

# Mon Valley Sewage Authority



## Monessen and Donner Pump Stations Screenings Improvements Project

### CONTRACT DOCUMENTS & SPECIFICATIONS PART II WQM Permit – February 2023 Issued For Bidding – March 2024

### CONTRACT ONE - GENERAL CONSTRUCTION CONTRACT TWO - ELECTRICAL



Prepared By:



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**MON VALLEY SEWAGE AUTHORITY  
MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS  
PROJECT**

**TABLE OF CONTENTS**

<u>SUBJECT</u>	<u>PAGE NO.</u>
<b>DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS</b>	
00 1113      Advertisement for Bids	00 1113-
00 2113      Instructions to Bidders	00 2113-1 – 7
00 4243      Bid Form	00 4243-1 – 7
00 4313      Bid Bond Form	00 4313-1
00 4345      Legal Status of Bidder	00 4345-1
00 5100      Notice of Award	00 5100-1 – 2
00 5200      Agreement	00 5200-1 – 7
00 5500      Notice to Proceed	00 5500-1
00 6112      Performance Bond	00 6112-1 – 2
00 6113      Labor and Material Payment Bond	00 6113-1 – 2
00 6325      Substitution Request Form	00 6325-1
00 6363      Change Order Form	00 6363-1
00 6516      Certificate of Substantial Completion Form	00 6516-1
00 6520      Sworn Statement	00 6520-1 – 2
00 7200      General Conditions	00 7200-1 – 50
00 7300      Supplementary Conditions	00 7300-1 – 3
00 7346      Wage Determination Schedule	00 7346-1
<b>DIVISION 01 – GENERAL REQUIREMENTS</b>	
01 1100      Summary of Work	01 1100-1 – 3
01 2513      Substitution Procedures	01 2513-1 – 3
01 3119      Project Meetings	01 3119-1 – 3
01 3300      Submittal Procedures	01 3300-1 – 5
01 4500      Quality Control	01 4500-1 – 2
01 5000      Temporary Facilities and Controls	01 5000-1 – 3
01 5713      Temporary Erosion and Sediment Control	01 5713-1 – 6
01 6000      Product Requirements	01 6000-1 – 2
01 7300      Operation and Maintenance Manuals	01 7300-1 – 2
01 7700      Closeout Procedures	01 7700-1 – 2
01 7890      Project Record Documents	01 7890-1
01 8200      Startup and Training	01 8200-1 – 2
01 8900      Site Construction Performance Requirements	01 8900-1 – 12
<b>DIVISION 03 – CONCRETE</b>	
03 1100      Concrete Forming	03 1100-1 – 5
03 1500      Concrete Accessories	03 1500-1 – 4

03 2000	Concrete Reinforcing	03 2000-1 – 6
03 3000	Cast-in-Place Concrete	03 3000-1 – 16
03 4100	Precast Prestressed Concrete	03 4100-1 – 7
 <b>DIVISION 04 – MASONRY</b>		
04 0650	Mortar and Masonry Grout	04 0650-1 – 7
04 2000	Unit Masonry	04 2000-1 – 12
 <b>DIVISION 05 – METALS</b>		
05 1200	Structural Steel Framing	05 1200-1 – 8
05 5300	Metal Gratings	05 5300-1 – 3
05 6000	Aluminum Fabrications	05 5300-1 – 10
 <b>DIVISION 06 – WOOD AND PLASTICS</b>		
06 1000	Rough Carpentry	06 1000-1 – 11
 <b>DIVISION 07 – THERMAL AND MOISTURE PROTECTION</b>		
07 5300	Elastomeric Membrane Roofing	07 5300-1 – 7
07 6000	Flashing and Sheet Metal	07 6000-1 – 5
07 9200	Joint Sealants	07 9200-1 – 7
 <b>DIVISION 08 – DOORS AND WINDOWS</b>		
08 1300	FRP Faced Aluminum Doors and Aluminum Frames	08 1300-1 – 7
08 7000	Door Hardware	08 7000-1 – 13
 <b>DIVISION 09 – FINISHES</b>		
09 9100	Painting and Coating	09 9100-1 – 10
 <b>DIVISION 11 – EQUIPMENT</b>		
11 1000	Mechanically Cleaned Bar Screen	11 1000-1 – 10
11 2000	Washer Compactor	11 2000-1 – 11
11 3000	Additional Equipment	11 3000-1 – 4
 <b>DIVISION 23 – HVAC</b>		
23 0590	Testing, Adjusting and Balancing	23 0590-1 – 6
23 3100	Ductwork	23 3100-1 – 4
23 3300	Ductwork Accessories	23 3100-1 – 5
23 3400	Fans	23 3100-1 – 5

**DIVISION 26 – ELECTRICAL**

26 0500	Electrical General Requirements	26 0500-1 – 8
26 0510	Basic Materials and Methods	26 0510-1 – 13

**DIVISION 31 – STRUCTURAL**

31 2316	Structural Excavation and Backfill	31 2316-1 – 5
31 2319	Dewatering	31 2319-1 – 4
32 9219	Seeding	32 9219-1 – 9

**DIVISION 40 – PROCESS INTEGRATION**

40 0500	Process Equipment General Requirements	40 0500-1 – 17
40 0507	Pipe Support Systems	40 0507-1 – 6
40 1500	Process Piping	40 1500-1 – 9

Not To Be Used For Bidding Purposes

## Section 00 1113

### Advertisements for Bids

#### MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT MON VALLEY SEWAGE AUTHORITY

Sealed Bids will be received by the Mon Valley Sewage Authority (OWNER) at the WWTP located at 20 S. Washington Street, Donora, PA, 15033 until 11:00 AM local time on **April 8, 2024**, at which time and place said Bids will be opened and publicly read aloud. The general description of the Work includes, but is not limited to the following:

The project will consist of modifications to the Monessen and Donner Pump Stations. The project will include the following improvements to each of the two (2) pump stations:

**Removal of the existing Comminutor and associated appurtenances/electrical connections. Installation of a new Mechanical Bar Screen, Washer Compactor, Debris Chute, Screenings Waste Receptacle, and associated appurtenances, as well as completion of structural, electrical, and process modifications to accommodate the new system components. Construction of a building addition extending from the side of the building to house a new Screenings Waste Receptacle. Replacement of the existing fan and air handling system.**

A more complete description of the Work is provided in the Contract Documents which can be examined at the Authority offices or the offices of the Wade Trim, Inc. (ENGINEER) at the following address: Four Gateway Center, 444 Liberty Avenue, Suite 300, Pittsburgh, PA, 15222. Site inspections prior to bid can be scheduled by calling Sean Gaskill, General Manager at 724-288-0472.

Digital copies of documents, via secure file transfer, for bidding purposes must be obtained at the offices of Wade Trim, Inc. or through email to Carter J. Johnson at [cjohnson@wadetrim.com](mailto:cjohnson@wadetrim.com) between the hours of 9:00 AM and 3:00 PM local time, Monday through Friday. All bidders must obtain bid documents as described above to be eligible. A mandatory prebid meeting will be held at 20 S. Washington Street, Donora, PA, 15033 on April 3, 2023.

Each proposal shall be accompanied by a Bid Bond in the amount of ten percent (10%) of the total bid which will be returned upon award of the Contracts.

Pennsylvania Prevailing Minimum Wage Rates will apply to all work on this project.

The Mon Valley Sewage Authority reserves the right to accept or reject any or all bids and to waive any informality in any bids should it consider same to be in its best interest.

Bids may not be withdrawn for a period of sixty (60) days after date of receiving bids.

The Owner has current Pennsylvania sales tax exemption status, which applies only to those items for which an exemption may be claimed under applicable State Sales and Use Tax Regulation.

All inquiries should be directed to Carter J. Johnson at 412-758-4365 or [cjohnson@wadetrim.com](mailto:cjohnson@wadetrim.com).

Steve Walko, Chairman  
Mon Valley Sewage Authority

# Section 00 2113 Instructions to Bidders

## Part 1 General

### 1.01 Introduction

- A. This project is being bid by the Mon Valley Sewage Authority (MVSA), OWNER, whose offices are located at their Wastewater Treatment Plant at 20 S. Washington Street, Donora, PA 15033. Completed bid documents are to be returned to this address in the form and at the time stipulated in these instructions and/or the Advertisement for Bids to the attention of Mr. Sean Gaskill, General Manager. Mr. Gaskill can be reached at (724) 288-0472 to arrange for a time to visit the project site.
- B. ENGINEER for the MVSA is Wade Trim, Inc. with offices located in Three Gateway Center, 401 Liberty Avenue., Suite 1600, Pittsburgh, PA 15222. All questions regarding the Contract Documents for this Project should be addressed to Carter Johnson, Engineer, at the address above, by phone at (412) 758-4365 or by email at cjohnson@wadetrim.com.

### 1.02 Defined Terms

- A. Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions. The term "Bidder" means one who submits a Bid directly to OWNER as distinct from a sub bidder who submits a Bid to a Bidder. The term "Successful Bidder" means the lowest, qualified, responsible Bidder to whom OWNER makes an award.

### 1.03 Scope of Work

- A. The scope and location of Work are set forth in Section 01 1100, Summary of Work.

### 1.04 Bidders Qualifications

- A. No Bid will be considered from any Bidder unless known to be skilled and regularly engaged in work of a character similar to that covered by the Contract Documents. In order to aid the OWNER in determining the responsibility of any Bidder, the Bidder, within 48 hours after being requested in writing by the OWNER to do so, shall furnish evidence, satisfactory to the OWNER, of the Bidder's experience and familiarity with Work of the character specified, and his financial ability to properly prosecute the proposed Work to completion within the specified time. The evidence requested may include, but shall not be limited to, the following:
  - 1. The address and description of the Bidder's plant or permanent place of business.
  - 2. Experience Statement.
    - a. Contractor shall have completed at least five (5) projects of similar scope and value conducting business under the current company name for at least 10 years. Proof of project experience shall be submitted by the apparently Successful Bidder to the Owner's Representative within seven (7) day after opening of the Bids.
    - b. The Experience Statement shall contain the following information:

- (1) The project title, a description of the work, and the contract amount.
  - (2) The dates when work was started and when it was completed.
  - (3) The name, address, and phone number of the owner's contact person for the project.
  - (4) The name, address, and phone number of the engineer's contact person for the project.
3. An itemized list of the Bidder's equipment available for use on the proposed Contract.
  4. The Bidder's financial statement, including statement of ownership of equipment necessary to be used in executing Work under Contract.
  5. The name and qualifications of the lead foreman for this Project.
- B. List of subcontractors and major equipment suppliers including company name, contact name, address, phone number, fax number and contact email address.
  - C. Evidence that the Bidder is authorized to do business in the state in which the project is located, in case of a corporation organized under the laws of any other state; and
  - D. Such additional information as will satisfy the OWNER that the Bidder is adequately prepared to fulfill the Contract.

#### **1.05 Examination of Contract Documents and Site**

- A. It is the responsibility of each Bidder before submitting a Bid, to:
  1. Examine the Contract Documents thoroughly,
  2. Visit the site to familiarize himself with local conditions that may in any manner affect cost, progress or performance of the Work,
  3. Consider federal, state, and local Laws and Regulations that may affect cost, progress, performance, or furnishing of the Work,
  4. Study and carefully correlate Bidder's knowledge and observations with the Contract Documents and such other related data,
  5. Promptly notify ENGINEER in writing of all conflicts, errors, ambiguities or discrepancies which Bidder has discovered in or between Contract Documents and such related documents, and
  6. Attend the mandatory prebid meeting to be held at 20 S. Washington Street, Donora, PA, 15033 on April 3, 2023.

- B. Original design drawings for the Monessen and Donner Pump Stations as well as as-built drawings compiled based on improvements made to the Monessen and Donner Pump Stations implemented during Phase I of the Authority's Long Term Control Plan will be provided for use to the CONTRACTOR.
- C. Reference is made to the Supplementary Conditions for the identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by ENGINEER in preparing the Contract Documents.
1. If such reports are not included as appendices to the Contract Documents, OWNER will make copies available to any Bidder requesting them. These reports are included for reference only and are not guaranteed as to accuracy or completeness, nor are they part of the Contract Documents.
  2. The Bidder may rely upon the general accuracy of the "technical data" contained in such reports but not upon other data, interpretations, opinions or information contained in such reports or otherwise relating to the subsurface conditions at the site, nor upon the completeness thereof for bidding or construction purposes.
  3. Before submitting his Bid each Bidder will, at his own expense, make such additional investigations and tests as the Bidder may deem necessary to determine his Bid for performance of the Work in accordance with the time, price and other terms and conditions of the Contract Documents.
- D. On request OWNER will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of his Bid. Bidder shall fill all holes and clean up and restore the site to its former conditions upon completion of such investigations and tests.
- E. The lands upon which the Work is to be performed, rights-of-way for access thereto and other lands designated for use by CONTRACTOR in performing the Work are identified in Section 01 1100, Summary of Work, or on the Plans, as applicable.
- F. The locations of utilities as shown on the Plans are taken from sources believed to be reliable. Neither OWNER nor ENGINEER will be responsible for any omissions or variations from, the indicated location of existing utilities which may be encountered in the Work.
- G. The submission of a Bid will constitute an incontrovertible representation by the Bidder that he has complied with every requirement of this Article 1.05, that without exception the Bid is based upon performing and furnishing the Work required by the Contract Documents and applying the specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown, indicated or required by the Contract Documents, that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in Contract Documents and the resolution by ENGINEER is acceptable to Bidder, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performing and furnishing the Work, and that the time stated in the Bid Form is sufficient to complete the project.



## 1.06 Interpretations Addenda

- A. Should any prospective bidder find discrepancies in or omissions from the Plans, Specifications or other parts of the Contract Documents, he may submit a written request to the ENGINEER for an interpretation thereof. The person submitting the request will be held responsible for its prompt delivery at least seven (7) days prior to the date for opening of Bids. Questions received less than seven (7) days prior to the date for opening of bids may or will not be answered. Any interpretation of inquiry will be made by Addendum duly issued to all prospective bidders via electronic email.
- B. Any change in or addition to the Contract Documents deemed necessary by the OWNER shall be made in the form of an Addendum issued to all prospective bidders who have taken out Contract Documents and all such Addenda shall become a part of the Contract Documents as though same were incorporated into same originally. Oral explanations and information do not constitute official notification and are not binding.

## 1.07 Bid Security

- A. Bid Security shall be made payable to OWNER, in an amount of ten (10) percent of the Bidder's maximum Bid price and in a form as indicated in the Advertisement. Bid Bonds, if indicated as acceptable in the Advertisement, shall be issued on the form included in the Contract Documents by a Surety meeting the requirements of paragraph 5.01 of the General Conditions.
- B. The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required Contract Security, whereupon it will be returned; if the successful Bidder fails to execute and deliver the Agreement and furnish the required Contract Security within 15 days of the Notice of Award, OWNER may annul the Notice of Award and the Bid Security of that Bidder will be forfeited. The Bid Security of any Bidder whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earliest of the seventh day after the "Effective Date of Agreement" (which term is defined in the General Conditions) or the expiration of the hold period on the Bids. Bid Security of other Bidders will be returned within 14 days of the Bid opening, unless indicated otherwise in the Advertisement.

## 1.08 Contract Time

- A. The number of days within which, or the date by which, the Work is to be Substantially Completed, if applicable, and also completed and ready for final payment (the Contract Time) are set forth in the Bid Form and will be included in the Agreement.

