testing and labeling. Also, provide miscellaneous equipment as specified below.

The systems, which shall be affected by this section, are as follows:

Computer and Phone cabling and termination

Security Cameras and wiring

Cable Television cabling and termination

Door access system.

Work provided by the Owner is as follows:

Single user PC equipment

Phone System

The City will provide the fiber connection to the new facility under a separate contract.

#### **WORK SEQUENCE**

This Contractor shall coordinate work with the Construction Manager and continue to completion following the project. During the construction period coordinate telecommunications schedule and operations with Owner, and Construction Manager.

#### CABLING SYSTEMS DESCRIPTION

The system shall include PLENUM rated horizontal data and voice cabling installed in the cable tray where indicated. Conduit raceway system shall be routed to each telecommunications outlet box as supplied by the electrical contractor. There shall be a single dedicated home run cable run to each location in the numbers indicated on the drawings, unless otherwise specified.

#### PROJECT RECORD DOCUMENTS

Documentation shall accurately record locations of cables.

# **QUALITY ASSURANCE**

The manufacturer shall be a company specializing in communication cable and/or accessories with a minimum of five years documented experience in producing cable and/or accessories similar to those specified below.

## **CODE REQUIREMENTS**

ANSI/IEEE C2 National Electrical Safety Code

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NFPA 70-1993 National Electrical Code 4 EIA/TIA Standards 568, 569, TSB-40

# **DELIVERY, STORAGE AND HANDLING**

Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location shall be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

#### **PART 2 - PRODUCTS**

#### **CABLE AND EQUIPMENT**

All cables and equipment shall be furnished, installed, wired and tested by the Contractor. All cable runs shall be homerun to Data room 113.

The data cable for this system shall meet the following specifications:

Data cables shall be CAT 6, blue in color, unshielded (UTP) four (4) pair twisted, PLENUM for use with data rates up to 1000 MHz.

The cable shall be restricted to four-pair size to support a broad range of applications. The pair twists of any pair shall not be exactly the same as any other pair. The pair twist lengths shall be selected by the manufacturer to ensure compliance with the near-end crosstalk requirements of EIA/TIA 568 and NEMA.

Cable shall meet specifications of NEMA (low loss), EIA/TIA 568, UL 444 and ICEA.

## MODULAR JACKS, WALL PLATES, AND PATCH PANELS

The modular jacks shall be A minimum 1 gang (2RJ45 connections) at each location as noted on plans an RJ 45 configuration. They shall consist of one, eight (8) conductor jack attached to quick connect terminals for easy termination of horizontal wiring.

- 1. Cable and Equipment Modify as follows:
  - a. All home run cables to Data room 113 shall be punched down to patch panels as described in below.
    - Cable to carry video signal will be for CATV only, security camera cable will be CAT 6 as described. See detail for TV requirements on sheet 1 IT202. As noted provide data cables and HDMI at all TV locations.
  - b. Cables shall be color coded per use according to the following:
    - Data Blue
    - Camera White
    - Speaker Beige
    - Security and Doors Grey
  - c. Speaker cabling shall be 16/2.
- 2. Modular Jacks, Wall Plates, and Patch Panels:
  - a. All jacks shall be CAT 6, colored to follow section above.

Terminate all cables in Support 113 to rack mounted patch panels. Provide separate 24-port panels — Total number required base on plan count (need to provide a minimum of 12 ports for future expansion). Contractor to provide new switches to the new rack - 48 port switches. HPE Aruba 2530-48G-PoE+ (need to provide a minimum of 12 ports for future expansion).

b. For each type of cabling in sufficient size and number for all cables to be run. Provide and install a free standing rack for mounting of the patch panels. Leave room for expansion between cable types. Coordinate location of rack in room with Owner. Leave sufficient room to walk around rack. Provide and install horizontal ladder rack at ceiling spanning the room from end to end in one direction.

Voice / Data jacks shall be Leviton or equal for CAT 6 cable.

Universal patch panels shall be Leviton or equal.

The modular jacks at each location shall be designed to snap into a single-gang modular faceplate, Leviton or equal, white in color.

**SECURITY CAMERAS** – IP camera – Back to Data Room – Cat6 The security cameras shall be as follows:

Furnish and install cameras required for this project as listed below. Must connect to existing ExacqVision network video recorder, requiring the furnishing of ExacqVision IP camera licenses (1 per camera) and include all mounting hardware.

- a. Camera system to be as listed below
  - 1. (1) 24-port video network switch HPE Aruba 2530-24G-PoE+
  - 2. Axis Q3709-PVE See Plan for quantity
  - 3. Axis P3719-PLE See Plan for quantity

Provide and install cable for each camera as located on IT sheets.

All camera cabling shall be terminated at the camera end to an RJ-45 jack in a surface box at the camera location, as noted above. Terminate other end of cable in data room noted on plan sheets to a patch panel.

Furnish and install cabling from cameras home run to data locations noted on the plans.

#### DOOR ACCESS SYSTEM

Door Access System:

System 1: Furnish and install electric strike and adjacent proximity reading device mounted to wall. Doors in this zone shall be released via proximity fob or from console at Reception 104.

Provide all necessary cabling to control modules in Data 113. Control module shall be contained in a single locking box including battery backup. Connect to line voltage source provided by Electrical Contractor. Per It door schedule plans

This contractor shall furnish and run all cable as listed below. This contractor will install electric strikes provided under Section 08 71 00

- a. Door Access System: Run one (1) 18/6 shielded cable for the reader and one (1) 16/2 cable for the strike from each door to Data 113 for connection to required equipment.
- b. Gates
  - Reader range at the 42" mount height 152 to 203mm (6 to 8in) (Lenel LSSP-6820) or equal.
     Reader range at the 72" mount height to have a Typical Maximum Read Range 3 to 5 meters (9 to 15ft) (HID U90) or equal.
  - 2. High and Low pedestal with dual readers required at both vehicle entry gates. DoorKing 1200-049 (Dark Bronze) or Equal
- c. Card access system and components to be:
  - 1. AC-SW-16RCU SOFTWARE Per Card Reader License
  - 2. AC-HID-READ-ICL- AVIGILON READER ICLASS SE R10 Card Reader
  - 3. AC-MER-CON-MR52- AVIGILON 2 READER INTERFACE Control Panel
  - 4. AC-LSP-16DR-MER- AVIGILON PSU 16DR MER DUAL Power Unit (Electrical to provide power outlet).
  - 5. HES 5000 12/24D, UNIVERSAL KEYSTRIKE 12 Door Strike Supplied by 08 71 00.
  - 6. T.REX-LT, Kantech request to exit Request to Exit Sensor
  - 7. T.REX-PLATE, Kantech request to exit back plate
  - 8. GE 1078CWM, Door contacts
  - 9. Push button release

# **PHONE SYSTEM**

Phone System will be installed and connected to the City's existing system back to City Hall under as separate contract not part of this bid:

a. All new phones will be supplied and installed by the City under a separate contract.

#### **PART 3 – EXECUTION**

#### **GENERAL WIRE AND INSTALLATION REQUIREMENTS**

All voice horizontal distribution cables shall be UL PLENUM rated Wiring Cables consisting of twisted four pair, 24 AWG annealed copper conductors. The outer jacket shall be PLENUM rated. All cables shall be capable of supporting all applications as listed above. No exposed wires are allowed.

HORIZONTAL DATA CABLE REQUIREMENTS

#### THE CABLE FOR THIS SYSTEM SHALL MEET THE FOLLOWING REQUIREMENTS:

The cable shall be rated for category 6 performance, UTP (unshielded twisted pair) 24AWG, plenum rated CMP type for use with, but not limited to, 100 MHz LAN (100 base T), 155.52 Mbs NRZ ATM, 622 Mbs LAN, etc. Category 6 cable shall be terminated, all four (4) pair on both ends, to Category 6 (TSB-40) compliant hardware. No splitting of the cable will be allowed behind the proper termination of the workstation or the TC / ER (Data Room 113). All cables shall meet the specified performance characteristics as defined in TIA/EIA-568-B.2-2001 standards and tested to these standards upon completion.

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Note the following clarification regarding the running of cable:

- a. Cables are not required to be in cable tray, however it is expected that all cable work will be installed in a neat and orderly fashion keeping as many cables bundled tightly together.
- b. Cable may be run exposed in open ceilings, conduit drops required at all areas below ceiling joist were exposed.
- c. Bidders shall review other mechanical plans to verify available chases and coordinate the use of these chases with those trades. Other penetrations must be made by the Communication Cable and Equipment Contractor. Fire stopping is the responsibility of this contractor.

Modular jacks shall be terminated as follows: Data and Voice shall be wired utilizing the TIA-568B concept Wiring Standards.

All four cable pairs are to be terminated on each modular jack. at each location. The phone jacks shall be located on the top two positions of the 4-position faceplate, and the data on the bottom two positions.

Each voice jack shall be wired with CAT 6 cables. Two voice jacks shall be wired at every location, with the jacks themselves being blue in color. Voice cables shall be pulled from each jack location and terminated on a blue CAT 6 jack. The jacks shall be mounted on a 24-port Systimax universal modular patch panel.

Each data jack shall be wired with CAT 6 cables, blue in color. Two jacks are to be wired at every location, with the jacks themselves being orange in color. Data cables shall be pulled from each jack location and terminated on an orange CAT 6 jack. The jacks shall be mounted on a 24-port Systimax universal modular patch panel. Or as noted within the triangle noting data location.

Voice and data shall be on their own separate patch panel.

All cables shall be terminated and tested. All lines shall be marked consistently, so they able to be identified at the wall jack.

Cable shall be terminated in Data 113.

The Engineer requests a brief on site walk through, at each location, just before actual work is started. At that time, head-end location information shall be finalized and the contractor shall be provided a jack-numbering scheme.

#### **SYSTEMS REQUIREMENTS**

Furnish and install all cables, connectors and equipment as shown on drawings and as specified above.

Qualified personnel utilizing state of the art equipment and techniques shall complete all cable terminations.

New Cables shall be tested as follows:

Test Equipment – Systems Contractor is responsible for supplying all test equipment to conduct the acceptance test.

Systems Contractor Responsibility – Systems Contractor shall conduct acceptance testing.

Procedures – Systems Contractor shall describe how they shall conduct the tests and provide copies of all test results to the Architect/Engineer.

Tests to be conducted:

All cable pairs shall be verified for paired validity, continuity, and polarity through toning of each conductor.

#### CABLE PULLING

Beginning installation means systems contractor accepts existing conditions.

Systems Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance funnels, pulling tension gauge, and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.

Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

During pulling operation an adequate number of workers shall be present to allow able observation at all points of duct entry and exit as well a the feed cable and operate pulling machinery.

Avoid abrasion and other damage to cables during installation.

#### **CABLE ROUTING**

All wiring shall be run in the plenum ceiling utilizing the cable tray whenever possible.

The cable shall be run through the plenum ceiling in a professional manner and be installed into the appropriate raceway, which is stubbed into the ceiling space for the appropriate outlet. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellem grips may be used to spread the strain over a longer length of cable.

Cables shall run at right angles while exiting the cable tray and be supported at intervals not to exceed four (4) feet by D-ring type hangers.

Sufficient cable shall be pulled with a coil of 4 feet placed in the ceiling. This service loop shall be coiled from 100% to 200% of its recommended minimum bend radius. The coil then shall be tie-wrapped to the conduit used for the vertical station drop.