## 1.09 Substitute and "Or-Equal" Items

- A. The Contract, if awarded, will be on the basis of materials and equipment described in the Plans or specified in the Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated in the Plans or specified in the Specifications that a substitute or an "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of Agreement. In addition, in no case shall ENGINEER's denial of CONTRACTOR's application give rise to any claim for additional cost, it being understood by CONTRACTOR that acceptance of substitute or an "or-equal" item of material is at the sole discretion of ENGINEER. Costs associated with the acceptance of the "or-equal" item shall be the responsibility of the CONTRACTOR and could

include labor and material costs associated with the additional engineering review, design changes associated with installation of the "or-equal" item, additional construction costs and any and all other charges associated with the "or-equal" item.

#### 1.10 Receipt and Form of Bid

- A. Bids shall be submitted at the time and place indicated in the Advertisement for Bids and shall be included in an opaque sealed envelope, marked with the Project title and name and address of the Bidder and accompanied by the Bid Security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face thereof. Any Bid received after the scheduled time and place indicated in the Advertisement for Bids shall be returned unopened.
1. OWNER invites bids on the Bid Form and other form(s) attached hereto. Bids will be received at the time and place indicated in the Advertisement and thereupon will be publicly opened and read. An abstract of the amounts of the base bids and any major alternates will be made available after the opening of Bids.
  2. OWNER may consider as informal any Bid on which there is an alteration of, or departure from the Bid Form attached hereto.
  3. The complete set of Contract Documents must be used in preparing Bids: neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents. In order to verify the completeness of the set of Contract Documents the Bidder used in preparing his Bid, the OWNER may require the Bidder to submit the set of Contract Documents he used in preparing his Bid. Bidder shall submit his Bid on the separate Bid Form included in these Contract Documents.
  4. The Bid Form shall be legibly prepared, with ink or typewriter, on the form included in these Contract Documents. Blank spaces in the Bid forms must be correctly filled in where indicated for each and every item for which a quantity is given. Bid Forms will be compared on basis of lump sum items, if any, and on product of the quantities of items listed at the respective unit prices bid.
  5. Erasures or other changes in the Bids must be explained or noted over the signature of the Bidder.
  6. All names must be typed or printed below the signature.
  7. The Bidder shall submit a LUMP SUM price proposal for the Work as shown on the Drawings and explained in the Specifications. Bids shall be compared based on the total LUMP SUM price and will serve in the Award of Contracts. Payment will be made based on the approved CONTRACTOR's Schedule of Values and the actual Work completed at the time of payment request. An unbalanced Schedule of Values may be rejected by the OWNER.
  8. The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
  9. The Legal Status of Bidder Form contained in the Contract Documents must be submitted with each Bid Form and must clearly state the legal position of

a Bidder. In the case of a corporation, the home address, name and title of all officers must be given. In the case of a partnership, show names and home addresses of all partners. If an individual, so state. Any individual bid not signed by the individual must have attached, thereto, a power of attorney evidencing authority to sign.

10. Other documents to be attached to the Bid Form and made a condition thereof are identified in the Bid Form. The same individual signing the Bid Form shall sign these other documents.

#### **1.11 Modifications and Withdrawal of Bids**

- A. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids. If, within 24 hours after Bids are opened, any Bidder files a duly signed written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of his Bid, that Bidder may withdraw his Bid and the Bid Security will be returned. Thereafter, at the sole option of OWNER, that Bidder will be disqualified from further Bidding on the Work to be provided under the Contract Documents.

#### **1.12 Award of Contract**

- A. OWNER reserves the right to reject any and all Bids for any reason, to waive any and all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, non-responsive, unbalanced, or conditional Bids. Discrepancies between words and figures will be resolved in favor of words. Discrepancies in the multiplication of units of work and unit prices will be resolved in favor of unit price. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- B. In evaluating Bids, OWNER shall consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data if requested in the Bid forms. It is OWNER's intent to accept alternates (if any are accepted) in the order in which they are listed in the Bid form but OWNER may accept them in any order or combination. OWNER has the sole discretion to reject any alternate without explanation. Subject to the approval of OWNER, the Contract will be awarded to the lowest responsive and responsible Bidder. Responsibility of Bidder will be determined on basis of past performance and Work of similar character, equipment and labor available to do the Work and financial status. Contract shall be considered to have been awarded after the approval of OWNER has been duly obtained and a formal Notice of Award duly served on the successful Bidder by OWNER. Contract shall not be binding upon OWNER until the Agreement has been duly executed by the Bidder and the duly authorized officials of OWNER.
- C. If the Contract is to be awarded, OWNER will give the successful Bidder a Notice of Award within 60 days after the day of the Bid opening, unless such other time is specified in the Advertisement for Bids.

#### **1.13 Signing of Agreement**

- A. Within 15 days after OWNER gives a Notice of Award to the successful Bidder, the CONTRACTOR shall sign and deliver the specified number of counterparts of the

Agreement to OWNER and ENGINEER with all other Contract Documents attached. Within ten (10) days thereafter, OWNER will deliver one (1) fully signed counterpart to CONTRACTOR. ENGINEER will identify, date or correct those portions of the Contract Documents not fully signed, dated or executed by OWNER and CONTRACTOR and such identification, dating or correction shall be binding on all parties.

**1.14 Pennsylvania Prevailing Minimum Wage Rates**

- A. Pennsylvania Prevailing Minimum Wage Rates will apply to this work and have been included with the Contract Documents or will be issued as an addendum to the Contract Documents during Bid Phase.

**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

**Section 00 4243  
Bid Form**

**PROJECT IDENTIFICATION: MONESSEN AND DONNER PUMP STATIONS  
SCREENINGS IMPROVEMENTS PROJECT**

Contract One: General Construction

Contract Two: Electrical/IC

THIS BID IS SUBMITTED TO: Mon Valley Sewage Authority, 20 S. Washington Street, Donora, PA 15033, hereinafter referred to as OWNER.

1. Enter Into Agreement

The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. BIDDER Accepts

BIDDER accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the day of Bid opening. BIDDER will sign and deliver the required number of counterparts of the Agreement with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of OWNER's Notice of Award.

3. BIDDER's Representations

In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

- a. BIDDER has examined and carefully studied the Bidding Documents and the following Addenda receipt of all which is hereby acknowledged:

Addendum No.	Date of Release	Signature
_____	_____	_____
_____	_____	_____
_____	_____	_____

- b. BIDDER has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the Work.
- c. BIDDER is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- d. BIDDER has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02. of the General Conditions.

BIDDER accepts the determination set forth in paragraph SC-4.02. of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which BIDDER is entitled to rely as provided in paragraph 4.02. of the General Conditions.

BIDDER acknowledges that such reports and drawings are not Contract Documents and may not be complete for BIDDER's purposes.

BIDDER acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the site.

- e. BIDDER is aware of the general nature of Work to be performed by OWNER and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.
- f. BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.
- g. BIDDER has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to BIDDER, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.

Where conflicts, errors, ambiguities or discrepancies have been discovered in or between Contract Documents and/or other related documents, and where said conflicts, etc., have not been resolved through the interpretations or clarifications by of insufficient time or otherwise, BIDDER has included in the Bid the greater quantity or better quality of Work, or compliance with the more stringent requirement resulting in a greater cost.

- h. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other BIDDER to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other BIDDER or over OWNER.

4. Bid Prices.

BIDDER shall complete the work, including the above-listed equipment, in accordance with the Contract Documents for the following **LUMP SUM** price:

**CONTRACT ONE: GENERAL CONSTRUCTION**

TOTAL LUMP SUM BASE CONTRACT PRICE: \$ \_\_\_\_\_

\_\_\_\_\_  
*(In Words)*

**CONTRACT TWO: ELECTRICAL/IC**

TOTAL LUMP SUM BASE CONTRACT PRICE: \$ \_\_\_\_\_

\_\_\_\_\_  
*(In Words)*

- 5. BIDDER agrees that the work will be substantially complete within 360 consecutive calendar days (12 months) after the date when the Contract Times commences to run as provided in paragraph 2.03 and 14.07. of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.09 and 14.10 of the General Conditions within 420 (14 months) consecutive calendar days after the date when the Contract Times commences to run.

BIDDER accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified in the Agreement.

- 6. Attached Documents.

The following documents are attached to and made a condition of this Bid:

- a. This Bid Form and the Required Bid Security in the form of a certified or cashiers check or bid bond in an amount not less than ten (10) percent of the bid price.
- b. Non-collusion Affidavit
- c. Legal Status of Bidder

- 7. Address for Communications.

Communications concerning this Bid shall be addressed to person and to the address of BIDDER indicated below:

Name (print): \_\_\_\_\_

Phone No.: \_\_\_\_\_

Address: \_\_\_\_\_

8. Defined Terms.

Terms used in this Bid which are defined in the General Conditions or Instructions will have the meanings indicated in the Instructions, the General Conditions and/or the Supplementary Conditions to the General Conditions.

SUBMITTED on \_\_\_\_\_, 2023.

State CONTRACTOR License No. \_\_\_\_\_  
If BIDDER is:

**An Individual**

By \_\_\_\_\_ (SEAL)  
*(Individual's name)*

doing business as \_\_\_\_\_

Business address: \_\_\_\_\_

**A Partnership**

By \_\_\_\_\_ (SEAL)  
*(Firm name)*

\_\_\_\_\_  
*(General partner)*

Business address: \_\_\_\_\_

**A Corporation**

By \_\_\_\_\_ (SEAL)  
*(Corporation name)*

\_\_\_\_\_  
*(State of incorporation)*

By \_\_\_\_\_ (SEAL)  
*(Name of person authorized to sign)*

\_\_\_\_\_  
*(Title)*

(Corporate Seal)

Attest \_\_\_\_\_  
*(Secretary)*

Business address: \_\_\_\_\_

Phone number: \_\_\_\_\_



**A Joint Venture**

By \_\_\_\_\_ (Name) (SEAL)

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

By \_\_\_\_\_ (Name) (SEAL)

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

NOTE: Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above.

Not To Be Used For Bidding Purposes

## INSTRUCTIONS FOR NONCOLLUSION AFFIDAVIT

1. This Noncollusion Affidavit is material to any contract awarded pursuant to this bid. According to the Pennsylvania Antibid-Rigging Act, 73 P.S. §§ 1611, et. seq., governmental agencies may require Noncollusion Affidavits to be submitted together with bids.
2. This Noncollusion Affidavit must be executed by the member, officer or employee of the bidder who makes the final decision on prices and the amount quoted in the bid.
3. Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of bids are unlawful and may be subject to criminal prosecution. The person who signs the Affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the bidder with responsibilities for the preparation, approval or submission of the bid.
4. In the case of a bid submitted by a joint venture, each party to the venture must be identified in the bid documents, and an Affidavit must be submitted separately on behalf of each party.
5. The term “complementary bid”, as used in the Affidavit, has the meaning commonly associated with that term in the bidding process, and includes the knowing submission of bids higher than the bid of another firm, any intentionally high or noncompetitive bid, and any other form of bid submitted for the purpose of giving a false appearance of competition.
6. Failure to file an Affidavit in compliance with these instructions will result in disqualification of the bid.

## NONCOLLUSION AFFIDAVIT

Required by the Mon Valley Sewage Authority and authorized by the Antibid-Rigging Act, Act No. 1983-45, Section 7 (73 P.S. 1617).

BEFORE ME, a Notary Public, personally appeared the undersigned Bidder (the “Bidder”), who being duly authorized to make this Affidavit on behalf of its owners, directors, and officers and being duly sworn according to law, deposes and says that, by submission of the bid to which this Affidavit is attached, the Bidder and each person signing on behalf of the Bidder; and if a joint bid, each signer jointly and severally as Bidders, certifies as to the organization of each under penalty or perjury, that to the best of the knowledge, information and belief of the Bidder, as follows.

SECTION 1. The prices submitted in the attached bid have been calculated and are hereby submitted independently and without collusion, consultation, communication or agreement of any kind with any competitor, for the purposes of restricting competition as to any matter relative to prices, escalations or quotations, with any competitor to the Bidder.

SECTION 2. Unless otherwise required by law, the prices which have been calculated and quoted in the attached bid have not been disclosed knowingly by the Bidder prior to submission of the bid, and will not be disclosed knowingly by the Bidder after the submission and prior to the opening of the bid, either directly or indirectly to any competitor of the Bidder or to any other Bidder.

SECTION 3. No attempt has been made prior to submission of the bid or will be made subsequent to the submission of the bid by the Bidder to induce in any way any other person, association, partnership, joint venture or corporation to submit or refrain from submitting a bid for the purpose of restricting competition.

SECTION 4. That the Bidder in preparation and submission of the attached bid to the Mon Valley Sewage Authority has not engaged in any "bid-rigging" activity as the same are defined in the Antibid-Rigging Act, Act No. 1983-45, Section 2 (73 P.S. 1612).

SECTION 5. The Bidder, its affiliates, subsidiaries, officers, directors and employees, and any person signing on behalf of the Bidder, have not been convicted or found liable for any act prohibited by State or Federal law in any jurisdiction involving conspiracy or collusion with respect to bidding on any public contract within the last three (3) years, except as are listed on the attachment, attached hereto and made a part hereof.

If any such person has been convicted or found liable for any such prohibited act, the same does not prohibit the Mon Valley Sewage Authority from awarding a contract to that person, but may be a ground for consideration on the question of whether the Mon Valley Sewage Authority should decline to award a contract to that person on the basis of lack of responsibility on that person.

SECTION 6. This Affidavit is made and submitted to comply with Section 7 of Act. No. 1983-45 of the Commonwealth of Pennsylvania (73 P.S. 1617) and all amendments or revisions thereto and the rules and regulations authorized thereunder, in order to permit the Mon Valley Sewage Authority to act thereunder as a governmental agency. Any misstatement in this Affidavit is, and shall be treated as, a fraudulent concealment from the Mon Valley Sewage Authority of the true facts relating to the submission of bids for this contract.

ATTEST OR WITNESS:

\_\_\_\_\_

\_\_\_\_\_  
Bidder

COMMONWEALTH OF PENNSYLVANIA

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

Sworn to and subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_, 2023.

\_\_\_\_\_  
Notary Public

End of Section

**Section 00 4313  
Bid Bond Form**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, \_\_\_\_\_  
as Principal, hereinafter called the Principal, and \_\_\_\_\_ a  
corporation duly organized under the laws of the State of \_\_\_\_\_ and duly  
authorized to transact business in the Commonwealth of Pennsylvania, as Surety, hereinafter called  
the Surety, are held and firmly bound unto the MON VALLEY SEWAGE AUTHORITY as OWNER,  
hereinafter called the OWNER, in the sum of  
\_\_\_\_\_ Dollars (\$ \_\_\_\_\_),  
which is equivalent to ten (10) percent of the total bid price, for the payment of which sum well and  
truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors,  
administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a Bid for the **MONESSEN AND DONNER PUMP  
STATIONS SCREENINGS IMPROVEMENTS PROJECT** being undertaken by the OWNER.

NOW, THEREFORE, if the OWNER shall accept the Bid of the Principal and the Principal shall  
enter into a Contract with the OWNER in accordance with the terms of such Bid, and give such Bond  
or Bonds as may be specified in the Contract Documents with good and sufficient surety for the  
faithful performance of such Contract and for the prompt payment of labor and material furnished in  
the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give  
such Bond or Bonds, if the Principal shall pay to the OWNER the difference not-to-exceed the  
penalty hereof between the amount specified in said Bid and such larger amount for which the  
OWNER may in good faith contract with another party to perform the Work covered by said Bid,  
then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and Sealed this \_\_\_\_\_ day of \_\_\_\_\_, 2023.

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Principal)

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

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Surety)

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

**Section 00 4345  
Legal Status of Bidder**

This Bid is submitted in the name of:

(Print) \_\_\_\_\_

The undersigned hereby designates below his business address to which all notices, directions or other communications may be served or mailed:

Street \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip Code \_\_\_\_\_

The undersigned hereby declares that he has legal status checked below:

- SOLE PROPRIETOR
- SOLE PROPRIETOR DOING BUSINESS UNDER AN ASSUMED NAME
- CO-PARTNERSHIP

The Assumed Name of the Co-Partnership is registered in the County of \_\_\_\_\_, Pennsylvania

- CORPORATION INCORPORATED UNDER THE LAWS OF THE STATE OF \_\_\_\_\_

The Corporation is

- authorized to conduct business in the Commonwealth of Pennsylvania
- not now authorized to conduct business in the Commonwealth of Pennsylvania
- possess all required licenses for the work being bid
- limited liability corporation

The name, titles, and home addresses of all persons who are officers or partners in the organization are as follows:

NAME AND TITLE

HOME ADDRESS

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 2023.

\_\_\_\_\_  
By (Signature)

\_\_\_\_\_  
Printed Name of Signer

\_\_\_\_\_  
Title

**Section 00 5100  
Notice of Award**

To: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date: \_\_\_\_\_

Attention: \_\_\_\_\_

Project: MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS  
PROJECT

Gentlemen:

Pursuant to the provisions of Article 1.12 of the Instructions to Bidders, you are hereby notified that the Mon Valley Sewage Authority (MVSA) during its regularly scheduled and duly advertised monthly Board Meeting held on \_\_\_\_\_ 2024, has directed the acceptance of your Bid for the above referenced Project in the amount of \_\_\_\_\_. This project shall consist of: installation of new Mechanical Bar Screens, Washer Compactors, Debris Chutes, Screening Waste Receptacles, and associated appurtenances at the Monessen and Donner Pump Stations, construction of a building addition on the side of the Monessen and Donner Pump Stations to house new Screenings Waste Receptacles, removal of the existing comminutor systems, access hatches, monorails, and associated appurtenances, conversion of the comminutor inlet channels into bypass channels, installation of manual bar screens in the new bypass channels, installation of weirs in the influent channels downstream of the Mechanical Bar Screens, replacement of the existing exhaust fans and air handling systems, installation of electrical conduit to power the equipment and lighting in the new building additions, associated electrical / process control work for integration of the new equipment, and other miscellaneous work as delineated in your Bid submitted to the MVSA on \_\_\_\_\_. Please comply with the following conditions within 15 days of the date of this Notice of Award; that is by \_\_\_\_\_.

1. Deliver to the ENGINEER three (3) fully executed counterparts of the Agreement (attached) including all the Contract Documents.
2. Deliver with each executed Agreement the Contract Security (Bonds), on the forms included in the Contract Documents, as specified in the General Conditions (Article 5) and Supplementary Conditions (Article SGC-5).
3. Deliver with each executed Agreement the Insurance Certificates (and other evidence of insurance) as specified in General Conditions (Article 5) or the Supplementary Conditions (Article SGC-5).
4. Please do not date Agreement and Contract Security (Bonds), as these will be dated by OWNER when executed by him.

It is important to comply with these conditions and time limits as failure to comply with these conditions within the time specified will entitle OWNER to consider your Bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within ten (10) days after you comply with these conditions, OWNER will return to you one (1) fully signed counterpart of the Agreement with the Contract Documents attached.

A pre-construction meeting will be scheduled with all contracts associated with this project after

receipt of all executed counterparts of the Agreement from each contractor. In accordance with paragraph 2.05 of the General Conditions, please submit to the ENGINEER the required schedules prior to the scheduling of a Preconstruction Meeting.

If you have any questions regarding the content of this correspondence or the Agreement, please call Mr. Jason McBride, P.E., Wade Trim, Inc., at (412) 498-4698.

Mon Valley Sewage Authority  
*(Owner)*

By: \_\_\_\_\_  
*(Authorized Signature)*

\_\_\_\_\_  
*(Title)*

cc: Jason McBride, P.E., Wade Trim, Inc.  
Aaron Bialon, Esq., Bialon & Bialon

Not To Be Used For Bidding Purposes

## Section 00 5200 Agreement

This Agreement, made and entered into this \_\_\_\_\_ day of \_\_\_\_\_ in the year 2023 by and between the Mon Valley Sewage Authority, hereinafter called OWNER, and \_\_\_\_\_, hereinafter called CONTRACTOR, for the following contract:

### MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

#### ARTICLE 1. WORK

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents.

The Project for which the Work under the Contract Documents may be the whole or only a part is described more fully in the Contract Specifications and on the Contract Drawings.

#### ARTICLE 2. ENGINEER

The Project has been designed by Wade Trim, Inc., Three Gateway Center, 401 Liberty Avenue, Suite 1600; telephone (412) 454-5566, who is hereinafter called ENGINEER and who is to act as OWNER's representative, assume all duties and responsibilities, and have the rights and authority assigned to ENGINEER in the Contract Documents, or approved by the OWNER, in connection with completion of the Work in accordance with the Contract Documents.

#### ARTICLE 3. CONTRACT TIMES

- 3.1 The Work will be substantially completed within three hundred and sixty consecutive calendar days (12 months) after the date noted in the Notice to Proceed and completed and ready for final payment in accordance with paragraphs 14.09 and 14.10 of the General Conditions within 420 consecutive calendar days (14 months) after the date when the Contract Times commence to run.
- 3.2 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1. above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), CONTRACTOR shall pay OWNER **Five Hundred Dollars (\$500.00)** for each day that expires after the time specified in paragraph 3.1. for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness for final payment or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER **Five Hundred Dollars (\$500.00)** for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment.



**ARTICLE 4. CONTRACT PRICE**

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the amount determined pursuant to paragraph 4.1. below:

4.1 For all Work, a Lump Sum of \_\_\_\_\_  
(use words)

\$ \_\_\_\_\_  
(Figures)

All specific cash allowances are included in the above price and have been computed in accordance with Article 11 of the General Conditions.

**ARTICLE 5. PAYMENT PROCEDURES**

CONTRACTOR shall submit Applications for Payment to ENGINEER for review and approval by the third day of the month following the month for which the application is made. ENGINEER shall submit the approved application to OWNER for review and approval at least 7 days prior to the OWNER's regularly scheduled meeting on the third Thursday of each month.

5.1 Progress Payments; Retainage. OWNER shall make monthly progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended or approved by ENGINEER, during construction as provided in paragraphs 5.1.1 and 5.1.2 below. All such payments will be measured as provided in the General Conditions.

5.1.1 Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts in accordance with paragraph 14.03 of the General Conditions.

5.1.1.1 Ninety (90) percent of Work completed (with the balance being retainage) If Work has been 50-percent completed as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to OWNER and determined that as long as the character and progress of the Work remain satisfactory to them,

Retainage will be reduced to five (5) percent of all of the Work completed to date and for subsequent future progress payments until Substantial Completion.

5.1.1.2 Ninety (90) percent (with the balance being retainage) of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to OWNER as provided in paragraph 14.03 of the General Conditions).

5.1.2 Upon Substantial Completion, in an amount sufficient to increase total payments to CONTRACTOR to ninety-seven and one-half (97-1/2) percent of the Contract Price (with the balance being retainage), less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 14.02 and 14.03 of the General Conditions.

- 5.2 Final Payment. Upon final completion and acceptance of the Work in accordance with paragraphs 14.09 and 14.10 of the General Conditions, OWNER shall pay the remainder of the Contract.

## ARTICLE 6. CONTRACTOR'S REPRESENTATIONS

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:

- 6.1 CONTRACTOR has thoroughly examined and carefully studied the Contract Documents (including the Addenda listed in paragraph 7.9) and the other related data identified in the Bidding Documents including "technical data."
- 6.2 CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work.
- 6.3 CONTRACTOR is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- 6.4 CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which, if available, have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions.

CONTRACTOR accepts the determination set forth in paragraph 4.02 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR is entitled to rely as provided in paragraph 4.02 of the General Conditions.

CONTRACTOR acknowledges that such reports and drawings are not Contract Documents and may not be complete for CONTRACTOR's purposes.

CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site.

CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto.

CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

- 6.5 CONTRACTOR is aware of the general nature of Work to be performed by OWNER and others at the site that relates to the Work as indicated in the Contract Documents.
- 6.6 CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.

- 6.7 CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies in the Contract Documents and the written resolution thereof by ENGINEER through issued addendum or addenda is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work. When said conflicts, etc., have not been resolved through interpretation or clarification by ENGINEER, because of insufficient time or otherwise, CONTRACTOR has included in the Bid the greater quantity or better quality of Work, or compliance with the more stringent requirement resulting in a greater cost; and said greater cost is included in the Contract Price.

## ARTICLE 7. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

- 7.1 This Agreement.
- 7.2 Performance, Payment, and other Bonds and insurance certificates
- 7.3 Notice of Award.
- 7.4 Notice to Proceed.
- 7.5 General Conditions.
- 7.6 Supplementary Conditions.
- 7.7 Specifications bearing the title MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT and consisting of the divisions and sections, as listed in table of contents thereof.
- 7.8 Drawings consisting of a cover sheet and drawing sheets with each sheet bearing the following general title: MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT.
- 7.9 Addenda issued prior to bid and listed in the CONTRACTOR'S Bid Form.
- 7.10 CONTRACTOR's Bid.
- 7.11 Documentation submitted by CONTRACTOR prior to Notice of Award.
- 7.11 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached thereto:

All written amendments and other documents amending, modifying or supplementing the Contract Documents pursuant to paragraphs 3.05 of the General Conditions.

There are no Contract Documents other than those listed above in this Article. The Contract Documents may only be amended, modified or supplemented as provided in paragraphs 3.05 of the General Conditions.

## ARTICLE 8. MISCELLANEOUS

- 8.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

- 8.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically, but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 8.3 OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.
- 8.4 Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- 8.5 Litigation: In the event of any dispute between the Owner and the Contractor which is not amicably resolved and which results in litigation, the parties agree that the Court of Common Pleas of the county in which the project resides is the sole legal forum and shall have exclusive and sole jurisdiction and venue over such litigation.

Not To Be Used For Bidding Purposes



**A Joint Venture**

\_\_\_\_\_

*Name of Joint Venture*

by \_\_\_\_\_ (SEAL)

*Name*

by \_\_\_\_\_ (SEAL)

*Name*

Address for giving Notice: \_\_\_\_\_

\_\_\_\_\_

Phone No.: \_\_\_\_\_

Attest \_\_\_\_\_

NOTE: If CONTRACTOR is a corporation, attach evidence of authority to sign.

End of Section

Not To Be Used For Bidding Purposes

**Section 00 5500  
Notice to Proceed**

To: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date: \_\_\_\_\_, 2023

Attention: \_\_\_\_\_

Project: **MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT**

Gentlemen:

Please note that the Contract Time under the above Contract will commence to run on \_\_\_\_\_  
\_\_\_\_\_. Within ten (10) days of this date, you are to start performing the Work. The dates  
of Substantial Completion and Final Completion are set forth in the Agreement; they are \_\_\_\_\_  
\_\_\_\_\_, and \_\_\_\_\_, respectively.

In accordance with paragraph 2.05 of the General Conditions, please submit to ENGINEER the  
required schedules prior to the scheduling of a Preconstruction Meeting.

Also, in accordance with paragraph 2.05 of the General Conditions, please request a Preconstruction  
Meeting from ENGINEER prior to delivery of any materials or start of any construction. A minimum  
of three (3) full working days notice is required to set up the Preconstruction Meeting. Also, please  
notify ENGINEER three (3) full working days in advance of any staking requirements or other  
activity on the Project.

Mon Valley Sewage Authority  
*(Owner)*

By: \_\_\_\_\_  
*(Authorized Signature)*

\_\_\_\_\_  
*(Title)*

cc: Jason J. McBride, P.E., Wade Trim, Inc.  
Aaron Bialon, Esq., Bialon & Bialon

**Section 00 6112  
Performance Bond**

Bond No. \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, That we, \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact business in the Commonwealth of Pennsylvania, hereinafter called the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact business in the Commonwealth of Pennsylvania, as Surety, hereinafter called "Surety," are held and firmly bound unto \_\_\_\_\_, as Obligee, and hereinafter called "Obligee," in the just and full sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), lawful money of the United States of America, to be paid to the said Obligee, to which payment well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, WHEREAS, the above Principal has entered into a contract with the said Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 2023 for

MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT

which contract is herein referred to and made a part hereof as fully and to the same extent as if the same were entirely written herein, and

WHEREAS, it was one of the conditions of the award of the said Obligee, pursuant to which said contract was entered into, that these presents should be executed.

AND THE SAID SURETY, for value received, hereby stipulates and agrees that no change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the Work to be performed thereunder or the Contract Documents accompanying the same shall in anywise affect its obligations on this Bond, and it does hereby waive notice of any such change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the Work or to the Contract Documents.

NOW, THEREFORE, if the above Principal shall in all respects comply with the terms and conditions of said contract, and his (their or its) obligations thereunder, including the Contract Documents therein referred to and made a part thereof, and such alteration as may be made in such contract or Contract Documents, as herein or therein provided for, then this obligation shall be void; otherwise, this Bond and obligation shall be and remain in full force and effect.



Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_.

Signed, sealed and delivered in the presence of:

\_\_\_\_\_  
Witness for CONTRACTOR

\_\_\_\_\_  
(Principal)

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

By \_\_\_\_\_

\_\_\_\_\_  
Witness for Surety

\_\_\_\_\_  
(Surety)

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

By \_\_\_\_\_

\_\_\_\_\_  
Attorney-In-Fact (Seal)

\_\_\_\_\_  
Address

\_\_\_\_\_  
Address of Surety

\_\_\_\_\_  
City Code                      Zip Code

\_\_\_\_\_  
City                                      Zip

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Telephone

Not To Be Used For Bidding Purposes

**Section 00 6113  
Labor and Material Payment Bond**

Bond No. \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, That we, \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact business in the Commonwealth of Pennsylvania, hereinafter called the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact business in the Commonwealth of Pennsylvania, as Surety, hereinafter called "Surety," are held and firmly bound unto \_\_\_\_\_, as Obligee, and hereinafter called "Obligee," in the just and full sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), lawful money of the United States of America, to be paid to the said Obligee, to which payment well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, WHEREAS, the above Principal has entered into a contract with the said Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 2023 for

MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT  
\_\_\_\_\_ which contract is herein referred to and made a part hereof as fully and to the same extent as if the same were entirely written herein, and

WHEREAS, it was one of the conditions of the award of the said Obligee, pursuant to which said contract was entered into, that these presents should be executed.

AND WHEREAS, this Bond is given in compliance with and subject to the provisions of the Public Works Contractor's Bond Law of 1967 (8 P.S. 193; 1967 P.L. 869, No 385), as amended, including all notices, time limitation provisions and other requirements set forth therein, which are incorporated herein by reference.