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To reduce or eliminate EMI", the following minimum distances shall be adhered to: Five (5) inches (125 mm) from power lines of 2kVa.

Eighteen (18) inches (450 mm) from high voltage lighting (including fluorescent).

Thirty-nine (39) inches (1125 mm) from power lines of 5kVa or greater.

Thirty-nine (39) inches (1125 mm) from transformers and motors.

#### LABEL IDENTIFICATION

Provide the following information on cable identification label and record name on form to be given to Architect/Engineer.

Install cable labels on each cable termination.

Labels shall be placed on the modular outlet faceplates and patch panels.

All labels shall be machine generated and be permanent. NO HAND WRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED, verify label identification with Owner

#### WARRANTY

Contractor shall provide a manufacturer's warranty of at least twenty years for all cable, connectors and blocks and per industry standards. Proof of certifications will be required prior to starting work on the structured cabling.

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#### **SECTION 28 31 00**

#### FIRE DETECTION AND ALARM

#### **PART 1 - GENERAL**

1.1 Summary: Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

#### 1.2 References:

- A. National Fire Protection Association:
  - 1. NFPA 72 National Fire Alarm Code.
  - 2. NFPA 262 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

# 1.3 System Description:

- A. Fire Alarm System: NFPA 72, automatic local fire alarm system
- B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
  - 1. Local fire alarm signaling devices sound and display with signal.
  - 2. Zone-coded signal transmits to central station.
  - 3. Location of alarm zone indicates on fire alarm control panel.
  - 4. Signal transmits to building smoke removal system.
  - 5. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service.
  - 6. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
  - 7. Signal transmits to release door hold-open devices.
  - 8. Signal releases magnetic door hold opens.
  - 9. Signal releases electric door locks.
- C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.
- D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
  - 1. Visual and audible trouble alarm indicates at fire alarm control panel.
  - 2. Visual and audible trouble alarm indicates at remote annunciator panel.
  - 3. Trouble signal transmits to central station.

#### E. Zoning:

#### 1.4 Submittals:

- A. Section 01 33 00 Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and.
- C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.
- D. Test Reports: Indicate procedures and results for specified field testing and inspection.
- E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

#### 1.5 Closeout Submittals:

- A. Section 01 70 00 Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of fire alarm equipment.

February 6, 2024 28 31 00 - 1 C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

### 1.6 Quality Assurance:

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.
- B. Perform Work in accordance with
- C. Maintain one copy of each document on site.

#### 1.7 Qualifications:

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Certified fire alarm installer with service facilities within miles of Project.

#### 1.8 Maintenance Service:

- A. Section 01 70 00 Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

#### 1.9 Maintenance Materials:

- A. Section 01 70 00 Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish six keys of each type.
- 1.10 Extra Materials: Refer to drawings

#### **PART 2 - PRODUCTS**

# 2.1 Control Panel:

- A. Manufacturers:
  - 1. Cerberus Pyrotronics.
  - 2. Edwards Systems Technology; Unit of General Signal.
  - 3. Faraday, Inc.
  - 4. Federal Signal Corp.; Commercial Products Group.
  - 5. Fire Control Instruments, Inc.
  - 6. Fire Lite Alarms, Inc.
  - 7. Gamewell Co. (The).
  - 8. Grinnell Fire Protection Systems.
  - 9. Harrington Signal, Inc; Fire Alarm.
  - 10. Honeywell, Inc.
  - 11. Notifier; Div. of Pittway Corp.
  - 12. Silent Knight.
  - 13. Simplex
- B. Product Description: UL/FM listed Modular fire alarm control panel with flush wallmounted enclosure.
- C. Power supply: Adequate to serve control panel modules, remote detectors, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 10 minutes.
- D. System Supervision: Component or power supply failure places system in trouble mode.
- E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.

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- F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.
- G. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts to provide accessory functions specified.

#### 2.2 Manual Fire Alarm Stations:

- A. Product Description: Manual single-action station with break-glass rod.
- B. Mounting: Surface.
- C. Type: Coded.
- D. Backbox: Manufacturer's standard.

#### 2.3 Spot Heat Detector:

A. Product Description: Fixed temperature, spot heat detector.

#### 2.4 Ceiling Smoke Detector:

- A. Product Description: NFPA 72, ionization type or photoelectric type ceiling smoke detector with the following features:
  - 1. Adjustable sensitivity.
  - 2. Plug-in base.
  - 3. Auxiliary relay contact.
  - 4. Integral thermal element rated 135 degrees F.
  - 5. Visual indication of detector actuation.
- B. Mounting: 4 inch outlet box.
- C. Furnish two-wire detector with common power supply and signal circuits.

#### 2.5 Duct-Mounted Smoke Detector:

- A. Product Description: NFPA 72, ionization type with the following features:
  - 1. Auxiliary SPDT relay contact.
  - 2. Key-operated normal-reset-test switch.
  - 3. Duct sampling tubes extending width of duct.
  - 4. Visual indication of detector actuation.
  - 5. Duct-mounted housing.
- B. Furnish two-wire detector with common power supply and signal circuits.

#### 2.6 Alarm Bells:

- A. Product Description: NFPA 72, vibrating, electric bell with the following features:
  - 1. Operating mechanism behind dome.
  - 2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.
  - 3. Size: 8 inch.
  - 4. Sound Rating: 81 dB at 10 feet.

## 2.7 Alarm Horn:

- A. Product Description: NFPA 72, surface type fire alarm horn with the following features:
  - 1. Sound Rating: 87 dB at 10 feet.
  - 2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.
- B. Cable Located Exposed in Plenums: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.
- C. Fire alarm circuit conductors have insulation color or code as follows:
  - 1. Power Branch Circuit Conductors: Black, red, white.
  - 2. Initiating Device Circuit: Black, red.

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- 3. Detector Power Supply: Violet, brown.
- 4. Signal Device Circuit: Blue (positive), white (negative).
- 5. Door Release: Gray, gray.

#### **PART 3 - EXECUTION**

#### 3.1 Examination:

- A. Section 01 30 00 Administrative Requirements: Coordination and project conditions.
- B. Verify products and systems receiving devices are ready for installation.

#### 3.2 Existing Work:

- A. Remove exposed abandoned fire alarm wiring. Cut cable flush with walls and floors, and patch surfaces.
- B. Disconnect and remove abandoned fire alarm equipment.
- C. Maintain access to existing fire alarm equipment and other installations remaining active and requiring access. Modify installation or provide access panel.
- D. Extend existing fire alarm installations using materials and methods as specified.
- E. Clean and repair existing fire alarm equipment to remain or to be reinstalled.

#### 3.3 Installation:

- A. Install manual station with operating handle 4 feet 6 inches feet above floor.
- B. Install audible and visual signal devices 7 feet 6 inches feet above floor.
- C. panel, box with last device or separate box adjacent to last device in circuit.
- D. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- E. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.
- F. Automatic Detector Installation: Conform to NFPA 72.
- G. Install engraved plastic nameplates in accordance with Section 28 05 00.
- H. Ground and bond fire alarm equipment and circuits in accordance with Section 26 05 26.

#### 3.4 Field Quality Control:

- A. Section: Field inspecting, testing, adjusting, and balancing.
- B. Test in accordance with NFPA 72 and local fire department requirements.

#### 3.5 Manufacturer's Field Services:

- A. Section 01 40 00 Quality Requirements: Manufacturer's field services.
- B. Include services of technician to supervise installation, adjustments, final connections, and system testing.
- 3.6 Demonstration and Training: Furnish 4 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

**END OF SECTION** 

## **SECTION 31 20 00 EARTHWORK**

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 3.5 Excavation Bracing & Sloping

3.6 Unanticipated Subsurface Conditions

1.1 Description
1.2 Quality Assurance
1.3 Submittals
1.4 Job Conditions 3.7 Excess Water Control 3.8 Preparation of Subgrade

3.9 Back Filling 2.2 Other Materials 3.10 Compaction

3.1 Surface Conditions 3.11 Site Access for Other Contractors

3.2 Preparation 3.12 Surplus Earth Material

3.3 Excavation 3.13 Grading

3.4 Trenching 3.14 Clean-Up and Damage

## **PART 1 GENERAL**

## 1.1 Description

- A. Work Included: Excavating, filling and grading required for this Work includes, but is not necessarily limited to:
  - 1. Excavating for footings and foundations.
  - 2. Building excavation.
  - 3. Filling and backfilling to attain indicated grades.
  - 4. Trenching and trench backfilling.
  - 5. Rough and finish grading of the site.
  - 6. Furnishing and installing granular cushion under all concrete slabs on grade.
  - 7. Soil compaction.
  - 8. Drainage of site for work in progress.
  - 9. Erosion control.
  - 10. Removal of excess topsoil and sub base earth materials off site.

# B. Related Work Specified Elsewhere

1.	Instructions to Bidders	Section 00 21 13
2.	Demolition	Section 02 41 16
3.	Concrete	Section 03 30 00
4.	Precast concrete	Section 03 41 00
5.	Landscaping	Section 32 90 00

## **1.2** Quality Assurance

- A. Testing Agency
  - 1. In-place soil compaction tests to be performed by testing laboratory employed by
  - 2. Test on material for controlled fill to be performed by testing laboratory employed by Contractor.
- B. Allowable Tolerances
  - 1. Grading tolerances:
    - a. Rough grade: Building and parking areas plus or minus 0.1 foot.

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- b. Finish grade
  - (1) Granular cushion under concrete slabs plus or minus 0.1 foot.
  - (2) Parking areas: See Section 32 12 00.
  - (3) Landscaped areas: See Section 32 90 00 or Landscape Plan.

## C. Reference Standards

- 1. American Society for Testing and Materials (ASTM):
  - a. D 698 Moisture-Density Relations of Soils Using 5 pound Rammer and 12-inch Drop, Standard Proctor Method.
  - b. D 2922 Nuclear Density Testing of Soil in Place, Shallow Depth.
- <u>1.3</u> Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specification; the following.
  - A. Samples of Granular Backfill
    - 1. Submit sample for under slab fill. See Soils report for approved design recommendations.
    - 2. A seventy-five (75) pound bag of any imported granular fill.
  - B. State of Ohio and local ordinance specification for soil erosion control.
  - C. Test Reports.

# 1.4 Job Conditions

# A. Environmental Requirements

- The site preparation Contractor will provide for erosion control over entire site in a
  manner that will satisfy all applicable regulations for same by the City, Huber Heights
  County of Montgomery, the State of Ohio, and the Federal Government. The cost for
  the requirement will be included in the contractor's proposal. This system will remain
  in effective operation until project is complete.
- A written plan listing methods, materials, and means to satisfy all of the above will be submitted to the Owner within 14 days of receiving a Letter of Intent to enter into a contract from the Owner.
- 3. Provide dewatering and drainage as required to accomplish Work of this Section.
- 4. Dust Control: provide as necessary to meet requirements and local ordinances.
  - a. Use all means necessary to control dust on and near the Work and on and near 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 conditions in which the Contractor leaves the site.
  - b. Thoroughly moisten all surfaces as required to prevent dust 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. Provide site erosion control per jurisdictional requirements as noted above.
- 3. Erect sheeting, shoring and bracing as necessary for protection of persons, improvements and excavations.

4. 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 2 PRODUCTS**

#### 2.1 Fill Material

#### A. General

- 1. Approval required: All fill material shall be subject to the acceptance of the Soils Engineer.
- 2. Notification: For approval of fill material, notify the Soils Engineer at least four days in advance when using excavated materials.

# B. Fill Material:

- 1. General: All fill material shall be of a nature with sufficient binder to form a firm and stable unyielding subgrade.
- 2. Crushed stone and sand may be substituted with the acceptance by Soils Engineer.
- 3. Expansion: All fill earth shall have a coefficient of expansion of not more than 3 percent from air dry to saturation under a surcharge of 60 pounds per square foot at 98 percent compaction.
- 4. Cleanliness: All fill earth shall be clean and free from debris and from rock larger than three inches in maximum dimension.
- The cushion under exterior slabs, drains and walks shall be clean granular soil material with no more than 5% passing the No. 200 sieve and at least 90% passing the 1" sieve. Soils meeting Unified Soil Classification (USCC) categories SP. GP or GW may qualify.
- C. Interior Fill Material: Fill under all interior concrete slabs on grade shall be clean well graded crushed limestone with particle size grading within the follow limits.
  - 1. Passing the one inch mesh: 100 percent.
  - 2. Passing the number four sieve: 25-60 percent.
  - 3. Passing the number 200 sieve: 3-12 percent.
  - 4. Depth: as shown on Drawings.

#### D. Trench and Structural Backfill

- 1. On-Site fill material: All on-site material used for trench and structural backfill shall meet the requirements of Article 2.1.B above.
- Imported Material: All imported material used for trench and structural backfill shall meet the requirements of Article 2.1.B above.
- 3. Maximum Lift Thickness: Nine (9) inches.
- E. Exterior Foundation Wall Backfill: Compacted on-site clay soil as approved by the Soils Engineer or as specified in 2.1 B. above.
- F. Fill Beneath Foundations: All fill material has been placed and approved by the Soils Engineer.
- G. Contractor can use on-site compactable materials to bring soil up to subgrade elevations below limestone fill under slabs; and for use in backfill. On-site materials may be used if tested by the Soils Engineer and verified to contain the proper composition and is dry enough for proper compaction.

February 6, 2024 31 20 00-3 **2.2 Other Materials:** All other materials, not specifically described but shown on drawings or as required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the approval of the Architect.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

# A. Inspection

- 1. Verify that preceding work affecting work of this Section has been satisfactory completed.
- 2. Prior to all work of this Section, become thoroughly familiar with the site, site conditions and all portions of the Work falling within this Section.

# 3.2 Preparation

### A. Field Measurements

- Finish Elevations and Lines: For the setting and establishing finish elevations and lines, establish two independent bench marks, carefully preserve all data and all bench marks. If displaced or lost, immediately replace to the approval of the Architect and at no additional cost to the Owner. Remove at completion of project.
- This contractor will be required to submit in writing that the existing grades have been verified and are within acceptable tolerances. If such verification is NOT received by the Architect prior to the start of excavation, contractor accepts ALL responsibility.
- B. Brush and tree removal: as indicated on the site plan. Remove trees and brush: dispose of off-site in accordance with all applicable codes and ordinances. Leave excavation free of roots and debris. Do not cause damage to trees not scheduled for removal.

#### 3.3 Excavation

- A. Site Construction Areas: Strip off organic top soil and stock pile that amount needed to complete the work as shown on the site plan. Excess compactable soil and top soil to be removed from site.
- B. Depressions resulting from removal of obstructions: 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 or Soils Engineer.
- C. Remove any frozen soil prior to placement of any additional fill.

### D. Structure Excavation

 Excavation: Remove all materials of every nature, description encountered, required, in obtaining indicated lines, grades, which, in Architect's opinion, can be loosened, removed by hand with hand tools, or with power shovels. Assume that all excavations to indicated lines, grades, can be done by aforementioned means. All excavated material will be removed from the Site except that material needed for backfill.

# E. Excavating for Footings

- 1. Preparation
  - a. To minimize differential settlement, it is essential that earth surfaces upon which footings will be placed be compacted to the acceptance of the Soils Engineer and in accord with the compaction requirements established in this Section of these Specifications.
  - b. Verify that all compaction is complete and accepted by the Soils Engineer prior to excavating for footings.

# 2. Excavating

- a. Excavate to the established lines and grades.
- b. Cut off bottom of trenches level and then remove all loose soil.
- c. Where soft spots are encountered, remove all defective material and replace with lean concrete or suitable compacted fill.
- d. Bearing soil conditions to be verified by the Soils Engineer prior to concrete placement on same.
- F. Below Floor Slabs and Adjacent Walks and Slabs:
  - 1. Under all floor slabs and all adjacent walks and slabs, remove and replace the existing soil as required for finish subgrades.

## G. Other Areas

- 1. Excavate to grades shown on the Drawings.
- 2. Where excavation grades are not shown on the Drawings, excavate as required to accommodate the installation.
- 3. On cut banks, neatly trim to the required finish surface as the cut progresses. As and alternative, the Contractor may leave the cuts full and the finish grade by mechanical or hand equipment to produce the finish surfaces as shown on the Drawings.
- H. Overexcavation: Back fill and compact all overexcavated areas as specified for fill below and at no additional cost to the Owner.
- I. Removal of Unsuitable Materials
  - 1. Remove unsuitable material from within the limits of the work specified in this
  - 2. Stockpile materials meeting requirements for controlled fill.
  - 3. Remove from the Site all rock larger than three inches in maximum dimension.
  - 4. If Contractor encounters any waste material contaminated soil during excavation the material should be stockpiled per DNR protocols and the Owner will have the material disposed from the site under a separate contract.
- J. Proofrolling: Within the limits of the concrete slabs, and yard area, roads, and limestone areas per site plan and before placement of underslab fill, proofroll the existing grade in two mutually perpendicular directions. Proofrolling shall be accomplished by heavily loaded 25 ton minimum weight rubber-tired tandem-axle dump truck. Areas exhibiting excessive deflection shall be undercut and stabilized prior to constructing concrete slabs and pavements.

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# 3.4 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

- 1. Trench as required to provide the elevations shown on the Drawings.
- 2. Where elevations are not shown on the Drawings, trench to sufficient depth to give 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 inadvertently carried below proper elevation, backfill with approved material compacted to provide a firm and unyielding subgrade and/or foundation to the approval of the Architect and at no additional cost to the Owner.
- D. Grading and Stockpiling Trenched Material
  - 1. Control the stockpiling of trenched material in a manner to prevent water running into excavations.
  - 2. Do no obstruct the surface drainage but provide means whereby storm and waste waters are diverted into existing gutters, temporary drains, or surface drains.
  - 3. Do not stockpile materials adjacent to open trenches.
- **3.5 Excavation Bracing and Sloping:** The soil report indicates that sloping or bracing of the excavation walls may be necessary to prevent caving in excavations.
  - A. Properly support all trenches in strict accord with all OSHA pertinent rules and regulations or local Codes, whichever is more strict. The Contractor will be responsible for the design of the bracing system. Employ a Registered Engineer for the design of all bracing systems.
  - B. Brace, sheet and support 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 improvements of every kind, whether on public or private property, will be fully protected from damage.
  - C. In the event of damage to such improvement, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
  - D. Arrange all 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 proved sufficient strength. Brace excavations along the existing buildings to prevent undermining of floor slabs and footings.

- E. Removal of Bracing: Exercise care in the drawing and removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavating faces being supported.
- 3.6 Unanticipated Subsurface Conditions: The Owner has had a subsurface investigation performed by a soils engineer, the results of which are contained in the consultant's report. The Contractor acknowledges that he has reviewed the consultant's report and any addenda thereto and that his bid for earthwork operations is based on the subsurface conditions, as described in that report. At any point during earthwork, and foundation construction operations, that the contractor encounters conditions that are different than those anticipated by the Soils Engineer report, he shall immediately (within 24 hours) bring this fact to the Architect and Soil Engineer's attention. Once a fact of unanticipated conditions has been brought to the attention of the Owner, Architect, and the Soils Engineer has concurred, immediate negotiations will be undertaken between the Owner and the Contractor to arrive at a change in Contract price for additional work or reduction at a change in Contract price for additional work or reduction at a change in work because of the unanticipated conditions. The Contractor agrees that the unit prices shown on the Bid Form would apply for additional or reduced work under the Contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and material basis.

#### 3.7 Excess Water Control

- A. Unfavorable Weather
  - 1. Do not place, spread or roll any fill material during unfavorable weather conditions.
  - 2. Do not resume operations until moisture content and fill density are satisfactory to the Specifications.
- B. Flooding: Provide berms or channels to prevent flooding of subgrade; promptly remove all water collecting in depressions including foundation excavations.
- C. Softened subgrade: Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and recompact as specified for fill and compaction below. For softened foundation subgrade refer to Section 3.3 E.1.a.
- D. Dewatering: Provide and maintain at all times during construction, ample means and devices with which to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations.

## 3.8 Preparation of Subgrade

- A. Leveling: Remove all ruts, hummocks, and other uneven surfaces by surface grading prior to placement of fill.
- B. Wet Soil Conditions: At bearing elevations where unstable bearing soils are encountered for support of shallow foundations, over excavate and place at least a 6" layer of coarse crushed limestone to create a firm working base. Provide firm base for support of equipment described in Article 3.11 of this Section if required. Soils Engineer will review the base prior to concrete placement.

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# 3.9 Backifilling

# A. Backfilling Prior to Approvals

- Do not allow or cause any or the Work performed or installed to be covered up or enclosed by work of this Section prior to all required inspections, tests, 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.
- 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 uncovering, all at no additional cost to the Owner.

# B. Filling

- After subgrade compaction has been reviewed by the Architect, spread approved fill
  material in layers not exceeding <u>nine</u> inches in uncompacted thickness. Promptly
  backfill excavations as work permits, but not before concrete walls, piers, have
  attained full design strength, and are properly braced.
- 2. Bring each layer to the moisture content described herein prior compaction.
- At fill banks, grade fill and then compact at least five feet beyond the grade of the finish bank. After the banks have been filled, trim to the finish grades and limits shown on the Drawings.
- C. Placing Granular Cushion: Carefully place and compact the granular cushion in areas to receive concrete slabs on grade, uniformly attaining the thickness indicated on the Drawings and providing all required transition planes.

# 3.10 Compaction

#### A. Moisture-conditioning

- 1. Water or aerate the fill material as necessary and thoroughly mix to obtain a moisture content which will permit proper compaction.
- 2. For all on-site clay soils designated to be compacted, bring to between minus 1 and 3 percent over optimum moisture content.
- 3. For all relatively non-expansive and predominately granular soils to be compacted, bring to within 2 percent below or above optimum moisture content.
- B. Compaction, General: Compact soil layer to at least the specified minimum degree; repeat compaction process until plan grade is attained. Percentage of compaction indicated shall be that percentage of maximum dry density obtainable by the ASTM designation D 698 method of compaction.

## C. Degree of Compaction Requirements

- 1. Structural fill: Densify all structural fill, including recompacted existing fill and backfill, to a minimum degree of compaction of 95%.
- 2. Pavement areas: Compact the upper twelve (12) inches of fill in pavement areas to a minimum degree of compaction of 98%.
- 3. Trenches in building 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 95%.