AND THE SAID SURETY, for value received, hereby stipulates and agrees that no change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the Work to be performed thereunder or the Contract Documents accompanying the same shall in anywise affect its obligations on this Bond, and it does hereby waive notice of any such change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the Work or to the Contract Documents.

NOW, THEREFORE, the condition of this obligation is such that if all claimants as defined in Public Works Contractor's Bond Law of 1967 (8 P.S. 193; 1967 P.L. 869, No 385), as amended, are timely paid for all labor and material used or reasonably required for use in the performance of the contract, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_.

Signed, sealed and delivered in the presence of:

\_\_\_\_\_  
Witness for CONTRACTOR

\_\_\_\_\_  
(Principal)

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

By \_\_\_\_\_

\_\_\_\_\_  
Witness for Surety

\_\_\_\_\_  
(Surety)

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

By \_\_\_\_\_

\_\_\_\_\_  
Attorney-In-Fact (Seal)

\_\_\_\_\_  
Address

\_\_\_\_\_  
Address of Surety

\_\_\_\_\_  
City Code                      Zip Code

\_\_\_\_\_  
City                                      Zip

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Telephone

Not To Be Used For Bidding Purposes

## Section 00 6325 Substitution Request Form

SPECIFICATION SECTION # \_\_\_\_\_

ARTICLE # \_\_\_\_\_

SPECIFIED PRODUCT \_\_\_\_\_

PROPOSED SUBSTITUTION \_\_\_\_\_

- A. Does specified product exceed, in any respect proposed substitution?  Y  N
- B. Does substitution affect dimensions shown on Plans?  Y  N
- C. Does substitution affect other trades more than original product?  Y  N
- D. Does warranty differ from that specified?  Y  N
- E. Does substitution affect cost to OWNER?  Y  N
- F. Does substitution result in any license fee or royalty?  Y  N

If you indicated "Yes" to any of the items above, attach thorough explanation on your Company letterhead, as follows:

1. Explain any differences between proposed substitution and specified product.
2. Summarize experience with product and manufacturer in Project area.
3. Attach complete technical data and literature.

The undersigned states that the function, appearance, and quality of the proposed substitution is equivalent or superior to the specified item, and that all information above and attached is true and correct.

Submitted by: \_\_\_\_\_ Date Submitted: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

Signature: \_\_\_\_\_

### For use by ENGINEER

ENGINEER'S RESPONSE	RESPONSE REQUIRED OF CONTRACTOR
No Exceptions Taken <input type="checkbox"/>	None <input type="checkbox"/>
Note Markings <input type="checkbox"/>	Confirm <input type="checkbox"/>
Comments Attached <input type="checkbox"/>	Resubmit <input type="checkbox"/>
Rejected <input type="checkbox"/>	
Engineer's review is for general conformance with the design concept and contract documents. Markings or comments should not be construed as relieving the contractor from compliance with the project plans and specifications, nor departures therefrom. The contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing his work in a safe manner.	
By _____ Date _____	



**Section 00 6516**  
**Certificate of Substantial Completion**

Project: MONESSEN AND DONNER PUMP STATIONS SCREENINGS IMPROVEMENTS PROJECT

OWNER: Mon Valley Sewage Authority

CONTRACTOR: \_\_\_\_\_

Contract Date: \_\_\_\_\_ Project No.: \_\_\_\_\_

Date of Issuance: \_\_\_\_\_

Project or Designated Portion Shall Include: \_\_\_\_\_

The Work performed under this Contract has been reviewed and found to be Substantially Complete. The date of Substantial Completion of the Project or portion thereof designated above is hereby established as \_\_\_\_ which is also the date of commencement of applicable warranties required by the Contract Documents except as stated below.

**DEFINITION OF DATE OF SUBSTANTIAL COMPLETION**

The date of Substantial Completion of the Work or designated portion thereof, is the date certified by ENGINEER when construction is sufficiently complete, in accordance with the Contract Documents, so OWNER can occupy or utilize the Work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

A list of items to be completed or corrected, prepared by ENGINEER is attached hereto. The failure to include any items on such list does not alter the responsibility of CONTRACTOR to complete all Work in accordance with the Contract Documents. The date of commencement of warranties for items on the attached list will be the date of final payment unless otherwise agreed to in writing.

The responsibilities of OWNER and CONTRACTOR for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:

OWNER shall have 45 days after receipt of this certificate during which he may make written objection to ENGINEER and CONTRACTOR as to any provisions of the certificate or attached list. Such objection may be cause for this Certificate of Substantial Completion to be null and void.

\_\_\_\_\_  
*Engineer*

\_\_\_\_\_  
*Authorized Representative*

\_\_\_\_\_  
*Date*

## Section 00 6520 Sworn Statement

COMMONWEALTH OF PENNSYLVANIA  
COUNTY OF WESTMORELAND

\_\_\_\_\_ being duly sworn, deposes and says:

That \_\_\_\_\_ is the (CONTRACTOR) (Subcontractor) for an improvement to the following described real property situated in Westmoreland County, Pennsylvania described as follows: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*(Insert Legal Description of Property)*

That the following is a statement of each Subcontractor and Supplier and laborer, for which the payment of wages or fringe benefits and withholdings is due but unpaid, with whom the (CONTRACTOR) (Subcontractor) has (contracted) (subcontracted) for performance under the contract with the OWNER or lessee thereof, and that the amounts due to the persons as of the date hereof are correctly and fully set forth opposite their names as follows:

Name of Subcontractor, Supplier, or Laborer	Type of Improvement Furnished	Total Contract Price	Amount Already Paid	Amount Currently Owning	Balance to Complete (optional)	Amount of Laborer Wages Due but Unpaid	Amount of Laborer Fringe Benefits and Withholdings Due But Unpaid
TOTALS:							

*(Some columns are not applicable to all persons listed) (Continued)*

That the CONTRACTOR has not procured material from, or subcontracted with, any person other than those set forth on the reverse side and owes no money for the improvement other than the sums set forth on the reverse side.

Deponent further says that he or she makes the foregoing statement as the (CONTRACTOR) (Subcontractor) or as \_\_\_\_\_ of the (CONTRACTOR) (Subcontractor) for the purpose of representing to the OWNER or lessee of the described on the reverse side premises and his or her agents that the property described on the reverse side is free from claims of construction liens, or the possibility of construction liens, except as specifically set forth on the reverse side and except for claims of construction liens by laborers which may be provided pursuant to the Commonwealth of Pennsylvania HB 1637 of 2005 (Act 52), an amendment to the Mechanics Lien Law of 1963 (P.L. 1175, No 497).

WARNING TO OWNER: AN OWNER OR LESSEE OF THE PROPERTY DESCRIBED ON THE REVERSE SIDE MAY NOT RELY ON THIS SWORN STATEMENT TO AVOID THE CLAIM OF A SUBCONTRACTOR, SUPPLIER, OR LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING OR A LABORER WHO MAY PROVIDE A NOTICE OF FURNISHING PURSUANT TO PENNSYLVANIA HB 1637 OF 2005, AS AMMENDED, TO THE DESIGNEE OR TO THE OWNER OR LESSEE IF THE DESIGNEE IS NOT NAMED OR HAS DIED.

\_\_\_\_\_  
(Deponent)

WARNING TO DEPONENT: A PERSON, WHO WITH INTENT TO DEFRAUD, GIVES A FALSE SWORN STATEMENT IS SUBJECT TO CRIMINAL PENALTIES AS PROVIDED IN PENNSYLVANIA HB 1637 OF 2005, AS AMMENDED.

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

\_\_\_\_\_  
Notary Public

\_\_\_\_\_ County, Pennsylvania

My Commission Expires \_\_\_\_\_

#### INSTRUCTIONS

1. A Sworn Statement in the preceding form must be provided before any CONTRACTOR or Subcontractor can file a Complaint, Cross-Claim, or Counter-Claim to enforce a construction lien.
2. An OWNER or lessee may withhold payment to a CONTRACTOR or Subcontractor who has not provided a Sworn Statement. An OWNER or lessee may withhold from a CONTRACTOR or Subcontractor who has provided a Sworn Statement the amount sufficient to pay all sums shown on the statement as owing Subcontractors, Suppliers, and laborers, or the amount shown to be due to lien claimants who have provided Notices of Furnishing pursuant to Pennsylvania Act 52, Mechanics Lien Law, as amended.
3. An OWNER or lessee may rely on a Sworn Statement to avoid a lien claim unless the lien claimant has provided the OWNER or lessee with a Notice of Furnishing pursuant to Pennsylvania Act 52, Mechanics Lien Law, as amended.
4. If the contract provides for payments by the OWNER to the general contractor, if any, in the normal course of construction, but the OWNER elects to pay lien claimants directly, the first time the OWNER elects to make payment directly to a lien claimant he or she shall provide at least 5 business days' notice to the general contractor of the intention to make direct payment. Subsequent direct disbursements to lien claimants need not be preceded by the 5-day notice provided in this section unless the OWNER first returns to the practice of paying all sums to the general contractor.

End of Section



**Section 00 7200  
General Conditions**

Article 1 Definitions ..... 1  
Article 2 Preliminary Matters ..... 5  
Article 3 Contract Documents Intent and Reuse ..... 6  
Article 4 Availability of Lands; Subsurface & Physical Conditions; Reference Points..... 9  
Article 5 Bonds and Insurance ..... 11  
Article 6 CONTRACTOR's Responsibilities ..... 15  
Article 7 Work by Others ..... 25  
Article 8 OWNER's Responsibilities ..... 25  
Article 9 ENGINEER's Status During Construction ..... 27  
Article 10 Changes in the Work; Claims..... 30  
Article 11 Cost of the Work; Allowances; Unit Price Work ..... 32  
Article 12 Change of Contract Price; Change of the Contract Times ..... 35  
Article 13 Tests and Inspection; Correction, Removal or Acceptance of Defective Work..... 37  
Article 14 Payments to CONTRACTOR and Completion..... 40  
Article 15 Suspension of Work and Termination ..... 46  
Article 16 Miscellaneous ..... 49

**Article 1 Definitions**

**1.01 Defined Terms**

Wherever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

**Addenda** -- Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Contract Documents.

**Agreement** -- The written Agreement between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

**Application and Certificate for Payment** -- The form included in the Contract Documents which is to be used by CONTRACTOR in requesting progress or final payment and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

**Asbestos** -- Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

**Bid** -- The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

**Bidding Requirements** -- The Advertisement for Bids, Instructions to Bidders, Supplemental Instructions to Bidders, Bid, Legal Status of Bidder, Bid Bond, and any other documents identified in the Bid Form, to be submitted with the Bid.

**Bonds** -- Bid, Performance and Payment bonds and other instruments of security.

**Change Order** -- A written order to the CONTRACTOR signed by the OWNER and the ENGINEER, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Price or the Contract Time. The Contract Price and Contract Time may be changed only by Change Order. A Change Order signed by the CONTRACTOR indicates his agreement therewith, including the adjustment in the Contract Price or Contract Time.

**Construction Change Requisition** -- A written directive issued by the ENGINEER which clarifies or interprets the Contract Documents or requests a change in the Work and may initiate a Work Order and/or Change Order. In no circumstances shall a Construction Change Requisition be construed as an order to proceed with the Work.

**Contract Documents** -- The Bidding Requirements, Agreement, Performance and other Bonds, Notice of Award, Notice to Proceed, Contract Forms, Conditions of the Contract, Specifications, Plans, Addenda, Documentation submitted by CONTRACTOR prior to Notice of Award and any Written Amendments, including Change Orders, Work Orders or Construction Change Requisitions duly delivered after execution of Agreement.

**Contract Price** -- The monies or other considerations payable by OWNER to CONTRACTOR for completion of acceptable Work in accordance with the Contract Documents as stated in the Agreement.

**Contract Time** -- The number of days or the date stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment in accordance with paragraph 14.11.

**CONTRACTOR** -- The person, firm or corporation with whom OWNER has entered into the Agreement.

**Day** -- A calendar day of 24 hours measured from midnight to the next midnight.

**Defective** -- An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment.

**Drawings** -- That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other Contractor submittals are not Drawings as so defined.

**Effective Date of Agreement** -- The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

**ENGINEER** -- The person, firm, or corporation identified in the Supplemental Instructions to Bidders.

**Field Order** -- A written order issued by ENGINEER which clarifies or interprets the Contract Documents or orders minor changes in the Work in accordance with paragraphs 9.04 and 9.05 but which does not involve a change in the Contract Price or the Contract Time.

**General Requirements** -- Specification Sections in Division 1 of the Specifications.

**Laws and Regulations; Laws or Regulations** -- Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.

**Milestone** -- A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of the Work.

**Notice of Award** -- The written notice by OWNER to the apparent successful Bidder stating that, upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

**Notice to Proceed** -- A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform his obligation under the Contract Documents.

**OWNER** -- The public body or authority, public agency as defined by Act 254 of PA 1980 (MCLA 125.1651 et seq.), corporation, limited liability company, association, partnership, or individual with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided and as identified in the Supplemental Instructions to Bidders.

**Partial Utilization** -- Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

**Plans** -- The Drawings which show the extent, character and Scope of the Work to be furnished and performed by CONTRACTOR and which have been prepared or approved by the ENGINEER or OWNER.

**Project** -- The total construction of which the Work to be provided under the Contract Documents may be the whole or a part as indicated elsewhere in the Contract Documents.

**Project Manual** -- The volume assembled for the Project which includes: Part I - Bidding Requirements, Part II - Contract Forms, Part III - Conditions of the Contract and Part IV - Specifications.

**Proposal** -- The offer or Bid of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

**Radioactive Material** -- Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 as amended.

**Resident Project Representative** -- The authorized representative of ENGINEER who may be assigned to the site or any part thereof.

**Samples** -- Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

**Shop Drawings** -- All drawings, diagrams, illustrations, schedules and other data or information required by the Contract Documents which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate material or equipment for some portion of the Work.

**Specifications** -- The Contract Documents which consist of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

**Subcontractor** -- An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

**Substantial Completion** -- The Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by his definitive Certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it was intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by ENGINEER's written recommendation of final payment in accordance with paragraph 14.11. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

**Supplemental General Conditions** -- The part of the Contract Documents which amends or supplements these General Conditions.

**Supplier** -- A manufacturer, fabricator, supplier, distributor, material man, or vendor having a direct contract with CONTRACTOR, or with any Subcontractor, or with OWNER, to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

**Underground Facilities** -- All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

**Unit Price Work** -- Work to be paid for on the basis of unit prices.

**Work** -- The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing, or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

**Work Order** -- A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 4.03 or to emergencies under paragraph 6.18. A Work Order will not change the Contract Price or Contract Time, but is evidence that the parties expect that the change directed or documented by a Work Order will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time as provided in paragraph 10.01.

**Written Amendment** -- (a) A written amendment of the Contract Documents signed by OWNER and CONTRACTOR (b) a Change Order, or (c) a Field Order. A Written Amendment may only be issued after the effective date of the Agreement and normally deals with non-engineering or non-technical rather than strictly construction related aspects of the Contract Documents.

## **1.02 Terminology**

The following words, terms, or phrases are not defined but, when used in the Contract Documents, have the following meaning:

Whenever in the Contract Documents the terms “as ordered,” “as directed,” “as required,” “as allowed,” “as approved” or terms of like effect or import are used, or the adjectives “reasonable,” “suitable,” “acceptable,” “proper” or “satisfactory” or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate, in general, the completed Work for compliance with the technical requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

## **Article 2 Preliminary Matters**

### **2.01 Delivery of Bonds and Insurance**

When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds and Insurance Certificates and other evidence of Insurance requested as CONTRACTOR may be required to furnish in accordance with Article 5.

### **2.02 Copies of Documents**

OWNER shall furnish to CONTRACTOR up to five (5) copies of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction. Electronic copies on disc may also be provided to the CONTRACTOR in lieu of hard copies of the drawings.

### **2.03 Commencement of Contract Time; Notice to Proceed**

Time is of the essence in the performance of the Work. The Contract Time will commence to run on the 30th day after the effective date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the effective date of the Agreement. In no event will the Contract Time commence to run later than the thirtieth day after the effective date of the Agreement. All time limits stated in the Contract Documents are of the essence of the Agreement.

### **2.04 Starting the Project**

CONTRACTOR shall start to perform the Work within ten (10) days of when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run. CONTRACTOR shall notify ENGINEER at least three (3) working days in advance of the time he intends to start Work.

### **2.05 Preconstruction Meeting**

Prior to the delivery of materials or the start of any construction, CONTRACTOR shall request a Preconstruction Meeting from ENGINEER. A minimum of three (3) full working days' notice shall be required.

Prior to the scheduling of the Preconstruction Meeting, CONTRACTOR shall submit to ENGINEER for review:

- A. A preliminary progress schedule indicating the starting and completion dates of the various stages of the Work, including any Milestones specified in the Contract Documents;
- B. A preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;
- C. An estimated monthly payment schedule, and a preliminary schedule of values for all of the Work.
- D. Contractor's written Safety Plan for this Project

The Preconstruction Meeting will be held for review and acceptance of the schedules, to establish procedures for handling Shop Drawings and other submittals, for processing Applications for Payment, and to establish a working understanding among the parties as to the Work.

## **Article 3 Contract Documents Intent and Reuse**

### **3.01 Intent**

Contract Documents comprise the entire Contract between OWNER and CONTRACTOR concerning the Work and supersede all prior representations and/or negotiations. They may be altered only by a Written Amendment.

Contract Documents are complementary; what is called for by one is as binding as if called for by all. Contract Documents will be governed by the Laws and Regulations of the place of the Project.

### **3.02 Reference to Standards and Specifications of Technical Societies**

Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, or Laws or Regulations in effect at the time of opening of Bids or, on the effective date of the Agreement if there were no Bids, except as may be otherwise specifically stated in the Contract Documents.

It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result shall be furnished and performed whether or not it is specifically called for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and interpretations shall be issued by ENGINEER as provided in paragraph 9.04.

No provision of any standard, specification, manual, code or instruction shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to OWNER, ENGINEER or any of ENGINEER's Consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of paragraph 9.10 or any other provision of the Contract Documents.

### **3.03 Reporting and Resolving Discrepancies**

Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby.

If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once, and, CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as authorized by paragraph 6.18). However, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement issued by one of the methods indicated in paragraph 3.05, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity or discrepancy between the provisions of the Contract Documents and;

- (i) the provisions of any standard, specification, manual, code or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
- (ii) the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

### **3.04 Order of Precedence**

In resolving conflicts, errors or discrepancies between Plans and Specifications:

- (i) Figured dimensions shall govern over scaled dimensions and
- (ii) Plans shall govern over Specifications.

### **3.05 Amending and Supplementing Contract Documents**

The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- (i) Formal Written Amendment,
- (ii) Change Order (pursuant to paragraph 10.03), or
- (iii) Work Order (pursuant to paragraph 10.01)

In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

- (i) Field Order (pursuant to paragraph 9.05),
- (ii) ENGINEER's review of a Shop Drawing or Sample (pursuant to paragraph 6.21), or
- (iii) ENGINEER's Written interpretation or clarification (pursuant to paragraph 9.04).

### **3.06 Reuse of Documents**

Neither CONTRACTOR nor any Subcontractor, manufacturer, fabricator, Supplier, distributor, or other person or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER

- (i) shall have or acquire any title to or ownership rights in any of the Plans, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's Consultant, and
- (ii) they shall not reuse any of such Plans, Specification, other documents or copies on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaptation by ENGINEER.

### **3.07 Electronic Data**

Copies of data furnished by OWNER or ENGINEER to CONTRACTOR or CONTRACTOR to OWNER or ENGINEER that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.



## **Article 4 Availability of Lands; Subsurface & Physical Conditions; Reference Points**

### **4.01 Availability of Lands**

OWNER shall furnish, as indicated in the Contract Documents and not later than the established Work Starting Date, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. OWNER shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which CONTRACTOR will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment unless otherwise provided in the Contract Documents.

### **4.02 Physical Conditions -- Investigations and Reports**

Reference is made to the Supplemental General Conditions for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon in preparation of the Contract Documents. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents.

The locations of utilities or other physical conditions relating to existing surface or subsurface structures at or contiguous to the site as shown on the Plans are taken from drawings from sources believed to be reliable. Neither the OWNER nor the ENGINEER will be responsible for any omissions of, or variations from the indicated location of existing utilities which may be encountered in the Work.

- (i) CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Except for such reliance on such "technical data", CONTRACTOR may not rely upon or make any claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to: the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto, or
- (ii) other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings, or
- (iii) any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information.

The cost of all the following will be included in the Contract Price and CONTRACTOR shall have full responsibility for:

- (i) Reviewing and checking all such information and data,
- (ii) Locating all Underground Facilities during construction,
- (iii) Coordination of the Work with the owners of such Underground Facilities, and
- (iv) Safety and protection of all such Underground Facilities as provided in paragraph 6.15 and repairing any damage thereto resulting from the Work.

#### **4.03 Unforeseen Physical Conditions**

If CONTRACTOR discovers one or both of the following physical conditions of surface or subsurface at the Project or improvement site, before disturbing the physical condition, the CONTRACTOR shall promptly notify OWNER and ENGINEER of the physical condition in writing:

- (i) A subsurface or a latent physical condition at the site differing materially from those indicated in the Contract Documents, or
- (ii) An unknown physical condition at the site of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for the improvement project.

Upon receiving notice thereof, OWNER, through ENGINEER, shall promptly investigate the physical condition. If OWNER, through ENGINEER, determines that the physical conditions do materially differ and will cause an increase or decrease in cost or additional time needed to perform the contract, such determination shall be made in writing and an equitable adjustment shall be made and the Contract Documents modified in writing accordingly. CONTRACTOR shall not be entitled to claim for additional costs or time because of a physical condition unless CONTRACTOR has complied with the notice requirements of this provision. CONTRACTOR shall not be entitled to claim an adjustment under the Contract Documents after CONTRACTOR has received final payment under the contract.

#### **4.04 Reference Points**

OWNER shall provide engineering surveys for construction to establish property corners, monuments, bench marks and similar reference points which in his judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for the preservation of established reference points and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations. Reference points destroyed by negligence of CONTRACTOR will be replaced by OWNER at the expense of CONTRACTOR. Construction Staking will be furnished by OWNER as provided in Division 01 of the Specifications.

#### **4.05 Asbestos, PCB's, Petroleum, Hazardous Waste or Radioactive Material**

OWNER shall be responsible for any Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site which was not shown or indicated in Plans or Specifications or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. OWNER shall not be responsible for any such materials brought to the site by CONTRACTOR, Subcontractor, Suppliers or anyone else for whom CONTRACTOR is responsible.

Upon discovering any such material, CONTRACTOR shall immediately:

- (i) Stop all Work in connection with such hazardous condition and in any area affected thereby (except in emergency as required by paragraph 6.18), and
- (ii) Notify OWNER and ENGINEER (and thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such hazardous condition or take corrective action, if any.

CONTRACTOR shall not be required to resume Work in connection with such hazardous condition or in any such affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR special written notice:

- (i) Specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or
- (ii) Specifying any special conditions under which such Work may be resumed safely.

If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Terms as a result of such Work stoppage or such special conditions under which Work is agreed by CONTRACTOR to be resumed, either party may make a claim therefor as provided in paragraph 10.05.

If after receipt of such special written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order such portion of the Work that is in connection with such hazardous condition or in such affected area to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Time as a result of deleting such portion of the Work, then either party may make a claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, employees, agents, other consultants and subcontractors of each and any of them from and against all claims, costs, losses, damages and expenses arising out of or resulting from such hazardous condition per this paragraph 4.05, provided that:

- (i) Any such claim, cost, loss or damage is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and
- (ii) Nothing in this subparagraph 4.05 shall obligate OWNER to indemnify any person or entity from and against the consequences of that person's or entity's own negligence.

The provisions of paragraph 4.03 are not intended to apply to Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site.

## **Article 5 Bonds and Insurance**

### **5.01 Performance and Other Bonds**

CONTRACTOR shall furnish performance and payment Bonds, on the form included in the Contract Documents, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one (1) year after the date when final payment becomes due, except as otherwise provided by Laws and Regulations or as specified in the Bond. CONTRACTOR shall also furnish such other Bonds as are required by the Supplemental General Conditions.

All Bonds shall be in the forms prescribed by the Contract Documents and be executed by such Sureties as:

- (i) are licensed to conduct business in the state where the Project is located, and
- (ii) are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch.

All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

If the Surety on any Bond furnished by CONTRACTOR is declared as bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of clauses (i) and (ii) of paragraph 5.01, CONTRACTOR shall within five (5) days thereafter substitute another Bond and Surety, both of which shall be acceptable to OWNER.

### **5.02 Licensed Insurers and Sureties**

All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required.

### **5.03 Insurance**

CONTRACTOR shall purchase and maintain during the term of the project such insurance as will protect him, OWNER(s) and ENGINEER(s) from claims arising out of the Work described in this Contract and performed by CONTRACTOR, Subcontractor(s) or Sub-subcontractor(s) consisting of:

- A. Workers' Compensation Insurance including Employer's Liability to cover employee injuries or disease compensable under the Workers' Compensation Statutes of the states in which Work is conducted under this Contract; disability benefit laws, if any; or Federal compensation acts such as U.S. Longshoremen or Harbor Workers', Maritime Employment, or Railroad Compensation Act(s), if applicable. Self-insurance plans approved by the regulatory authorities in the state in which Work on this Project is performed are acceptable.
- B. An occurrence form Commercial General Liability policy to cover bodily injury to persons other than employees and for damage to tangible property, including loss of use thereof, plus appropriate endorsements to protect OWNER, and ENGINEER against claims, demands, and lawsuits from employees of the CONTRACTOR and Subcontractors, including the following exposures:
  - (a) All premises and operations.
  - (b) Explosion, collapse and underground damage.
  - (c) CONTRACTOR's Protective coverage for independent contractors or Subcontractors employed by him.
  - (d) Broad form blanket, contractual liability for the obligation assumed in the Indemnification or Hold Harmless agreement found in the General Conditions or Supplementary General Conditions of this Contract.
  - (e) The usual Personal Injury Liability endorsement with no exclusions pertaining to employment.

- (f) Products and Completed Operations coverage. This coverage shall extend through the Contract guarantee period.
  - (g) Broad form property damage.
  - (h) Cross liability endorsement.
- C. A Comprehensive Automobile Liability policy to cover bodily injury and property damage arising out of the ownership, maintenance or use of any motor vehicle, including owned, non-owned and hired vehicles. Comprehensive General Liability and the Comprehensive Auto Liability shall be written by the same insurance carrier, though not necessarily in one policy.
- D. CONTRACTOR shall purchase for OWNER an OWNER's Protective Liability policy to protect OWNER, ENGINEER, their consultants, agents, employees and such public corporations in whose jurisdiction the Work is located for their liability for Work performed by CONTRACTOR, the Subcontractor(s) or the Sub-subcontractor(s) under this Contract.
- E. When a limit of liability is identified in the Supplemental General Conditions, CONTRACTOR shall purchase a Builder's Risk-Installation Floater in a form acceptable to OWNER covering property of the Project for the full cost of replacement as of the time of any loss which shall include, as named insureds,
- (a) CONTRACTOR,
  - (b) all Subcontractors,
  - (c) all Sub-subcontractors,
  - (d) OWNER and ENGINEER(s) or Architect(s), as their respective interests may prove to be at the time of loss,

covering insurable property which is the subject of this Contract, whether in place, stored at the job site, stored elsewhere, or in transit at the risk of the insured(s).

Coverage shall be effected on an "All Risk" form including, but not limited to, the perils of fire, wind, vandalism, collapse, theft, flood and earthquake, with removal of passive design error exclusion. Except as may otherwise be required by OWNER, CONTRACTOR may arrange for such deductibles as he deems to be within his ability to self-assume, but he will be held solely responsible for the amount of such deductible and for any co-insurance penalties. Any insured loss shall be adjusted with OWNER and CONTRACTOR and paid to OWNER and CONTRACTOR as Trustee for the other insureds.

F. Umbrella or Excess Liability:

1. CONTRACTOR is granted the option of arranging coverage under a single policy for the full limit required or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability policy equal to the total limit(s) requested. Umbrella or Excess policy wording shall be at least as broad as the primary or underlying policy(ies) and shall apply both to CONTRACTOR's General Liability and to his Automobile Liability Insurance and shall be written on an occurrence basis.

G. Railroad Protective Liability:

1. Where any of the Work is within a railroad right-of-way or where a limit of liability is identified in the Supplemental General Conditions, CONTRACTOR will provide coverage in the name of each railroad company having jurisdiction over rights-of-way across which Work under the Contract is to be performed. The form of policy and the limits of liability shall be determined by the railroad company(ies) involved. See the Supplemental General Conditions for limits and coverage requested.

**5.04 Limits of Liability**

The required limits of liability for insurance coverages required in paragraphs 5.03 shall be not less than those specified in the Supplemental General Conditions.

**5.05 Notice of Cancellation or Intent Not to Renew**

Policies will be endorsed to provide that at least 30 days written notice shall be given to OWNER and to ENGINEER of cancellation, intent not to renew, or material modification of the coverage.

**5.06 Evidence of Coverage**

Prior to commencement of the Work, CONTRACTOR shall furnish to OWNER and ENGINEER, Certificates of Insurance in force on the OWNER's Form of Certificate provided in the Contract Documents. Other forms of Certificate are acceptable only if:

- (i) they include all of the items prescribed in OWNER's Form of Certificate, including agreement to cancellation provisions outlined in paragraph 5.05 above and
- (ii) they have approval of OWNER and ENGINEER.

Prior to the commencement of the Work, CONTRACTOR shall furnish to OWNER complete "originally signed" copies of OWNER's Protective Liability Policy. The number of copies shall be the same as the number of counterparts of the Agreement. OWNER reserves the right to request complete copies of other policies if deemed necessary to ascertain details of coverage not provided by the certificates. Such policy copies shall be "Originally Signed Copies," and so designated.

**5.07 Qualification of Insurers**

- A. In order to determine financial strength and reputation of insurance carriers, all companies providing the coverages required shall be licensed or approved by the Insurance Bureau of the state in which the Project is located and shall have a financial rating not lower than XI and a policyholder's service rating no lower than B+ as listed in A.M. Best's Key Rating Guide, current edition. Companies with ratings lower than B+:XI will be acceptable only upon written consent of OWNER.

**5.08 Damage Claims - Acknowledgment and Reports**

CONTRACTOR shall furnish to OWNER an acknowledgment receipt from the insurance carrier for each damage claim against the Project. The receipt shall include the insurance carrier's assigned claim number.

Upon request, CONTRACTOR or his insurance carrier shall also furnish to OWNER a status report on all damage claims. This report shall include inspections made, the disposition of claims, and what action has been taken towards settlement of each claim.