- c. Compact the upper twelve (12) inches of backfill in pavement areas to a minimum degree of compaction of 98%.
- d. Densify cohesionless backfill material to a minimum relative density of 70% as determined by the ASTM test designated as D 2049.
- 4. At the upper two feet in areas to receive planting, compact to at least 90% maximum dry density. Compact all fill in these areas, beneath the upper two feet, to 95% maximum dry density.
- 5. The base of all footing foundations supported on fill are to be compacted to a minimum of 98% of the maximum density.

#### D. Soil Compaction Control

- Inspections: Contractor will notify the Soils Engineer daily before starting soil compaction. Contractor will not start any soil compaction without Soils Engineer approval. Soils Engineer will make daily inspection to insure proper compaction. Any material found to be improperly compacted will be removed at the Soils Engineer direction.
- 2. Operators: All compaction will be performed only by qualified mechanics experienced in the use of equipment and techniques to be used.
- 3. Compaction methods: Compaction methods used must be accepted by the Architect and Soils Engineer prior to commencement of work. Contractor will be prepared to demonstrate any methods used prior to Architect's approval.
- 4. Samples and Test: The Owner will employ a qualified engineer to perform required site and laboratory tests to verify conformance of compaction requirements. Contractor will verify with Architect the nature of tests before starting work to assure sample can be taken in locations and at time interval required.
- E. Flooding and Jetting: Compaction by flooding and jetting is expressly prohibited.
- 3.11 Site Access for Other Contractors: The General Contractor will determine during the bidding period and include in the Base Bid all costs required to provide access to the Site for:
  - A. Precast concrete hauling and erection equipment.
  - B. Concrete transportation and placing equipment.
  - C. Structural steel erector.
  - D. Mechanical Contractors.
  - E. The above Contractors are not responsible for any sitework to get their equipment into position. The Architect will not hear of any excuses for the General Contractor not having the Site accessible for these Contractors.
- 3.12 Surplus Earth Material: Stockpile all surplus earth, not needed to complete filling and grading, on the property and outside the limits of work as directed by the Architect. At completion of the project, remove from the site all surplus earth materials. See note at 3.3 A. Same applies to excess excavated subgrade materials.

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# **3.13 Grading**

- A. General: Except as otherwise directed by the Architect, perform all rough and finish grading required to attain the elevations indicated on the Drawings.
- B. Treatment after completion of grading
  - After grading is completed and the Architect has finished his inspection, permit no further excavation, filling or grading except with the approval and inspection of the Architect.
  - Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

# 3.14 Cleanup and Damage

- A. At completion of work, clean and remove from site all debris, materials from work, machines, etc.
- B. Any damage done to foundations, utilities, etc., by this Contractor, or his subcontractors, during work under this Contract, shall be repaired or replaced to the satisfaction of the Owner and Architect, without additional costs.

## **SECTION 32 12 00 ASPHALTIC CONCRETE PAVING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.3 Traffic and Parking Marking Materials

1.2 Quality Assurance 3.1 Surface Conditions

1.3 Submittals 3.2 Preparation 1.4 Product Handling 3.3 Installation

1.5 Job Conditions2.1 Materials3.4 Field Quality Control3.5 Cleaning and Protection

2.2 Asphalt Pavements 3.6 Paving Schedule

## **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Asphaltic concrete pavement required for this work is indicated on the Drawings and includes, but is not necessarily limited to:
  - 1. Final preparation of subgrade to receive stabilizing aggregate base course.
  - 2. Place mineral aggregate stabilizing base course, work and compact.
  - 3. Asphalt surfacing materials.
  - 4. Placing asphaltic concrete.
  - 5. Flood test.
  - 6. Parking stall stripes and traffic lines.
  - 7. Resurfacing of existing parking lot and driving areas.

# B. Related Work Specified Elsewhere

Quality Requirements
 Cast-In-Place Concrete
 Sitework
 Subgrade preparation
 Section 01 45 00
 Section 03 30 00
 Section 31 20 00
 Section 31 20 00

# **1.2** Quality Assurance

A. Qualifications of Asphalt Concrete Producers: Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

# B. Qualifications of Workers

- Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of work described for this Section, and who shall be present at all times during progress of the work of this Section and shall direct all work performed under this Section.
- 2. For actual finishing of asphaltic concrete surfaces and operation of the required equipment, use only personnel who are thoroughly trained and experienced in the skills required.

# C. Testing Agency

- Testing and inspection of asphalt pavement mix and testing of placed stabilizing base course and asphalt pavement will be performed by independent testing laboratory appointed and paid for by Owner in accord with Section 01 45 00. Testing and inspection will be performed so as to minimize disruption of Work.
- 2. Allow testing laboratory access to the mixing plant for verifications of weights or proportions, character of materials used and determination of temperatures used in the preparation of asphalt concrete mix.
- 3. When and if required, the testing laboratory will perform laboratory tests on proposed asphalt pavement mix to determine conformity with requirements.
- 4. The testing laboratory will perform one series of compaction tests fro stabilizing base course and for each asphalt pavement course. Paving contractor to pay for costs of additional testing as required due to improper performance of work.
- 5. When stabilizing base course or portion thereof has been placed and compacted in accord with requirements, notify the testing laboratory to perform density tests. Do not place asphalt pavement until results have been verified and base course installation approved.
- If compaction tests indicate that stabilizing base course or asphalt paving do not meet specified requirements; remove defective work, replace and retest at Contractors expense.
- D. Requirements of Regulatory Agencies: Comply with applicable requirements of State of *Ohio*, Department of Transportation, Division of Highways Standard Specifications for Road and Bridge Construction, latest edition.

#### E. Allowable Tolerances

- 1. Thickness: In-place compacted thicknesses will not be acceptable if exceeding following allowable variation from thicknesses shown on Drawings.
  - a. Binder Course: 1/8 inch, plus or minus.
  - b. Surface Course: 1/2 inch, plus or minus.
- 2. Surface Smoothness
  - Test finished surface of each asphalt concrete course for smoothness, using a 10 foot straightedge applied parallel to and at right angles to centerline of paved areas.
  - b. Check surfaced areas at intervals directed by Architect.
  - c. Surfaces will not be acceptable if exceeding the following:
    - (1) Binder course: 1/4 inch in 10 feet.
    - (2) Surface Course: 1/8 inch in 10 feet.
    - (3) Crowned surfaces
      - (a) Test crowned surfaces with a crown template, centered and at right angles to the crown.
      - (b) Surfaces will not be acceptable if varying more than ¼ inch from the template.
    - (4) Granular Base: 3/8 inch in 10 feet.
- 3. Asphalt Mix Proportions
  - a. Aggregate passing No. 4 and larger sieves: +-7%
  - b. Aggregate passing No. 8 and No. 100 sieves (inclusive): +-4%
  - c. Aggregate passing No. 200 sieve: +-2%
  - d. Bituminous material: +0.4%

#### F. Reference Standards

- 1. Asphalt Institute (AI): SS-1, Construction Specifications for Asphalt Concrete and Other Plant Mix Types.
- 2. American Society for Testing and Materials (ASTM):
  - a. D 242, Mineral Filler for Bituminous Paving Mixtures.
  - b. D 290, Recommended Practice for Bituminous Mixing Plant Inspection.
  - c. D 692, Coarse Aggregate for Bituminous Paving Mixtures.
  - d. D 946, Emulsified Asphalt.
  - e. D 995, Requirements for Mixing Plants for Hot-mixed, Hot-laid Bituminous Paving Mixtures.
  - f. D 1073, Fine Aggregate for Bituminous Paving Mixtures.
  - g. D 1188, Bulk Specific Gravity of Compacted Bituminous Mixtures.
  - h. D 1241,
  - i. D 1557, Moisture-density Relations of Soils Using Ten Pound Hammer and 18 inch Drop.
  - j. D 1559,
  - k. D a663, Hot-mixed, Hot-laid Asphalt Paving Mixtures.
  - I. D 2027, Cutback Asphalt
  - m. D 2167, Density of Soil in Place by Rubber-balloon Method.
  - n. D 2489, Degree of Particle Coating of Bituminous-aggregate Mixtures.
- 3. Federal Specifications (FS)
  - a. TT-P-115, Paint, Traffic, Highway, White and Yellow.
- 4. Ohio Department of Transportation (DOT)
  - a. Construction and Materials Manual
- **1.3 Submittals:** Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specification; the following:
  - A. Samples: Provide samples of materials of laboratory testing and job-mix design.
    - 1. Coarse and fine aggregate from each material source and each required grading.
    - 2. Asphalt cement for each penetration grade.
  - B. Mix Design: Use Marshall method of mix design or other method acceptable to Architect.
  - C. Certificates
    - 1. Certify that materials comply with Specification requirements.
    - 2. Signed by asphalt concrete producer and Contractor.
  - D. At least once, during each days paving, a copy of the ingredients print-out will be sent to the site for inspection by the Architect, available upon request.

## 1.4 Product Delivery, Storage and Handling

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

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### 1.5 Job Conditions

#### A. Weather Limitations

- 1. Perform paving operations only when the ambient temperature in the shade is 50 degrees F. and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application.
- 2. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
- 3. Base course may be placed when air temperature is not below 30 degrees F. and rising, when acceptable to the Architect.
- B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.
- C. Traffic Control: Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.
- D. Dust Control: Use all means necessary to prevent spread of dust during performance of the work of this Section. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

## **PART 2 PRODUCTS**

#### 2.1 Materials

### A. Stabilizing Base Course Materials

1. Granular Base: Angular crushed natural stone; free from shale, organic matter and debris, ASTM D 1241; graded within following limits:

Percentage by Weight Passing

Gradation No. 2		
Sieve Size	Crushed Stone	
1 inch	100	
3/8 inch	40-75	
No. 4	25-60	
No. 10	15-45	
No. 40	-	
No. 200	2-12	

# B. Asphalt Pavement Materials

- 1. Aggregate for Asphalt Concrete, General
  - a. Ohio DOT Item 304
  - b. Mineral Filler: Finely ground particles of limestone hydrated lime or other mineral dust acceptable to Architect; fee of clay, silt or other deleterious matter; ASTM D 242.
- 2. Binder course within following limits:
  - a. Layer thickness = 3.5"

- b. Ohio DOT Item 441 (1)
- 3. Surface course within the following limits:
  - a. Layer thickness = 2.2"
  - b. Ohio DOT item 441 (1)
- 4. Other Materials: All other materials, not specifically described but required for proper and complete installation of asphaltic concrete pavement, shall be as selected by the Contractor subject to the approval of the Architect.

# 2.2 Asphalt Pavement Mix (Ohio DOT)

- A. Job-mix criteria
  - 1. Provide job-mix formulas for each required asphalt-aggregated mixture.
  - 2. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.
  - 3. Comply with the mix requirements of State of Ohio Highway Standards.
  - 4. Maintain material quantities within allowable tolerances of the governing standards.
- B. Maintain thorough and uniform mixture.
- C. Bring asphalt cement and mineral constituents to required temperatures before mixing. Ensure aggregate are sufficiently dry so as not to cause foaming in mixture.

# 2.3 Traffic and Parking Marking Materials

- A. Traffic lane marking paint with chlorinated rubber base.
- B. Factory mixed, quick drying and non bleeding, FS TT-P-115, Type III.
- C. Color: White
- D. Handicap Parking Signs: ADA and Local Code compliant signs mounted on steel posts. One at each designated stall.

#### **PART 3 EXECUTION**

## 3.1 Surface Conditions

- A. Inspection
  - 1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  - Verify that asphaltic concrete pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
- B. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Architect.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

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# 3.2 Preparation

- A. Ensure grading of sub-grade is to required elevation.
- B. Water and thoroughly mix sub-grade until optimum moisture content is obtained with deficiency of moisture content exists. When excess of moisture exists, rework and aerate sub-grade until optimum moisture content is obtained
- C. Before final rolling, shape entire section, add additional sub-soil as required and compact sub-grade to provide grades, elevation and cross-section indicated, with due allowance for the thickness of base course and finished surfacing to be placed thereon. Points of finished sub-grade surface shall be within one inch elevations indicated.

#### D. Proof Roll

- 1. Proof roll prepared sub-base surface using heavy, rubber-tired rollers.
- 2. Notify Contractor of unsatisfactory conditions.
- 3. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

## E. Loose and Foreign Material

- 1. Remove loose and foreign material from compacted sub-base surface immediately before application of paving.
- 2. Use power brooms or blowers, and hand brooming as required.
- 3. Do not displace sub-base material.
- 4. Remove all rocks or boulders exceeding six inches in size.

### 3.3 Installation

- A. Placement of Stabilizing Aggregate Base Course
  - 1. Check subgrade for conformity with elevations and section immediately before placing aggregate base material.
  - 2. Spread, shape and compact all aggregate base material deposited on the subgrade during the same day.
  - 3. Compact aggregate base course material to not less than 95% of maximum density: ASTM D 1557, Method D.
  - 4. Add water during compaction to bring stabilizing base course materials to optimum moisture content. When an excess moisture exists, rework stabilizing base course materials until optimum moisture content is obtained.
  - 5. Properly compact areas adjacent to curbs, catch basins, man holes and other areas not accessible to rollers with mechanical or hand tamping devices. Ensure granular sub-base course materials are not contaminated with deleterious materials.
  - 6. Test density of compacted aggregate base course; ASTM D 2167.
  - 7. Conduct one test for each 2500 square yards of in-place material, but in not case not less than one daily for each layer.
  - 8. Ensure top surface of base course is true to lines and grades indicated, with all points within ½ inch of elevation indicated.
  - 9. Remove or repair improperly prepared areas as directed by the Architect.

# B. Frame Adjustments

- 1. Set frames of subsurface structures to final grade as a part of this work, include existing frames, and new frames furnished under other work of project.
- 2. Placing frames:
  - a. Surround frames set to elevation with a ring of compacted asphalt concrete base prior to paving.
  - b. Place asphalt concrete mixture up to one inch below top of frame, slope to grade, and compact by hand tamping.
- 3. Adjust frames to proper position to meet paving.
- 4. If permanent covers are not in place, provide temporary covers over opening until completion of rolling operations.
- 5. Set cover frames to grade, flush with surface of adjacent pavement.

# C. Preparing the Mixture

- 1. Transportation:
  - a. Transport asphalt concrete mixtures from mixing site in trucks having tight, clean compartments.
  - b. Coat hauling compartments with a lime-water mixture to prevent asphalt concrete mixture from sticking.
  - c. Elevate and drain compartment of excess solution before loading mix.
  - d. Provide covers over asphalt concrete mixture when transporting to protect from weather and to prevent loss of heat.
  - e. During periods of cold weather or for long distance deliveries, provide insulation around entire truck bed surfaces.

# D. Equipment

- 1. Provide size and quantity of equipment to complete the work specified within project time schedule.
- 2. Bituminous Pavers: Self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or gouging surfaces, and control pavement edges to true lines without use of stationary forms.
- 3. Rolling Equipment:
  - a. Self-propelled, steel, wheeled and pneumatic-tired rollers that can reverse direction without backlash.
  - b. Other type rollers may be used if acceptable to the Architect.
- 4. Coating Equipment: All equipment for line painting shall be specifically designed for that purpose and shall be subject to the inspection and approval of the Architect.
- Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters and other miscellaneous small tools to complete the work specified.

### E. Placing the Mix

- 1. Place asphalt pavement within 4 hours of priming stabilizing base course.
- 2. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine.
- 3. Spread mixture at a minimum temperature of 225 degrees F.
- 4. Inaccessible and small areas may be placed by hand.
- 5. Place each course so that when compacted it will conform to the indicated grade, cross-section, finish thickness, and density indicated.

# 6. Paver Placing

- a. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.
- b. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
- c. Complete base courses for a section before placing surface courses.
- d. Place mixture in continuous operation as practicable.

# 7. Hand Placing:

- a. Spread, tamp, and finish mixture using had tools in areas where machine spreading is not possible, as acceptable to Architect.
- b. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.

# 8. Joints:

- a. Carefully make joints between old and new pavements, or between successive day's works, to ensure a continuous bond between adjoining work.
- b. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.
- c. Clean contact surfaces free of sand, dirt, or other objectionable material apply tack coat to base course that has been exposed to traffic.
- d. Offset transverse joints in succeeding courses not less than 24 inches.
- e. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.
- f. Offset longitudinal joints in succeeding courses not less than 6 inches.
- g. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

### F. Compacting the Mix

- 1. Compact each asphalt paving course to required density, with approved rolling equipment.
- 2. Provide sufficient rollers to obtain the required pavement density.
- 3. Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.
- 4. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.
- 5. Keep roller wheels sufficiently moist so as not to pick up material.
- 6. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- 7. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.
- 8. Do not roll centers of sections first under any circumstances.
- 9. Breakdown Rolling:
  - a. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
  - b. Operate rollers as close as possible to paver without causing pavement displacement.
  - c. Check crown, grade, and smoothness after breakdown rolling.

d. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

## 10. Second Rolling:

- a. Follow breakdown rolling as soon as possible, while mixture is not in condition for compaction.
- Continue second rolling until mixture has been thoroughly compacted.

## 11. Finish Rolling:

- a. Perform finish rolling while mixture is still warm enough for removal of roller marks.
- b. Continue rolling until roller marks are eliminated and course has attained specified density.

# 12. Patching:

- a. Remove and replace defective areas.
- b. Cut-out and fill with fresh, hot asphalt concrete.
- c. Compact by rolling to specified surface density and smoothness.
- d. Remove deficient areas for full depth of course.
- e. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
- f. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

#### G. Flood Test

- 1. Schedule: Perform a flood test in the presence of the Architect.
- 2. Method:
  - a. Perform the flooding by use of a water tank truck.
  - b. If a depression is found where water ponds to a depth of more than 1/8", fill or otherwise correct to provide proper drainage.
  - c. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.
- 3. Results of a heavy rain may be used in lieu of flood test. Contractor will not delay completion of paving while waiting for such rain and will flood test if so directed by the Architect.

## H. Marking Asphalt Concrete

- 1. Cleaning:
  - a. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
  - b. Do not begin marking asphalt concrete pavement until acceptable to Architect.
- 2. Apply paint with mechanical equipment:
  - a. Provide uniform straight edges.
  - b. Not less than 2 separate coats in accord with manufacturer's recommended rates.
- 3. Locate all striping where indicated on Drawings.

# 3.4 Field Quality Control

## A. Paving Quality Requirements

 General: In addition to other specified conditions, comply with following minimum requirements; Provide final surfaces of uniform texture, conforming to required grades and cross sections. 2. Density: Minimum acceptable density of in-place course material is 98% of the recorded laboratory specimen density.

# 3.5 Cleaning and Protection

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of Architect.

#### B. Protection

- 1. After final rolling do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6 hours.
- 2. Provide barricades and warning devices as required to protect pavement and the general public.
- 3. Cover openings of structures in the area of paving until permanent coverings are placed.

# 3.6 Paving Schedules

A. Under no circumstances will the total thickness of paving be less than amount indicated on the Drawings. There is no tolerance allowed below this minimum thickness.

\* \* \* \* \* \* \* \* \* \* \* \* \*

## **SECTION 32 31 13 CHAIN LINK FENCES AND GATES**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Materials

1.2 Quality Assurance 3.1 Surface Conditions

1.3 Submittals 3.2 Preparation
1.4 Product Delivery, Storage 3.3 Installation

and Handling 3.4 Adjust and Clean

#### **PART 1 GENERAL**

# 1.1 Description

- A. Work Included: Chain link fencing and gates required for this Work is indicated on the Drawings and includes necessary accessories.
- B. Related Work Specified Elsewhere

Concrete
 Finish grading
 Section 03 30 00
 Section 31 20 00

# 1.2 Quality Assurance

- A. Qualifications for Erectors
  - 1. For actual installation of chain link fencing and gates, use only personnel completely trained and experienced in installation of the approved materials and thoroughly familiar with the original design and the approved Shop Drawings.
  - 2. Gates shall meet UL 325 Standard
- Submittals: Within 35 days after award of Contract, and before any chain link fencing materials are delivered to the job site, submit to the Architect in accordance with these Specifications; the following:
  - A. Shop Drawings: Details of fabrication and installation.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect chain link fencing materials before, during and after installation and to protect the 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 2 PRODUCTS**

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#### A. Fence and Gate

- 1. Contractor shall furnish all of the materials and shall erect a thermal fusion bonded, PVC coated chain link fabric fence on a steel framework to a height as noted on the Drawings.
- 2. Contractor shall exercise particular care in the prosecution of this work to assure that he will not come in contact with any underground electrical or telephone conduits, overhead wiring, mechanical or electrical equipment.

## B. Chain Link Fence Materials

- 1. Basic Specifications:
  - a. Height: As shown on Drawings
  - b. Fabric: 2" Mesh, 8 Gauge Polymer Coated Fabric, Color: Black
  - c. Top Rail: 1-5/8" OD, SS40 weight Polymer Coated, Color: Black
  - d. Line Posts: 2-3/8" OD, SS40 weight Polymer Coated, Color: Black
- 2. Fabric shall be Polymer Coated, Class 2b over metallic-coated wire per ASTM Specification F-668. Mesh size to be 2" square.
  - a. Provide fabric in one-piece heights measured between top and bottom of outer edge or selvage knuckle or twist. Comply with ASTM A-392 and CLFMI CLF 2445.
  - b. Fabric shall be connected: to line posts with nine gauge (9 ga.) wire clips every fourteen inches (14"); to top rail with nine gauge (9 ga.) wires every twenty-four inches (24"); to terminal, corner, and gate posts by integrally weaving into the post or by using one-quarter inch by three-quarter inch (¼" X ¾") tension bars tied to the post every fourteen inches (14")with eleven gauge (11 ga.) one inch (1") wide steel bands and three-eighth inch (¾") diameter bolts and nuts; to tension wire with eleven gauge (11 ga.) nog rings every twenty-four inches (24").
- 3. Breaking strength of fabric wire shall be 1,290 lbf minimum.
- 4. Top rail shall be one and five-eighth inches OD, SS40 weight. Top rail shall pass through intermediate posts tops and form a continuous brace within each stretch of fence and be securely fastened to terminal posts.
- 5. End, corner and pull posts shall be two & seven eight inches 2-1/8" OD, SS40 weight
- 6. Gate frames shall be 1.90" O.D. pipe welded at each corner. Each frame shall have three-eighth inch (%") diameter adjustable truss rods. Gates shall have positive type latching devices with provisions for padlocking. Single acting gate shall be installed where shown on the drawings.
- 7. All posts, rails and appurtenances shall be ASTM F1043 Group IA hot-dip galvanized pipe having a zinc coating of 1.8 oz/ft² (550 g/m²) on the outside and 1.8 oz/ft² (550 g/m²) on the inside surface. Exterior of pipe to have F1043 PVC thermally fused color coating, minimum thickness 10 mils (0.254 mm). Pipe posts shall have tops which exclude moisture. End, corner, pull and gate posts shall be braced with the same material as top rail and trussed to line posts with three-eighth inch (¾") rods and lightener's. Each post shall be set in a concrete foundation of 1-2-4 mix having a minimum diameter of nine inches (9") and at least forty-eight inches (48") deep or below frost line. Line posts shall be evenly spaced eight feet (8'-0") or less apart. Line posts may be driven 48" deep in lieu of concrete footings.
- 8. Standard tolerances apply. Installation shall be by experienced fence erectors, on lines and grades furnished by the Company.
- 9. If 95% of the materials are made in the USA Mill certifications are not required.
- Privacy Slats Fin2000 Slats by PrivacyLink or approved equal. Colors Beige, Redwood, Black, White, Royal Blue, Forest Green, Gray, Dark Brown, Sky Blue – Color by Architect