Failure of CONTRACTOR to comply with this paragraph may result in the amount of such damage claims being withheld from CONTRACTOR's monthly pay estimate. Such withholding shall be reimbursed in the monthly pay estimate following compliance with this paragraph.

#### **5.09 Cost of Insurance**

The unit cost of the insurance herein specified will not be a specific bid item, but the cost of such insurance will be included by CONTRACTOR in the various unit prices or lump sum price bid.

#### **5.10 Waiver of Rights**

OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.03 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and all other persons or entities identified in the Supplemental General Conditions to be listed as insureds or additional insureds in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder.

OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work; and in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants and any other persons or entities identified in the Supplemental General Conditions to be listed as insureds or additional insureds under such policies for loss and damages so caused.

None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

#### **5.11 Receipt and Application of Insurance Proceeds**

Any insured loss under the policies of insurance required by paragraph 5.03.E will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause. If no other special agreement is reached the damaged Work shall be repaired or replaced, the monies so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

OWNER as fiduciary shall have power to adjust and settle any loss under the policies required by paragraph 5.03.E with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers.

### **Article 6 CONTRACTOR's Responsibilities**

#### **6.01 Supervision and Superintendence**

CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract

Documents.

CONTRACTOR shall keep on the Work at all times during its progress a competent superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. Any superintendent or foreman who neglects to have Work done in accordance with the Plans and Specifications shall be removed from the Project. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

#### **6.02 Labor and Working Hours**

CONTRACTOR shall provide competent, suitably qualified personnel in their various duties. CONTRACTOR shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons, the Work, property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours (7:00 a.m. to 4:00 p.m.), and CONTRACTOR will not permit the performance of Work on Sunday or any legal holiday without OWNER's written consent given after prior written notice to ENGINEER.

#### **6.03 Services, Materials and Equipment**

Unless otherwise specified in Section 01 1100, Summary of Work, CONTRACTOR shall furnish and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Contract Documents shall expressly run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence, (including reports of required tests) as to the kind and quality of materials and equipment to be incorporated in the Work. CONTRACTOR shall not use material in the Work until the necessary sampling and testing has been performed. All materials which do not meet the requirements of the Specifications at the time they are to be used will be rejected, and unless otherwise permitted by ENGINEER, shall be plainly marked and removed immediately from the Work.

All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents.

#### **6.04 Substitutes and "Or-Equals"**

Whenever an item of materials or equipment is specified or described in the Contract Documents for installation in the Work by using the name of a proprietary item or the name of a particular manufacturer, fabricator, supplier or distributor, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words indicating that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or materials or equipment of other manufacturers, fabricators, suppliers or distributors may be accepted by ENGINEER under the following circumstances:

- A. "Or-Equal": If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in



ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

- B. Substitute Items: If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.04.A, it will be considered a proposed substitute item.

CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. The procedure for review by ENGINEER will include the following, as supplemented in the General Requirements, and as Engineer may decide is appropriate under the circumstances. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

If CONTRACTOR wishes to furnish or use a substitute item of material or equipment CONTRACTOR shall make written application to ENGINEER on the Substitution Request Form provided for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use and capable of performing the same function as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not acceptance of the proposed substitute for use in the Work will require a change in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute, and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

All variations of the proposed substitute from that specified shall be identified in the application and available maintenance, repair and replacement service shall be indicated. The application shall also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which shall be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute.

All data to be provided by CONTRACTOR in support of any proposed "or-equal" or substitute item will be at CONTRACTOR's expense. ENGINEER will be the sole judge of acceptability, and no "or-equal" or substitute shall be ordered, installed or utilized without ENGINEER's prior written acceptance. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any "or-equal" or substitute.

ENGINEER will record time required by ENGINEER and ENGINEER's consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the Contract Documents occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's consultants for evaluating any proposed substitute and in making any changes in the Contract Documents.

#### **6.05 Concerning Subcontractors**

CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organizations, including those who are to furnish the principal items of materials or equipment, whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. CONTRACTOR shall furnish ENGINEER a complete list of any Subcontractor,

Supplier or other person or organization furnishing principal items of material or equipment within four (4) days of request.

Failure to object to any Subcontractor, Supplier, other person or organization by OWNER or ENGINEER shall not constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

If OWNER or ENGINEER after due investigation has reasonable objection to any Subcontractor, Supplier, other person or organization proposed by CONTRACTOR after the Notice of Award, CONTRACTOR shall submit an acceptable substitute and the Contract Price shall be increased or decreased by the difference in cost occasioned by such substitution, and an appropriate Change Order shall be issued. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, other person or organization against whom CONTRACTOR has reasonable objection. CONTRACTOR shall not award Work to Subcontractor(s), in excess of 50% of the Contract Price, without prior written approval of the OWNER.

CONTRACTOR shall be fully responsible for all acts and omissions of his Subcontractors, Suppliers and of persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any Subcontractor, Supplier or other person or organization. OWNER or ENGINEER may furnish to any Subcontractor, Supplier or other person or organization, to the extent practicable, evidence of amounts paid to CONTRACTOR on account of specific Work done.

CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR. CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the ENGINEER through CONTRACTOR.

If the amount of the subcontract or the nature of the Work to be performed thereunder warrants, OWNER may require the Subcontractor to furnish, for the benefit of CONTRACTOR, Bonds in an amount proportioned to the amount of his subcontract, and for the same purpose and under the same specifications as those of the general contract. The Surety on the general contract shall not be eligible to furnish such Subcontract Bonds.

All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as and additional insured on the property insurance provided in paragraph 5.03.E, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants and all other additional insureds for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same. CONTRACTOR shall file a true copy of such agreement with the OWNER.

## 6.06 Patent Fees and Royalties

CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others.

If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in Contract Documents.

To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, costs, losses, damages and expenses arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

## 6.07 Permits and Licenses

CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges, permit, review, and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work.

## 6.08 Laws and Regulations

CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to furnishing and performance of the Work. Neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws, ordinances, rules, and Regulations.

If CONTRACTOR performs any Work that is contrary to such laws, ordinances, rules and regulations, CONTRACTOR shall bear all claims, costs, losses, damages and expenses caused by, arising out of or resulting therefrom. However, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Plans are in accordance with such laws, ordinances, rules, and regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.

**Compliance with Environmental Laws:** The successful bidders (CONTRACTOR) must comply with all applicable Federal and Pennsylvania laws, rules and regulations dealing with the prevention of environmental pollution and the preservation of natural resources. Each bidder must thoroughly acquaint himself/herself with and comply with all the terms and provisions of any such statutes and rules and regulations promulgated pursuant to such statutes. All costs of compliance with such statutes, rules and regulations shall be considered incidental to the work are to be performed by each contractor and no separate or additional payment shall be made for such compliance.

**Trade Practices Act:** Any aluminum or steel products to be furnished or used for the Project under any Contract must comply with the Pennsylvania "Trade Practices Act" (71 P.S. §773.101, et. seq.).

**Pennsylvania Steel Products Procurement Act:** If any steel products are to be utilized or supplied in the performance of any contract only "Steel Products", as that term is defined in the

"Pennsylvania Steel Products Procurement Act", 73 P.S. §1881, et. seq., shall be used or supplied in the performance of the contract or any subcontracts thereunder. Contractors, vendors and suppliers shall make themselves familiar with the provisions of this Act as it relates to this Project. Certifications from each Contractor of compliance with the Act must be submitted with each Application for Payment or at time of processing the product or equipment submittals (shop drawings).

**Pennsylvania Prevailing Minimum Wage Rates:** The current Pennsylvania Prevailing Minimum Wage Rates will apply to all contracts. The wage rates have been included in Specification Section 00 7346- Wage Determination Schedule. Contractors will be required to submit monthly reports to the Engineer for review. Failure to submit the reports in a timely manner will result in delay or denial of approval and payment of the Contractor's monthly payment request. Contractors are required to submit any and all documentation required by the provisions of the contract documents and required by the provisions of the Pennsylvania Prevailing Wage Act and the rules and regulations promulgated by the Pennsylvania Department of Labor and Industry relative to that Act and its provisions.

#### **6.09 Taxes**

CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

#### **6.10 Use of Premises**

CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Project site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area or to the owner or occupant thereof or of any adjacent land or areas resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with any such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. CONTRACTOR's continuing obligations under paragraph 6.24 shall be applicable to any claim hereunder.

#### **6.11 Removal of Debris and Cleaning**

During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by OWNER at Substantial Completion of the Work. CONTRACTOR shall restore to their original condition all property not designated for alteration by the Contract Documents. If the CONTRACTOR shall fail to keep the above noted areas cleaned of dust or debris resulting from his operations, he shall be so notified in writing by the ENGINEER. If within 24 hours after receipt of such notice the CONTRACTOR shall fail to clean such areas satisfactorily, the OWNER may have such other agency as he shall designate, perform the work and all costs of such cleaning shall be paid for by the CONTRACTOR.

## **6.12 Loading Structures**

CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

## **6.13 Protection of Utilities**

When it is possible for construction operations to endanger any public or private utility, conduit, or structure, the CONTRACTOR shall notify the utility owner of this possibility, and safeguard and support such utilities, conduits, or structures. Where it is the policy of any utility owner to make its own repairs to damaged conduit or other structures, the CONTRACTOR shall cooperate to the fullest extent with the utility, and he shall see that his operations interfere as little as possible with these operations, and the CONTRACTOR shall assume the cost of any charge against the OWNER therefor. In cases where existing sewers, drains, gas, electric, telephone, cable TV and water service connections are encountered, the CONTRACTOR shall perform his operations in such a manner that service will be uninterrupted, and the cost thereof shall be at the CONTRACTOR's expense, unless otherwise provided.

## **6.14 Record Documents**

CONTRACTOR shall maintain in a safe place at the Site one (1) record copy of all Specifications, Plans, Addenda, Written Amendments, Change Orders, Work Orders, Construction Change Requisitions, and Field Orders, in good order and annotated to show all changes made during construction. These record documents together with all Samples and all Shop Drawings shall be available to ENGINEER for examination and shall be delivered to ENGINEER for OWNER upon completion of the Work.

## **6.15 Safety and Protection**

CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

- (1) all persons on the Work site or who may be affected by the Work.
- (2) all the Work and materials or equipment to be incorporated therein, whether in storage on or off the site, and
- (3) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them.

CONTRACTOR shall restore, at his own expense, any public or private property damaged or injured in consequence of any act or omission on his part, or on the part of his employees or agents, to a condition equal or better than that existing before such injury or damage was done. If CONTRACTOR neglects to restore or make good such damages or injury OWNER may upon 48 hours' notice, proceed to restore or make good such damage or injury and to order the cost

thereof deducted from any monies that are due or may become due CONTRACTOR for this Work. CONTRACTOR's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.11 that the Work is Acceptable.

#### **6.16 Safety Representative**

CONTRACTOR shall be responsible to designate for itself and its employees, and its subcontractors a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### **6.17 Hazard Communication Program**

CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with applicable Laws or Regulations.

#### **6.18 Emergencies**

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from OWNER or ENGINEER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If ENGINEER determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Order or Change Order will be issued to document the consequences of such action.

#### **6.19 Shop Drawings and Samples**

CONTRACTOR shall submit Shop Drawings required by the Contract Documents to ENGINEER for review, in accordance with an accepted schedule. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show ENGINEER the materials and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.21.

CONTRACTOR shall also submit all samples required by the Contract Documents to ENGINEER for review in accordance with an accepted schedule. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, the use for which intended, and other data as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.21. The number of each sample to be submitted will be as specified in the Specifications.

#### **6.20 Submittal Procedures**

Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

- (i) all field measurements, quantities, dimension, specified performance criteria, installation requirements, manufacturer's recommendations, material, catalog numbers and similar information with respect thereto,

- (ii) all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and
- (iii) all information relative to CONTRACTOR's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

CONTRACTOR shall have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

Each submittal will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to review and approval of that submittal.

At the time of each submission, CONTRACTOR shall in writing call ENGINEER's attention to any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawing's or Sample Submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to ENGINEER for review and approval of each such variation.

#### **6.21 ENGINEER's Review**

ENGINEER will review Shop Drawings and Samples in accordance with the schedule of Shop Drawing and Sample submittals accepted by ENGINEER as required by paragraph 2.05. ENGINEER's review shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto. The review of a separate item as such will not indicate review of the assembly in which the item functions.

CONTRACTOR shall make any corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and resubmit new samples for review. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

CONTRACTOR's stamp of approval on any Shop Drawing or sample shall constitute a representation to OWNER and ENGINEER that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, manufacturer's recommendations, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that CONTRACTOR has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents.

ENGINEER's review of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any variations from the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to such variation at the time of submission and ENGINEER has given written concurrence to the specific variation, nor shall any concurrence by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings. ENGINEER's review shall not relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.20.

Where a Shop Drawing or sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions accepted by ENGINEER per paragraph 2.05, no related Work shall be commenced until the submittal has been reviewed by the ENGINEER.

## **6.22 Continuing the Work**

CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as CONTRACTOR and OWNER may otherwise agree in writing.

## **6.23 CONTRACTOR's General Warranty and Guarantee**

CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee excludes defects or damage caused by:

- (i) abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or their employees, agents, or representatives, or any person or entity for whom CONTRACTOR is responsible; or
- (ii) normal wear and tear under normal usage.

CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

- (i) observations by ENGINEER;
- (ii) recommendation of any progress or final payment by ENGINEER;
- (iii) the issuance of a certificate of Substantial Completion or any payment by OWNER to CONTRACTOR under the Contract Documents;
- (iv) use or occupancy of any part of the Work by OWNER;
- (v) any acceptance by OWNER or failure to do so;
- (vi) any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER per paragraph 14.11;
- (vii) any inspection, test or approval by others; or
- (viii) any correction of defective Work by OWNER.

## **6.24 Indemnification**

CONTRACTOR shall indemnify, defend, and save harmless the OWNER, and the ENGINEER, their consultants, agents, officers, directors and employees (the "Indemnified Parties"), from and against all claims, costs, losses, damages and expenses by reason of any liability asserted or imposed upon any one or more of the Indemnified Parties for damages because of bodily injury, including death at any time resulting therefrom, sustained by any person or persons, or on account of damage to property, including loss of use thereof, arising out of or in consequence of the performance of this Work, whether such injuries to persons or damage to property are due, or claimed to be due, to the negligence of CONTRACTOR, his Subcontractors, or any one or more of the Indemnified Parties, except this indemnification shall not extend to any Indemnified Party if such injury or damage shall be occasioned by the sole negligence of such Indemnified Party.

In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors or employees by any employee (or the survivor or personal



representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.24 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier or other person or organization under worker's compensation acts, disability benefit acts, or other employee benefit acts.

All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

## **Article 7 Work by Others**

### **7.01 Related Work at Site**

OWNER may perform additional Work related to the Project by himself, or have additional Work performed by a utility owner, or let other direct contracts therefor which shall contain General Conditions similar to these.

If any part of CONTRACTOR's Work depends for proper execution or results upon the work of any such other contractor or utility owner, CONTRACTOR shall inspect and promptly report to ENGINEER in writing any latent or apparent defects or deficiencies in such work that render it unsuitable for such proper execution and results. CONTRACTOR's failure to so report shall constitute an acceptance of the other work as fit and proper for integration with CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in the other work.