# C. Rolling and Man Gates

- Construction for rolling gate shall consist of four inch (4") O.D. gate posts and three
  inch (3") O.D. latch post with receiver. Gate to be constructed in a manner to
  insure ease of operation and maintenance.
- 2. Gate portion shall be fabricated with two and one-half inch (2-1/2") O.D. pipe top and bottom members and two inch (2") O.D. pipe vertical members.
- 3. Gate assembly shall include Pipe Frame Stiffener or equal.
- 4. Gate #1 and Gate #2 motorized cantilevered gate 30'-8" / 26'-8".
- 5. Man gates with lockable latch as shown on site plan 3'-8" opening (6) required.
- 6. Gate shall roll on heavy duty large diameter rollers (size and number as recommended by fence material supplier). All material shall be hot-dipped zinc coated steel per ASTM Specifications A-120-65, A-123-66 or A-153-65.
- 7. Operator: Heavy-duty slide gate operator. 480 Voltage Phase 3HP Per Electrical Drawings, motor see electrical sheets. Interface with radio controlled devices, card reader and loop detectors. The system must allow city vehicle to use their vehicle radio's to open the gate similar to a click 2 enter system. Provide heating kits at each powered location.
- 8. The gate should be equipped with a free exist loop.
- 9. Motorized gate to have an additional knox box holding an operating signal button when power is on; when power is off a chain opening device. Other gates to be manual swing as shown on drawings.
- 10. All fencing per ASTM F1043.

#### **PART 3 EXECUTION**

# 3.1 Surface Conditions

#### A. Inspection

- Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that final grading in fence location is completed without irregularities which would interfere with fence installation.
- 3. Verify that chain link fencing and gates may be installed in strict accordance with the original design and the approved Shop Drawings.

#### B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 Preparation

February 6, 2024

- A. Measure and lay out complete fence line.
- B. Measure parallel to surface of ground.
- C. Locate and mark position of posts.
- D. Locate line posts at equal distance spacing, not exceeding 8 foot centers.

32 31 13-3 CHAIN LINK FENCES AND GATES E. Locate corner posts at positions where fence changes direction more than 10 degrees.

#### 3.3 Installation

- A. Install new fencing to match layout.
- B. Posts
  - 1. Line post spacing: 8 feet on center maximum.
  - 2. Pull posts: Pull posts shall be installed at all points of deflection greater than 30 degrees in the line of fence and also at all points where there are abrupt changes in grade.
  - 3. Do not begin prior to completion of the final grading. Drill holes for posts footings in firm undisturbed or compacted soil.
  - 4. Minimum post hole diameter three times outside post diameter.
  - 5. Minimum post hole depth: 3 inches below post bottom.
  - 6. Place concrete in hole to depth of post bottom in a continuous pour.
  - 7. Set post plumb to 1/4 inch in 10 feet.
  - 8. Fill hole with concrete to 2 inches above grade.
  - 9. Crown surface of concrete to slope away from post.
  - 10. Set keepers, stops, sleeves and other accessories into concrete as required.
- C. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- D. Tension Wire: Install tension wires before stretching fabric and tie to each post with ties and clips.
- E. Fence Fabric: The fabric shall be placed on the side of the fence as designated by the Owner or his representative.
  - Stretch fabric tight between terminal post so that fabric remains in tension after pulling force is released.
  - 2. Position bottom of fabric approximately 1 inch to 2 inches above ground level at each post.
  - 3. Cut fabric to form one continuous piece between terminal posts.
  - 4. Attach fabric to terminal post using tension bars and tension band:
    - a. Thread tension bars through fabric.
    - b. Tension band spacing not to exceed 15 inches on center.
  - 5. Attach fabric to line posts using wire ties or clips, spacing not to exceed 15 inches on center.
  - 6. Attach top edge of fabric to top rail using wire ties or clips, spacing not to exceed 24 inches on center.
  - 7. Attach bottom edge of fabric to bottom tension wire using wire ties or clips, spacing not to exceed 24 inches on center.
- F. Stretcher Bars: Thread through fabric and secure to posts with metal bands spaced not over 15 inches on center.
- G. Gates
  - 1. Install gates plumb and level, 1/4 inch in 10 feet.

- 2. Install ground-set items in concrete for anchorage, as recommended by fence Manufacturer.
- 3. Adjust hardware to provide smooth operation.

# 3.4 Adjust and Clean

- A. Adjust brace rails and tension rods for rigid installation.
- B. Tighten hardware, fasteners and accessories.
- C. Remove excess and waste materials from project site.

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#### **SECTION 32 31 19 ORNAMENTAL METAL FENCES AND GATES**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX 1.1 Description 2.1 Manufacturer

1.2 Quality Assurance2.2 Material1.3 Submittals2.3 Fabrication1.4 Product Delivery, Storage3.1 Preparation

and Handling 3.2 Installation

1.5 Reference Standards 3.3 Adjust and Cleaning

#### **PART 1 GENERAL**

### 1.1 Description

- A. Work Included: Ornamental metal fencing required for this Work is indicated on the Drawings and includes necessary accessories.
- B. Related Work Specified Elsewhere

1. Concrete Section 03 30 00

# 1.2 Quality Assurance

- A. Qualifications for Erectors
  - For actual installation of ornamental metal fencing and gates, use only personnel completely trained and experienced in installation of the approved materials and thoroughly familiar with the original design and the approved Shop Drawings.
- <u>1.3</u> Submittals: Within 35 days after award of Contract, and before any fencing materials are delivered to the job site, submit to the Architect in accordance with these Specifications; the following:
  - A. Shop Drawings: Details of fabrication and installation.

### 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect fencing materials before, during and after installation and to protect the 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.

# 1.5 Reference Standards

- A. In addition to all pertinent codes and regulations, comply with:
  - 1. ASTM A526 Steel Sheet Zinc-coated (galvanized by the Hot Dip Process)
  - 2. ASTM B117 Salt Spray Testing

### **PART 2 PRODUCTS**

### 2.1 Manufacturer:

- A. The following specification is for the AEGIS II, Majestic 2-rail style manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma. Betafence USA, Phone- 214-887-4571
- B. Other accepted systems:
  - 1. Guardsman System by Merchants Metal.
  - 2. Others as approved per Section 00 21 13.

# 2.2 Materials

- A. The materials for fence framework (i.e., pickets, rails, and posts) shall be manufactured from coil steel having a minimum yield strength of 50,000 psi. The steel shall be galvanized to meet the requirements of ASTM A526 with a minimum zinc coating weight of .90 ounces per square foot (coating Designation G-90), hot-dip process. Galvanized framework shall be subject to a six stage pretreatment/wash (with zinc phosphate) followed by "PERMACOAT tm", an electrostatic spray application of a two coat power system. The base coat is a thermosetting epoxy power coating (gray in color) with a minimum thickness of 2-4 mils. The top coat is a "no-mar" TGIG polyester power coat finish with a minimum thickness of 2-4 mils. The color shall be Black. Coated galvanized frame work shall have a solt spray resistance of 2,000 hours using ASTM B117 without loss of adhesion.
- B. Material for fence pickets shall be 1" square x 16 ga. tubing. The cross-sectional shape of the rails shall conform to the manufacturer's **Forerunner** ™ design with outside cross-section dimensions of 1.75" square and a minimum thickness of 14 ga. Post spacing shall be 8' o.c. nominal with 2-1/2" square posts. Picket holes in the **Forerunner** rail shall be spaced 4.98" o.c. Picket retaining rods shall be 0.125" dia. galvanized steel. Posts shall be a minimum of 2-1/2" square x 12 ga. Rubber grommets shall be supplied to seal all picket-to-rail intersections.

#### 2.3 Fabrication

- A. Pickets, rails, and posts shall be precut to specified lengths. **Forerunner** rails shall be pre-punched to accept pickets.
- B. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the **Forerunner** rails (Note: This can best be accomplished by making an alignment jig). Retaining rods shall be inserted into each **Forerunner** rail so that they pass through the predrilled holes in each picket.
- C. Completed sections (i.e., panels) shall be capable of supporting a 6000 lb. load applied at midspan without permanent deformation. Panels shall be biasable to a 25% change in grade.

D. Gates shall be fabricated using <u>AEGIS</u> panel material and gate ends having the same outside cross-section dimensions as the <u>Forerunner</u> rail. Each upright and rail intersection shall be joined by welding. Each picket and rail intersection shall also be joined by welding. Gates shall be fitted with a welded box to receive a standard lockset specified elsewhere. Strike post shall also be provided with a welded box for an electric strike specified elsewhere.

#### **PART 3 EXECUTION**

- **3.1 Preparation**: All new installation shall be laid out by the contractor in accordance with the construction plans.
- 3.2 Installation: Fence posts shall be set at spacings of 8' o.c. plus or minus 1/2", depending on the span specified. Gate posts shall be spaced according to the gate openings specified in the construction plans. The posts shall be imbedded in the precast concrete panels as indicated on the drawings. AEGIS II panels shall be attached to posts using panel brackets supplied by the bolt-on hardware supplied by manufacturer.

# 3.3 Installation

- A. Adjust pickets, rails and posts for rigid installation.
- B. Tighten hardware, fasteners and accessories.
- C. Remove excess and waste materials from project site.

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City of Huber Heights - New Public Works Facility

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### **SECTION 32 90 00 LANDSCAPING**

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

**INDEX** 1.1 Description

1.2 Quality Assurance 3.1 Surface Conditions

2.1 Materials

1.3 Submittals 3.2 Preparation 1.4 Product Delivery, Storage and Handling 3.3 Installation 3.4 Inspection 1.5 Alternatives

1.6 Warranty 3.5 Maintenance

#### **PART 1 GENERAL**

# 1.1 Description

A. Work Included: Planting required for this Work in indicated on the Drawings and, in general, includes planting and other ground cover throughout the Work.

B. Related Work Described Elsewhere

Section 31 20 00 1. Excavating, filling, and grading

# **1.2 Quality Assurance**

A. Qualifications of Installers: Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

#### B. Standards

- 1. All plants and planting material shall meet or exceed the specifications of Federal, State, and County laws requiring inspection for plant disease and insect control.
- 2. Quality and size shall conform with the current edition of "Horticultural Standards" for number one grade nursery stock as adopted by the American Association of Nurserymen.
- 3. All plants shall be true to name and one of each bundle or lot shall be tagged with the name and size of the plants in accord with the standards of practice of the American Association of Nurserymen. In all cases, botanical names shall take precedence over common names.
- 4. Substitutions: These will be permitted with written approval if good cause can be given as to why they must be made.
- 1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:
  - A. Materials List: Submit a complete list of all plants and other items proposed to be installed. Include complete data and source, size, and quality.

February 6, 2024 32 90 00-1 **LANDSCAPING**  This shall in no way be construed as permitting substitution for specific items described in the Drawings of these Specifications unless the substitution has been approved in advance by the Architect.

- B. As-built Drawings: During course of the installation, carefully record in red line on a print of the planting Drawings all changes made to the Planting system layout during installation.
- C. Maintenance Instruction: Send to Architect on completion of installation. Instructions should include lawn and plant watering requirements, lawn mowing, weed and aeration, plant pruning, fertilizing and raking.

# 1.4 Product Delivery, Storage and Handling

- A. Deliver all items to the site in their original containers with all labels intact and legible at time of Architect's inspection.
- B. Immediately remove from the site all plants that are not true to name and all materials that do not comply with the provisions of this Section of these Specifications.
- C. Use all means necessary to protect plant materials before, during and after installation and to protect the installed work and materials of all other trades.
- Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc.
- E. Replacements: If there is damage or rejection, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
- 1.5 Alternatives: The Work of this Section is affected by alternatives as described on the Drawings and in these Specifications.
- 1.6 Warranty: The landscape contractor agrees to guarantee all plants for one year from the time of planting and Turf one year from germination and 3 mowings. This guarantee includes furnishing new plants, as well as the labor and materials for installation of replacements. The contractor will not be liable for losses due to vandalism or improper maintenance.

# PART 2 PRODUCTS

#### 2.1 Materials

### A. Fertilizer

- General: All fertilizer shall be a commercial balanced 16-8-8 fertilizer delivered to the site in bags labeled with the Manufacturer's guaranteed analysis.
- 2. Special protection: If stored at the site, protect fertilizer from the elements at all times.

- B. Mulch: All mulch shall consist of standard size ground bark chips, 1/4 inch to one inch in size, and shall be mill-run chips of Douglas Fir bark, or as equal approved in advance by the Architect.
- C. Tree Stakes: Unless otherwise indicated on the Drawings, all tree stakes shall be redwood, construction heart grade, rough-sawn, two inches by two inches by eight feet long.
- D. Grass Seed
  - 1. General: All grass seed shall be:
  - a. Free from noxious weed seeds and recleaned:
  - b. Grade A recent crop seed;
  - c. Treated with appropriate fungicide at time of mixing;
  - d. Delivered to the site in sealed containers with dealer's guaranteed analysis and season certification of weight, purity and germination.
  - 2. Proportions by weight:

a.	Baron bluegrass:	20%
b.	Majestic bluegrass	20%
C.	Touchdown bluegrass	20%
d.	Pennlawn fescue	20%
e.	Fiesta rye grass	20%

- f. Or approved equal
- E. Topsoil: Good, clean, fertile, humus-bearing topsoil free of toxic materials, noxious weed, stones, clods or other objectionable materials. Soil brought in shall have a qualified commercial soil test approved by the Architect. Approved material from the site maybe used.
- F. Edging: Polyethylene edging similar to valley view's "Black Diamond" bed divider at all landscape / mulch areas.

### G. Plant Materials

- 1. Size: Plant materials will conform to the sizes given in the plant list and will be of a minimum size or larger. All measurements of spread, height, caliper, ball size and etc... will be in accord with the "USA Standards for Nursery Stock".
- 2. Quality: All plants will be healthy, vigorous and free from disease and insect pests. All plants will have normal, healthy root systems and be free of scars and blemishes. All trees must have straight trunks, unless noted as "clumps", with full crowns and good structures.
- 3. Root protection: Plants designated B & B should be balled and burlapped, with firm, natural earth balls. Broken or loose balls should not be planted. Container grown plants should have a well established root system and have been growing in the container for a minimum of one year.
- 4. Do not prune plants before delivery except as authorized by the Architect. In no case shall tress to topped before delivery.
- 5. Plant materials shall be subject to approval by the Architect as to size, health, quality, character, etc.

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#### 6. Measurements

- a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Drawings or Plant List.
- b. Measure caliper of trees 12 inches above surface of ground.
- c. Where caliper or other dimensions of plant materials are omitted from Plant Lists, these plant materials shall be normal stock for type listed.
- d. Plant materials larger than those specified may be supplied with approval of Architect if complying in all other respects and at no additional cost to Owner.
- e. Shape and form: Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified on Plant List.
- f. Provide plant materials from a licensed nursery or other source that has been previously accepted by the Architect.
- H. Sod: Sod will be vigorous, well rooted, healthy turf free from disease, insects, pests and weeds. It should contain a mixture of improved bluegrass varieties.
- I. Other Materials: All other materials, not specifically described but required for a complete and proper planting installation, shall be as selected by the Contractor subject to the approval of the Architect.

#### **PART 3 EXECUTION**

### 3.1 Surface Conditions

# A. Inspection

- 1. Before all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- 2. Verify that all planting may be completed in accord with the original design and the reference standards.

#### B. Discrepancies

- 1. If there is discrepancy, immediately notify the Architect.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Preparation

- A. Dimensions on Drawings are approximate. Before proceeding with work, carefully check and verify dimensions and quantities. Report variations between Drawings and site to the Architect before proceeding with work.
- B. Plant totals are for convenience only and are not guaranteed.
- C. All planting indicated on Drawings will be required unless indicated otherwise.

### 3.3 Installation

# A. Finish Grading

- 1. The site will be brought to rough grade by the General Contractor. Finish grading will be done by landscaping contractor.
- 2. Make minor adjustments of finish grades at the direction of the Architect, if needed. Exterior planters shall receive a minimum of 2 feet of top soil.
- 3. Finish grading shall consist of:
  - a. Redistribution of any top soil stored on site and/or additional soil required to bring surface to proper elevation.
  - b. Tilling of planting, lawn and ground cover areas as specified.
  - c. After tilling, bring areas to uniform grade by floating or hand raking.
  - d. Slope grade around building away from walls for a distance of not less than 10' at a slope not less than 1/2" per foot, unless otherwise noted.
  - e. Surface drainage shall be directed in manner indicated on the Drawing or Site Plan by molding surface to facilitate the natural run-off of water. Fill low spots and pockets with top soil and grade to drain properly.
  - f. Finish grade of all planting, lawn and turf areas shall be 1-1/2 inches below grade of adjacent pavement of any kind.

### B. Soil Preparation

- 1. All lawn and groundcover planting areas must receive a minimum of 3 inches of topsoil.
- 2. Report any unusual subsoil conditions requiring special treatment to Architect.
- 3. In all areas where shrubs, trees, ground covers of lawns are to planted, an application of no less than 10 pounds of commercial fertilizer shall be thoroughly dug into the top 3 inches of soil at the above rate per 1,000 square feet. Work areas into a smooth and even grade.
- 4. During preliminary grading, weeds shall be dug out from all planting areas by their roots and removed from the site.
- 5. All rocks of undue size and nonconforming foreign matter such as building rubble, wire, cans, sticks, etc., shall be removed from the site.
- 6. Beds shall be raked smooth and put in first class condition before final acceptance by Architect.
- C. Edging: The planting areas around the building will be separated from the lawn area by a polyethylene where not separated by concrete paving or walks.

#### D. Landscaping Headers

- 1. Provide headers and stakes where shown on Drawings.
- 2. Where specified, provide 2" x 6" headers, (or two pieces 1" x 6" laminated where a curve is shown). to separate lawn areas from planting areas unless otherwise shown on the Drawings.
- 3. Extend redwood headers 1/2 inch above grade and hold in place with 1' x 2' stakes of length necessary to extend into a solid earth a minimum of 12 inches. All stakes shall be of sound material, neatly pointed, driven vertically and securely nailed to headers. Space stakes as not to exceed four feet on center. Top of stakes shall be set 1/2 inch below the tops of headers and cut at an angle to slope away from header top.

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- Compact backfill on both sides of headers to the density of the undisturbed adjoining earth.
- 5. When metal headers are called for on the Drawings, install them in accord with Manufacturer's recommendations.

# E. Planting Trees and Shrubs

#### 1. General:

- a. Plant nursery stock immediately upon delivery to the site and approval by the Architect except that, if this is not feasible, heel-in all bareroot and balled material with damp soil and protect from sun and wind.
- b. Regularly water all nursery stock in containers and place them in a cool area protected from sun and drying winds.
- 2. Execution: Planting pits for all shrubs and evergreens should be at least 12 inches wider than the root ball to be planted. They should be at least 24 inches wider than the root balls for all trees. Provide for at least 6 inches of good topsoil below bottom of the ball of roots.

# 3. Plantings:

- a. Do not plant trees and shrubs until all major construction operations are completed.
- b. All plants will be set straight, at the correct alignment and at the same grade as before being transplanted. When properly placed, the plants should be gradually filled with fertile topsoil and well watered to settle the soil.
- c. Fertilizer: The recommended amount of an approved "time release" fertilizer (such as "Easy Grow" packets) will be placed in the planting hole while it is being backfilled.
- d. Wrapping and guying: The trucks of all trees should be wrapped with an approved type of tree wrap. Guying of trees is not necessary if they do not sway of lean. Trees that do not remain straight and steady must be properly staked. Support shall consist of at least two 2" x 2" x 3 foot lumber stakes driven into hole base before backfill so as not to damage roots. Tie tree to stakes in at least two places (near top and in middle) with a rubber hose nailed to stake and applied in a figure eight to insure safe support.
- e. Relocation of trees: If underground construction work or obstructions are encountered in excavation of tree holes, Architect will select alternate locations.
- f. Space the ground cover plants evenly as indicated on the Drawings, staggering the spaces around shrubs and trees as well as in the open areas.
- g. Mulching: In all planting areas, a 2 foot wide strip around the building and a circle 3 feet in diameter, around all trees in lawn areas, will be covered with a 3 inch layer of shredded hardwood bark.
- h. Pruning: All trees and shrubs will be pruned to remove dead or injured twigs and branches and to compensate for the loss of roots from transplanting. The amount of pruning will be limited to the minimum necessary to not change the natural habit or shape of the plant.

### 4. Lawn - Sod

### a. Preparation

- (1) Grade all seed beds, thoroughly removing all ridges and depressions and making all areas into smooth, continuous, firm planes that ensure proper drainage.
- (2) Remove all soil lumps, rocks, and other deleterious material.
- b. Fertilizing: Apply the specified fertilizer at the rate of 10 pounds per 1,000 square feet, raking lightly into the soil.