CONTRACTOR shall afford each contractor who is party to such a direct contract, and each utility owner, (and OWNER, if OWNER is performing the additional work with OWNER's employees), proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of his Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected.

If the performance of additional work by other contractors or utility owner or OWNER was not noted in the Contract Documents, written notice thereof shall be given to CONTRACTOR prior to starting any such additional work. If CONTRACTOR believes that the performance of such additional work by OWNER or others involves additional expense to CONTRACTOR or requires an extension of the Contract Time, CONTRACTOR may make a claim therefor as provided in paragraph 10.05. Claims for delay or inconveniences due to operations of such other parties for work noted in the Contract Documents will not be allowed.

## **Article 8 OWNER's Responsibilities**

### **8.01 Communication to CONTRACTOR**

Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

## **8.02 Replacement of ENGINEER**

In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

## **8.03 Furnishing Data**

OWNER shall furnish the data required of OWNER under the Contract Documents promptly.

## **8.04 Pay When Due**

OWNER shall make payments to CONTRACTOR promptly after they are due as provided in paragraphs 14.04 and 14.11.

## **8.05 Lands and Easements; Reports and Tests**

OWNER's duties in respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.04. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of investigations and tests of subsurface and latent physical conditions at the site.

## **8.06 Insurance**

OWNER's responsibilities in respect of purchasing and maintaining insurance are set forth below:

- (1) The OWNER shall assume responsibility for such boiler and machinery insurance as may be required or considered to be necessary by the OWNER in the course of construction, testing or after completion.
- (2) The OWNER shall assume responsibility for such insurance as will protect the OWNER against any loss of use of the OWNER's property due to those perils insured pursuant to paragraph 8.06(1).

## **8.07 Change Orders**

In connection with OWNER's rights to request changes in the Work in accordance with Article 10, OWNER (especially in certain instances as provided in paragraph 10.03) is obligated to execute Change Orders.

## **8.08 Inspections, Tests, and Approvals**

OWNER'S responsibility in respect to certain inspections, tests and approvals is set forth in paragraph 13.03.

## **8.09 Limitation on OWNER's Responsibility**

OWNER shall not supervise, direct or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

## 8.10 Undisclosed Hazardous Materials

OWNER's responsibility in respect of undisclosed Asbestos, PCB's, Petroleum, Hazardous Waste or Radioactive Materials uncovered or revealed at the site is set forth in paragraph 4.05.

## Article 9 ENGINEER's Status During Construction

### 9.01 OWNER's Representative

ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER'S representative during construction shall be as set forth in the Contract Documents.

### 9.02 Visits to Site

ENGINEER may make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine solely for the benefit of the OWNER, in general, if the Work is proceeding in accordance with the Contract Documents. It will not be the responsibility of the ENGINEER to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

### 9.03 Resident Project Representative

If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more continuous observation of the Work. A Resident Project Representative will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding his actions. Resident Project Representative's dealings in matters pertaining to the on-site Work shall in general be only with ENGINEER and CONTRACTOR, and dealings with Subcontractors shall only be through or with the full knowledge of CONTRACTOR. The Resident Project Representative's duties and responsibilities include:

(1) Schedules

Review the progress schedule, schedule of Shop Drawing submissions and schedule of values prepared by CONTRACTOR.

(2) Conferences

Arrange a schedule of progress meetings and other job conferences as required in consultation with ENGINEER and notify those expected to attend in advance.

(3) Liaison

Serve as ENGINEER's liaison with CONTRACTOR, working principally through CONTRACTOR's superintendent and assist him in understanding the intent of the technical aspects of the Contract Documents. Assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when CONTRACTOR's operations affect OWNER's on-site operations.

(4) Shop Drawings and Samples

Advise ENGINEER and CONTRACTOR or its superintendent immediately of the commencement of any Work requiring a Shop Drawing or Sample submission if the submission was identified on the schedule and has not been reviewed by ENGINEER.

(5) Review of Work, Rejection of Defective Work, Inspections, and Tests:

- a. Conduct on-site observations of the Work and report to ENGINEER whenever he believes that technical aspects of any executed Work is unsatisfactory, faulty or defective or does not meet the requirements of any inspections, tests or approval required to be made or has been damaged prior to final payment; and advise ENGINEER when he believes that any partially completed portion of the Work should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
- b. Observe, record and report to ENGINEER appropriate details relative to test procedures and startups.
- c. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the outcome of these inspections and report to ENGINEER.

(6) Modifications

Consider CONTRACTOR's suggestions for modifications in Plans or Specifications and report them with recommendations to ENGINEER.

(7) Reports

Prepare periodic reports as required of progress of the Work and CONTRACTOR's compliance with the approved progress schedule and schedule of Shop Drawing submissions.

(8) Completion

Verify that all items on final list of items requiring completion or correction have been completed or corrected and make recommendations to ENGINEER concerning acceptance.

(9) Exceptions

Resident Project Representative:

- a. Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment.
- b. Shall not approve or accept any portion of the completed Work.
- c. Shall not undertake any of the responsibilities of CONTRACTOR, Subcontractors or CONTRACTOR's superintendent, or expedite the Work.
- d. Shall not advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents.
- e. Shall not advise on or issue directions as to safety precautions and programs in connection with the Work.
- f. Shall not advise on or issue directions regarding CONTRACTOR's failure to comply with Laws and Regulations applicable to the furnishing or performance of the Work.

#### **9.04 Clarifications and Interpretations**

ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

#### **9.05 Authorized Variations in Work - Field Order**

ENGINEER may authorize minor adjustments in the Work to avoid obstructions or interferences which do not involve an adjustment in the Contract Price or the Contract Time, and which are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order and shall be binding on OWNER, and also on CONTRACTOR who shall perform the change promptly. If OWNER or CONTRACTOR believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a claim may be made therefore as provided in Paragraph 10.05.

#### **9.06 Rejecting Defective Work**

ENGINEER will have authority to disapprove or reject completed portions of the Work which ENGINEER believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed or completed.

#### **9.07 Shop Drawings, Change Orders, and Payments**

ENGINEER's responsibility for Shop Drawings and samples are set forth in paragraphs 6.19 through 6.21 inclusive.

ENGINEER's responsibilities as to Change Orders are set forth in Articles 10, 11, and 12.

ENGINEER's responsibilities in respect of Applications for Payment are set forth in Article 14.

#### **9.08 Determinations for Unit Price Work**

ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER's written decision thereon will be final and binding (except as modified by ENGINEER to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, subject to the provisions of Paragraph 10.05.

#### **9.09 Decisions on Disagreements, Claims**

ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work performed thereunder. Claims, disputes and other matters relating to the acceptability of the Work, or the interpretation of the requirements of the Contract Documents pertaining to the execution and progress of the Work, shall be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph.

ENGINEER will, with reasonable promptness, render a written decision on the issue referred. If OWNER or CONTRACTOR believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. Date of

ENGINEER's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.

ENGINEER's written decision on the issue referred will be final and binding on OWNER and CONTRACTOR, subject to the provisions of Paragraph 10.05.

In this capacity ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. Provisions of paragraph 9.10 will govern ENGINEER's liability to CONTRACTOR under this paragraph.

#### **9.10 Limitations on Engineer's Responsibilities**

Neither ENGINEER's authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any manufacturer, fabricator, Supplier, distributor or any other person or to any surety for or employee or agent of any of them.

ENGINEER will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents. These limitations on authority and responsibility shall also apply to ENGINEER's Consultant's, Resident Project Representative and assistants.

ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractors, Suppliers, or of the agents or employees of any CONTRACTOR, Subcontractor, Supplier or of any other persons at the site or otherwise performing any of the Work.

ENGINEER will not be responsible to CONTRACTOR, Subcontractors, or Suppliers, or to their agents or employees for injuries, damages, claims, losses, or expenses (including attorney's fees) of whatsoever kind resulting from or caused by any act or omission of ENGINEER in preparation for, arising from, relating to or concerning the Project. Such acts or omissions include, but are not limited to, ENGINEER's negligence, tortuous conduct, errors, omissions, strict liability breach of contract, or breach of warranty. ENGINEER makes no representations to CONTRACTOR, Subcontractors, Suppliers, or their agents or employees regarding or respecting any work performed by ENGINEER in preparation for, arising from, relating to or concerning the Project. Neither CONTRACTOR, its agents or employees, nor any Subcontractors or Suppliers or their agents or employees, are intended beneficiaries of ENGINEER's agreement with OWNER, nor are such parties intended beneficiaries of ENGINEER's duties or responsibilities arising therefrom.

ENGINEER disclaims all duties to CONTRACTOR, Subcontractors, Suppliers or their agents or employees arising from, relating to or concerning ENGINEER's involvement in the Project. OWNER and CONTRACTOR further agree to notify CONTRACTOR's, Subcontractors or Suppliers of this disclaimer of ENGINEER's liability and require them to abide by this disclaimer.

### **Article 10 Changes in the Work; Claims**

#### **10.01 Authorized Changes in the Work**

Without invalidating the Agreement and without notice to any surety, OWNER may at any time or from time to time, order additions, deletions or revisions in the Work. These additions,

deletions or revisions will be authorized by a Written Amendment, Change Order, or a Work Order. Upon receipt of any such document, CONTRACTOR shall proceed with the Work involved. All such Work shall be executed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

If OWNER and CONTRACTOR are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Time that should be allowed as a result of a Work Order, a claim may be made as provided in paragraph 10.05.

#### **10.02 Unauthorized Changes in the Work**

Additional Work performed without authorization will not entitle CONTRACTOR to an increase in the Contract Price or an extension of the Contract Time, except in the case of an emergency as provided in paragraph 6.18 and except for uncovering Work as provided in paragraph 13.04.

#### **10.03 Execution of Change Orders**

Changes in the Work which are required by OWNER, or emergencies, or because of uncovering Work found not to be defective, or as provided in paragraphs 10.01, 11.02, 11.03, 13.08, or 13.09, or because of any other claim for a change in the Contract Time or the Contract Price which are agreed to by the parties shall be accomplished by means of a Change Order recommended by the ENGINEER and duly executed by the OWNER and CONTRACTOR.

#### **10.04 Notification to Surety**

If notice of any change affecting the general scope of the Work or change in the Contract Price is required by the provisions of any Bond to be given to the Surety, it shall be CONTRACTOR's responsibility to so notify the Surety, and the amount of each applicable Bond shall be adjusted accordingly. CONTRACTOR shall furnish proof of such adjustment to OWNER.

#### **10.05 Claims**

The rendering of a decision by ENGINEER with respect to any claim, dispute or other matter, except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.13, will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or at law in respect of any such claim, dispute or other matter. Any claim, dispute, or other matter by CONTRACTOR shall additionally be subject to the provisions set forth in paragraph 9.10.

Written notice of each such claim, dispute and other matter shall be delivered by the claimant to ENGINEER and the other party to the Agreement within 15 days of the occurrence of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with written supporting data will be submitted to ENGINEER and the other party within 45 days of such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data. A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

ENGINEER will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part,
2. approve the Claim, or
3. notify the parties that the ENGINEER is unable to resolve the Claim if, in the ENGINEER's sole discretion, it would be inappropriate for the ENGINEER to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

In the event that ENGINEER does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

ENGINEER's action under Paragraph 10.05 will be final and binding upon OWNER and CONTRACTOR.

No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this paragraph 10.05.

## **Article 11 Cost of the Work; Allowances; Unit Price Work**

### **11.01 Cost of the Work**

The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.01.B:

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith.
3. Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER who will then determine, with the advice of ENGINEER, which bids if any, will be accepted.
4. Costs of special consultants including, but not limited to, engineers, architects, testing laboratories, surveyors, lawyers and accountants employed for services specifically related to the Work.
5. Supplemental costs including the following:



- (a) The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.
- (b) Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site, and hand tools not owned by the workmen, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

The rental rate established for each piece of CONTRACTOR owned equipment, including appurtenances and attachments to equipment, used will be determined by use of the Rental Rate Blue Book for Construction Equipment, Volume 1, 2, or 3, as applicable; the edition which is current at the time the Work was started will apply. The established rental rate will be equal to the "Monthly" rate divided by 176; modified by the rate adjustment factor and the applicable map adjustment factor, plus the "Estimated Operating Costs per Hour."

For equipment not listed in the Rental Rate Blue Book, Volume 1, 2, or 3, the rental rate will be determined by using the rate listed for a similar piece of equipment or by proportioning a rate listed so that the capacity, size, horsepower, and age are properly considered.

For equipment for which there are no comparables in the Rental Rate Blue Book, Volume 1, 2, or 3, the monthly rate shall be reasonable, but not more than 5 percent of the current list price, or invoice, of the equipment. The base hourly rate shall then be determined by dividing the monthly rate by 176 to which sum 20 percent will be added. The 20 percent includes adjustments and operating costs.

- (c) Sales, consumer use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by any governmental authority.
- (d) Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- (e) Losses and damages (and related expenses) to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by OWNER in accordance with paragraph 5.03), provided such losses and damages have resulted from causes other than the negligence, other tortuous conduct or breach of contract of CONTRACTOR, any Subcontractor, Supplier or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's Fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 12.01.A.2.

- (f) The cost of utilities, fuel, and sanitary facilities at the site.
- (g) Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage, and similar petty cash items in connection with the Work.
- (h) Cost of premiums for additional bonds and insurance required because of changes in the Work and premiums for property insurance coverage within the limits of the deductible amounts established by OWNER in accordance with paragraph 5.03.

B. The term Cost of the Work shall not include any of the following:

1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals, general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR, whether at the site or in his principal or a branch office for general administration of the Work.
2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.
3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.
4. Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same except for additional Bonds and insurance required because of changes in the Work.
5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including, but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.
6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.01.A.

C. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, CONTRACTOR's fee shall be determined as set forth in paragraph 12.01.A.

D. Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

## **11.02 Cash Allowances**

It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done by such Subcontractors or Suppliers and for such sums within the limit of the allowances as may be acceptable to ENGINEER. CONTRACTOR agrees that:

1. The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and,
2. CONTRACTOR's costs for unloading and handling on the site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances. No demand for additional payment on account of any of the foregoing will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances and the Contract Price shall be correspondingly adjusted.

## **11.03 Unit Price Work**

Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Bid Form.

The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

Where the quantity of a major item of Work that is covered by a unit price differs by more than 25% from the quantity of such Work indicated in the Contract Documents, an adjustment in unit price shall be considered and if appropriate, a Change Order will be issued. A major item of Work is defined as any item whose total cost, determined by multiplying the original bid quantity and the Contract Unit Price, is equal to or greater than 5 percent of the original total Contract Price.

## **Article 12 Change of Contract Price; Change of the Contract Times**

### **12.01 Change of Contract Price**

The Contract Price may only be changed by a Change Order. Any claim for an adjustment in the Contract Price shall be based on written notice by the party making the claim, to the ENGINEER and the other party to the Agreement in accordance with the provisions of paragraph 10.05. Where a Change Order diminishes the quantity of Work to be done, this shall not constitute a basis for a claim for damages or anticipated profits on the Work that may be dispensed with.

The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

- (1) Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved subject to the provisions of paragraph 11.01.B.
- (2) By a supplemental schedule of prices contained in the CONTRACTOR's original bid and incorporated in the Contract.
- (3) By mutual acceptance of a lump sum or unit price proposal from the CONTRACTOR.
- (4) If none of the above methods is agreed upon, the value shall be determined on the basis of the Cost of the Work and a percentage for overhead and profit. Cost of the Work shall be determined as provided in paragraphs 11.01.A and 11.01.B. The CONTRACTOR's fee shall be determined as provided in paragraph 12.01.A.