- c. Sowing
  - (1) Sow with a seeder approved for that purpose by the Architect.
  - (2) Sow at the rate of five pounds per 1,000 square feet.
  - (3) Promptly after seeding, wet the seed bed thoroughly, keeping all areas moist throughout the germination period.
  - (4) Seeded areas may also be hydro-seeded.
- d. Mulching: After sowing, rake or broom seed gently and roll area to firm in seed. After rolling, cover area evenly with a top dressing of clean straw or marsh hay.
- e. After Mulching: Thoroughly water seeded areas with a fine spray. Reseed areas that do not show prompt germination at 15 day intervals until an acceptable stand of grass is assured.
- f. Sodding
  - (1) Prepare and fertilize areas to be sodded as described above.
  - (2) Sod rolls should be fitted tightly with staggered joints when installed. It should then be rolled and watered adequately before any drying or shrinking of the sod can take place.
  - (3) After placement, fertilize sod at the rate of 10 pounds per 1,000 square feet.
- g. Protection: Protect all turf areas by erecting temporary fences, barriers, signs, etc., as necessary to prevent trampling.
- 3.4 Inspection: Besides normal progress inspections, schedule and conduct the following formal inspections, giving the Architect at least 24 hours notice of readiness for inspection:
  - A. Inspection of plants in containers before planting.
  - B. Inspection of plant locations, to verify compliance with the Drawings.
  - C. Final Inspection After Completion of Planting: Schedule this inspection sufficiently in advance, and in cooperation with the Architect, so that the final inspection may be conducted within 24 hours after completion of planting.
  - D. Final inspection at the end of the maintenance period, provided that all previous deficiencies have been corrected.

#### 3.5 Maintenance

- A. General: Maintain all planting and lawn areas, starting with the landscaping operations and continuing for 30 calendar days after all landscaping is complete and approved by the Architect.
- B. Work Included
  - 1. Maintenance shall include all watering, weeding, cultivating, spraying, and pruning necessary to keep the plant materials in a healthy growing condition and to keep the planted areas neat and attractive throughout the maintenance period.
  - 2. Provide all equipment and means for proper application of water to those planted areas not equipped with an irrigation system.
  - 3. Protect all planted areas against damage, including erosion and trespassing by providing and maintaining proper safeguards.

February 6, 2024 32 90 00-7 LANDSCAPING 4. Mow lawn areas, if necessary, for not more than 14 days after installation.

### C. Replacements

- 1. At the end of the maintenance period, all plant material shall be in a healthy growing condition
- 2. During the maintenance period, should the appearance of any plant indicate weakness and probability of dying, immediately replace that plant with a new and healthy plant of the same type and size without additional cost to the Owner.
- D. Extension of Maintenance Period: Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

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# SECTION 41 22 00 HOISTS AND CRANES (Alternate #3)

**SCOPE** Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

**INDEX** 1.1 Description

1.2 Quality Assurance

1.3 Submittals

1.4 Product Delivery, Storage and Handling

1.5 Job Conditions

1.6 Maintenance and Service

1.7 Warranty2.1 Crane

2.2 Equipment

2.3 Acceptable Manufacturers

2.4 Fabrication

3.1 Surface Conditions

3.2 Installation

3.3 Field Quality Control

3.4 Adjustments and Cleaning

3.5 Maintenance 3.6 Instructions

### **PART 1 GENERAL**

# 1.1 Description

A. Five (5) Tons Ton Capacity Crane - Repair 130 and, Mezz 201

1. The work under this section includes all labor, materials, and equipment for fabrication and installation of one (1) five (5) ton capacity, floor controlled, bridge mounted overhead traveling crane; 45'-6" span, 26'-0" available lift, for operation of 480 volt, 3 phase, 60, A.C. All motors controlled from radio-controlled station with backup sliding pendant festoon system. 121"-2.5" runway and tiebacks by building steel contractor; rail and hooks by crane contractor.

B. Related Work Specified Elsewhere

1. Temporary facilitiesSection 01 51 002. Structural steelSection 05 12 003. PaintingSection 09 91 004. Electric serviceDivision 26

### 1.2 Quality Assurance

A. Qualifications of Manufacturers: The Manufacturer shall be one regularly engaged, for the past five years, in the business of design, engineering, manufacturer, installation and servicing cranes of the type and character required by these Specifications. In the interest of unified responsibility, they shall be the manufacturer of the entire crane machine, controller and other parts of the crane operating equipment.

### B. Qualifications of Installers

- 1. Manufacturer's representative or authorized agent of crane equipment Manufacturer.
- 2. Minimum 10 years experience installing cranes.
- 3. Furnish at least one person who shall be thoroughly trained and experienced in the installation of the selected equipment and who shall be present at all times during execution of the work of this Section and who shall direct the entire crane installation.
- Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:

- A. Samples: Submit color samples in duplicate.
- B. Crane Dimensions
  - 1. Rail span
  - 2. OSHA requirements
  - 3. All related lifts and clearances
- C. Material List: Accompanying the Shop Drawings, submit two copies of a complete list of all materials and equipment proposed to be furnished.
- D. Certificates: Furnish certification of licensing by the Local Building authority.
- E. Operation and Maintenance Data: Upon completion of the installation, and as a condition of its acceptance, deliver to the Owner and the Owner one copy each of a Manual compiled in accord with the provisions of Section 01300 of these Specifications.
  - 1. Maintenance Manual: Furnish manual including:
    - a. Parts list.
    - b. Lubrication requirements.
    - c. Maintenance requirements for all equipment.
  - 2. Operation Instructions: Provide instructions to Owner's personnel including:
    - a. Safety procedures.
    - b. Proper operation of all equipment.
    - c. Routine maintenance procedures.

# 1.4 Product Delivery, Storage and Handling

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades. Protect equipment and exposed finished during transportation and erection against damage and stains.
- B. Deliver materials in Manufacturer's original, unopened protective packaging.
- C. Store materials in original protective packaging. Prevent soiling, physical damage or wetting. This Contract will co-ordinate storage with the General Contractor. Owner assumes no responsibility to provide a storage space.
- D. 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.

#### 1.5 Job Conditions

- A. Existing Conditions: This Contractor will carefully examine the site for access for his equipment. This Contractor will co-ordinate the scheduling of his work with the General Contractor.
  - 1. Crane contractor is responsible for providing an enclosure around the runway electrical bus above mezzanine 201 needs to be protected so a person cannot touch and or accidently hit the electrical bus.

### 1.6 Maintenance and Service

- A. All maintenance shall be performed by trained employees of the crane contractor during regular working hours of the trade.
- B. Two (2) standard service manuals will be provided and will include erection information and identification of parts for proper care of equipment.
- C. Recommended spare parts list and prices are to be developed after completion of engineering to be furnished upon request.
- **1.7 Warranty:** Fully warranty all equipment and installations, of crane for two (2) years from date of Owner acceptance. Warranty shall cover materials and workmanship and replacements made at no addition cost to the Owner.

### **PART 2 PRODUCTS**

# 2.1 Cranes

- A. The cranes will be designed for CMAA Class "C" indoor service.
- B. The cranes under this Section shall be standardized by and be designed in accordance with CMAA specification No. 74 to meet the service class rating proposed. The cranes will also comply with the current OSHA Standards.

# 2.2 Equipment

A. Crane Specifications – One (1) Repair Bay Five (5) Ton

Crane Type	Top Running	# of Cranes	1
Capacity	5 tons	Operation	Indoors
Span	45'-6"	Power	480V3ph/60Hz
Lift	26' – 0"	Reeving	4 Part Single
Hoist	5 tons wire rope	Control Encl.	NEMA 12
Whl Load	6,700 lbs.	CMAA Class	C Moderate Duty
Bridge Endtruck	Std. 6'-6¾ " wheel base	Operation Type	Radio/Sliding PB
Configuration	Single Girder	Control Voltage	110V
Girder T.	Structural Profile Beam	Cross Conductors	Festooned
Walkway	N/A	Paint	Yellow
Runway	By Building Contractor	Runway Conduct.	Cond. Bar
ASCE Rail	40#/yd ASCE rail	Runway Collect.	Spring Shoe
Columns	By Bldg. Contractor	Runway Length	121'-2.5"
		Runway Supports	As Detailed

Drive	Motor Type	Speed (FPM)	Motor (s)	HP	Brake Type
Hoist	Crane Duty	20/3	One	7.2/1.2	DC Disc
Trolley	Crane Duty	0-80 Var	One	0.6	DC Disc
Bridge	Crane Duty	0-100 Var	Two	0.4	DC Disc

B. Other Materials: All other materials, not specifically described but required for a complete and proper installation of the crane system, shall be as selected by the Contractor subject to the approval of the Owner.

# 2.3 Acceptable Manufacturers

- A. Manufacturers
  - 1. Custom Steel, Inc.
  - 2. Dearborn Crane
  - 3. Kone Crane
  - 4. Lift Incorporated
  - 5. Metropolitan Crane & Hoist
  - 6. Superior Crane Corp.
- B. Requests for approval of crane contractors not named in this section of these Specifications will not be considered unless they are submitted to the Owner ten (10) working days or more prior to receipt of bids and are accompanied by the following information:
  - 1. List of five similar installation arranged to show name of the project, crane capacity, speed, travel and date of completed installation.
  - 2. Complete literature, performance and technical data describing the proposed equipment.
  - 3. List of ten service accounts by building name, building manager and Owner.
  - Location of closest service office from which this installation would be maintained.
  - 5. Location of closest parts inventory for this installation.
- **2.4 Fabrication:** Fabricate all equipment to codes, standards and approved Shop Drawings. This Contractor responsible to obtain field or guaranteed hoistway dimensions. Make all correction to faulty work because of incorrect hoistway dimensions, at no additional cost to the Owner.

#### **PART 3 EXECUTION**

#### 3.1 Surface Conditions

- A. Inspection
  - Prior to beginning the installation of crane equipment examine following and verify that no irregularities exist that would affect quality of execution of work as specified.
    - a. Crane rail: Installed by Crane Contractor.
  - 2. Verify that the crane system may be installed in complete accord with all pertinent codes and regulations, the original design and the reference standards.
- B. Discrepancies
  - 1. In the event of discrepancy, immediately notify the Owner.
  - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

# 3.2 Installation

- A. General
  - Install each crane in accord with accepted Manufacturer's directions and CMAA Class "C" original design and approved Shop Drawings.
  - 2. Install rail stops per Owners approved location.
- B. Paint all exposed and unfinished metal work furnished by this Contractor after installation.

# 3.3 Field Quality Control

- A. Provide all personnel, equipment and instruments required for the inspection and testing.
- B. Have acceptance inspection required by local authority performed by enforcing agency.
- C. The Owner reserves the right to accept the crane in terms of smoothness and leveling accuracy. If corrections are determined as necessary, they will be at the expense of the crane contractor and will be completed before final payment.

# 3.4 Adjustments and Cleaning

- A. Adjustments
  - 1. Adjust complete crane system.
  - 2. Lubricate all equipment in accord with accepted Manufacturer's instructions.
- B. Clean Up
  - 1. Remove all loose materials and filing resulting from this Work.
  - 2. Remove crating and packing materials from premises.
- **3.5 Maintenance:** Perform the maintenance described under this Section of these Specifications for the period specified.
- 3.6 Instructions: When all required approvals of this portion of the Work have been obtained, and at a time designated by the Owner, thoroughly demonstrate to the Owner's maintenance personnel the operation and maintenance of all items installed under the work of this Section and demonstrate the contents of the Manuals submitted under Article 1.3 of this Section of these Specifications.

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City of Huber Heights - New Public Works Facility

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