#### **12.01.A CONTRACTOR's Fee**

The CONTRACTOR's Fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

- (1) A mutually acceptable fixed fee; or if none can be agreed upon,
- (2) a fee based on the following percentages of the various portions of the Cost of the Work:
  - (a) for costs incurred under paragraphs 11.01.A.2 and 11.01.A.1, the CONTRACTOR's Fee shall be 15%;
  - (b) for costs incurred under paragraph 11.01.A.3, the CONTRACTOR's Fee shall be five (5) percent; and if a Subcontract is on the basis of the Cost of the Work plus a fee, the maximum allowable to all Subcontractor(s) in total as a fee for overhead and profit shall be 15%; and,
  - (c) no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B.
  - (d) The amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease plus a deduction in CONTRACTOR's Fee by an amount equal to ten (10) percent of the net decrease; and,
  - (e) when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's Fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.A.2.a through 12.01.A.2.d, inclusive.

#### **12.02 Change of Contract Time**

The Contract Time may only be changed by a Change Order. Any claim for an adjustment in the Contract Time shall be based on written notice submitted by the claimant and delivered to the ENGINEER and the other party to the Agreement in accordance with the provisions of paragraph 10.05.

Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

### **12.03 Delays**

Where the CONTRACTOR is prevented from completing any part of the Work within the Contract Time due to delay beyond the control of CONTRACTOR, the Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefor as provided in paragraph 12.01. Such delays shall include, but not be limited to, acts or neglect by OWNER or others performing work as contemplated by Article 7, or to fires, floods, epidemics, abnormal weather conditions, or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

Where CONTRACTOR is prevented from completing any part of the Work within the Contract Time due to any delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Time in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

OWNER, ENGINEER and the related entities of each of them shall not be liable to CONTRACTOR for any claims, costs, losses, damages or expenses sustained by CONTRACTOR on or in connection with any other project or anticipated project.

CONTRACTOR shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of CONTRACTOR.

All time limits stated in the Contract Documents are of the essence of the Agreement.

## **Article 13 Tests and Inspection; Correction, Removal or Acceptance of Defective Work**

### **13.01 Notice of Defects**

A. Prompt notice of all defective work of which OWNER or ENGINEER have actual knowledge shall be given to CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article 13.

### **13.02 Access to Work**

OWNER, ENGINEER and ENGINEER's representatives, other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspection and testing. CONTRACTOR shall provide proper and safe conditions for such access and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.

### **13.03 Tests and Inspections**

CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

If any Law and Regulation, code, or order of any public body having jurisdiction requires any Work or part thereof to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefor, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval.

CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER's or ENGINEER's acceptance of a manufacturer, fabricator, Supplier or distributor of materials or equipment proposed to be

incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work.

The cost of all other inspections, tests and approvals required by the Contract Documents shall be paid by OWNER unless otherwise specified.

All inspections, tests or approvals other than those required by law, ordinance, rule, regulation, code or order of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR or by ENGINEER if so specified.

Cost of materials to be used in inspection and transportation costs shall be paid for by the CONTRACTOR.

Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve CONTRACTOR from his obligations to perform the Work in accordance with the Contract Documents.

#### **13.04 Uncovering Work**

If any Work that is to be tested, inspected or approved is covered without written concurrence of ENGINEER, or contrary to the written request of ENGINEER, it shall, if requested by ENGINEER, be uncovered for ENGINEER's observation. Such uncovering shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely written notice of his intention to cover such Work and ENGINEER has not acted with reasonable promptness in response to such notice.

If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. Except as otherwise specified in paragraph 13.04, the cost of Work shall be paid for as follows:

- (i) If it is found that such Work is defective, CONTRACTOR shall bear all the expenses of such uncovering, exposure, observation, inspection and testing, and of satisfactory reconstruction, (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals) and an appropriate deductive Change Order shall be issued. If the parties are unable to agree as to the amount or extent of any change in Contract Price or Contract Time, OWNER may make a claim as provided in paragraph 10.05
- (ii) If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and reconstruction. If the parties are unable to agree as to the amount or extent of any change in Contract Price or Contract Time, CONTRACTOR may make a claim as provided in paragraph 10.05.

#### **13.05 Owner May Stop the Work**

If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

### **13.06 Correction or Removal of Defective Work**

If required by ENGINEER, CONTRACTOR shall promptly either correct all defective Work, whether or not fabricated, installed or completed, or if the Work has been rejected by ENGINEER, remove it from the site and replace it with non-defective Work. CONTRACTOR shall pay all claims, costs, losses, damages and expenses caused by or resulting from such correction or removal (including, but not limited to all costs of repair or replacement of work of others).

### **13.07 Two Year Guarantee Period**

If within two (2) years after the date of Substantial Completion (or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions:

- (i) repair defective land or areas; or
- (ii) correct such defective Work, or,
- (iii) if the defective Work has been rejected by OWNER, remove it from the site and replace it with Work that is not defective, and
- (iv) satisfactorily correct or repair or remove and replace any damage to other Work or the work of others or other land or areas resulting therefrom.

If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses, damages and expenses caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement or work of others) shall be paid by CONTRACTOR.

Repair or replacements made under the guarantee shall bear an additional one (1) year guarantee dated from the acceptance of repair or replacement.

### **13.08 Acceptance of Defective Work**

If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER'S recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all claims, costs, losses, damages and expenses attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness). In such case, if acceptance occurs prior to ENGINEER'S recommendation of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate reduction in the Contract Price. If the acceptance occurs after such recommendation, an appropriate amount shall be paid by CONTRACTOR to OWNER.

### **13.09 Owner May Correct Defective Work**

If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.06, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents (including any requirements of the progress schedule), OWNER may, after

48 hours' written notice to CONTRACTOR and his Surety without prejudice to any other remedy he may have, correct and remedy any such deficiency.

In exercising his rights under this article OWNER shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees such access to the site as may be necessary to enable OWNER to exercise his rights under this paragraph.

All claims, costs, losses, damages and expenses incurred or sustained by OWNER in exercising such rights shall be charged against CONTRACTOR and a Change Order shall be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate reduction in the Contract Price. Such claims, costs, losses, damages and expenses will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's defective Work.

CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER's rights hereunder.

## **Article 14    Payments to CONTRACTOR and Completion**

### **14.01    Schedules**

At least ten (10) days prior to submitting the first Application for a progress payment, CONTRACTOR shall submit to ENGINEER a final schedule of Shop Drawing submission and where applicable a schedule of values of the Work. These schedules shall be satisfactory in form and substance to ENGINEER.

The schedule of values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the Work into component parts. Each unit cost so established shall include its proportionate share of the CONTRACTOR's general operating charges such as profit, overhead, supervision, insurance, bond premiums, interest, equipment cost, depreciation and rental, contingencies, expendable tools, equipment and supplies. The total cost of the items and quantities the CONTRACTOR lists in the schedule of values shall equal the total Contract Price established in the Bid.

The schedule of values shall include a complete set of detailed work sheets on bid take off and bid summary covering estimated general conditions expense (field overhead), general overhead, profit mark ups and revisions leading to the final bid amount.

When the schedule of values is approved by the ENGINEER, it shall become part of the Agreement and shall be used as the basis for CONTRACTOR progress payments, and to establish unit prices at which extra work may be authorized or deducted from the original Agreement.

Progress Payments based upon Unit Price Work will be based upon the number of units completed.



#### **14.02 Application for Progress Payment**

At least ten (10) days before each progress payment falls due (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment, Contractor's Declaration, Payment Schedule, and updated Progress Schedules indicating the anticipated completion dates of the various stages of the Work and estimated payments during the next three (3) months. The Contractor's Application for Payment and Contractor's Declaration shall be filled out on the forms provided in the Contract Documents and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents and also as ENGINEER may reasonably require. The Payment Schedule shall be on the form provided in the Contract Documents or in a format acceptable to the ENGINEER. On the second and all subsequent payments, partial waivers of lien and a sworn statement shall also be required for all Work completed and paid for on previous certificates.

If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such data, satisfactory to OWNER, as will establish OWNER's title to the material and equipment and protect OWNER's interest therein, including applicable insurance. A receipted vendor's invoice showing the quantities of materials and the amounts paid will be required.

Retainage with respect to progress payments will be in accordance with paragraph 14.03, and it will be retained until after completion of the entire Work and its final acceptance. When the amount to be retained is reduced to less than ten (10) percent, the CONTRACTOR shall file with the OWNER the written consent of the Surety to such reduction and shall furnish an affidavit that all his indebtedness by reason of the Contract has been paid.

#### **14.03 Retainage**

The OWNER shall retain a portion of the amount due the Contractor to insure the proper performance of the Contract except that the sum withheld by the OWNER from the Contractor shall not exceed 10% of the amount due the Contractor until 50% of the Contract is completed. When the contract is 50% completed, one-half of the amounts retained by the OWNER shall be returned to the Contractor. However, before any payment is made the ENGINEER must approve the application for payment in accord with the provisions of the Contract Documents. The sum withheld by the OWNER from the Contractor after the Contract is 50% completed shall not exceed 5% of the value of completed work based on monthly progress payment requests.

In the event a dispute arises between the Owner and any prime contractor, which dispute is based upon increased costs claimed by one prime contractor occasioned by delays or other actions of another prime contractor, additional retainage in the sum of one and one-half times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved unless the contractor causing the additional claim furnishes a bond satisfactory to the Owner to indemnify the Owner against the claim. All money retained by the Owner may be withheld from the contractor until substantial completion of the contract.

To be eligible for any Progress Payment the Contractor must be making satisfactory progress, and there must be no specific cause for greater withholding.

Upon Substantial Completion the Retainage shall be determine as provided in Article 5 of the Agreement..

#### 14.04 Review of Applications for Progress Payment

ENGINEER will, within ten (10) days after receipt of each Contractor's Application for Payment, Contractor's Declaration and Payment Schedule, either indicate in writing a recommendation of payment and present an Engineer's Certificate for Payment to the OWNER, or may return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's review of the Contractor's Application for Payment and Certificate for Payment and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

- (i) the Work has progressed to the point indicated;
- (ii) the quality of the Work is in accordance with the Contract Documents subject to an evaluation of the Work as a functioning Project upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in the recommendation; and
- (iii) that CONTRACTOR is entitled to payment of the amount recommended.

However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that:

- (i) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents, or
- (ii) that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

Neither ENGINEER's review of CONTRACTOR's Work for the purpose of recommending payments nor ENGINEER's recommendation of any payment, including final payment, will impose responsibility on ENGINEER:

- (i) to supervise, direct or control the Work, or
- (ii) for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
- (iii) for the failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of Work, or
- (iv) for any failure of CONTRACTOR to perform or furnish Work in accordance with the Contract Documents or
- (v) to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or
- (vi) to determine that title to any Work, materials, or equipment has passed to OWNER free and clear of liens.

- A. ENGINEER may refuse to recommend the whole or any part of any payment if, in his opinion, it would be incorrect to make such representations as stated above to OWNER. ENGINEER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:
- (1) the Work is defective, or completed Work has been damaged requiring correction or replacement;
  - (2) the Contract Price has been reduced because of Change Orders;
  - (3) OWNER has been required to correct defective Work or complete the Work in accordance with paragraph 13.09; or
  - (4) ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.

#### **14.05 Payment Becomes Due**

Thirty (30) days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount recommended will (subject to the provisions of paragraph 14.05.A) become due, (or only if OWNER is a public agency, within 15 days after OWNER receives the funds which are to be provided by a department or agency of the federal or state government, whichever is later) and when due will be paid by OWNER to CONTRACTOR.

- A. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:
- (a) claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;
  - (b) Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;
  - (c) there are other items entitling OWNER to a set-off against the amount recommended; or
  - (d) OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.04.A.1 through 14.04.A.3.

If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER will give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.05.

#### **14.06 Contractor's Warranty of Title**

CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to

OWNER at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter in these General Conditions referred to as "Liens").

#### **14.07 Substantial Completion**

When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall, in writing to OWNER and ENGINEER, certify that the entire Work is substantially complete and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion.

If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving his reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a list of items to be completed or corrected before final payment.

OWNER shall have 45 days after receipt of the certificate during which he may make written objection to ENGINEER and CONTRACTOR as to any provisions of the certificate or attached list. Such objection will be cause for the certificate of Substantial Completion to be null and void.

As a part of delivery of the certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance.

OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the list of items to be completed.

#### **14.08 Partial Utilization**

Use by OWNER of completed portions of the Work may be accomplished prior to Substantial Completion of all the Work subject to the following:

- (1) OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any part of the Work which OWNER believes to be substantially complete and which may be so used without significant interference with construction of the other parts of the Work. If CONTRACTOR agrees, CONTRACTOR will certify to OWNER and ENGINEER that said part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion.
  - (a) If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving his reasons therefor.
  - (b) If ENGINEER considers that part of the Work to be substantially complete, ENGINEER will execute and deliver to OWNER and CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion for that part of the Work, attaching thereto a punch list of items to be completed or corrected before final payment.

Prior to issuing a certificate of Substantial Completion for that part of the Work, ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to the division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, utilities and

insurance for that part of the Work, which shall become binding upon OWNER and CONTRACTOR at the time of issuing the definitive certificate of Substantial Completion for that part of the Work unless OWNER and CONTRACTOR shall have otherwise agreed in writing and so informed ENGINEER.

OWNER shall have the right to exclude CONTRACTOR from any part of the Work which ENGINEER has so certified to be substantially complete, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the punch list.

In lieu of the issuance of a certificate of Substantial Completion as to part of the Work, OWNER may take over operation of a facility constituting part of the Work whether or not it is Substantially Complete if such facility is functionally and separately usable; provided that prior to any such takeover, OWNER and CONTRACTOR have agreed as to the division of responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, correction period, heat, utilities and insurance with respect to such facility.

#### **14.09 Final Inspection**

Upon written notice from CONTRACTOR that the Work is complete, ENGINEER will make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

#### **14.10 Final Application for Payment**

After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked up record documents and other documents--all as required by the Contract Documents, and after ENGINEER has indicated that the Work is acceptable, subject to the provisions of paragraph 14.13, CONTRACTOR may make application for final payment following the procedure for progress payments.

The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents and such other data and schedules as ENGINEER may reasonably require, consent of surety, if any, to final payment, together with complete and legally effective releases or waivers, satisfactory to OWNER, of all Liens arising out of or filed in connection with the Work.

In lieu of the releases or waivers of Lien, and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or his property might in any way be responsible, have been paid or otherwise satisfied.

If any Subcontractor, manufacturer, fabricator, supplier or distributor fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

#### **14.11 Final Payment and Acceptance**

If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation--all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR has fulfilled all of his obligations under the Contract Documents, ENGINEER will, within ten (10) days after receipt of the final Application

for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application to OWNER for payment. At that time ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.13.

Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application.

If the Application and accompanying documentation are appropriate as to form and substance, OWNER shall, within 45 days after receipt thereof pay CONTRACTOR the amount recommended by ENGINEER. If the OWNER rejects the Application, he shall do so in writing stating the appropriate sections of the Contract Documents upon which the rejection is based. The CONTRACTOR may take the necessary remedial actions and resubmit the Application.

#### **14.12 Final Completion Delayed**

If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

#### **14.13 Waiver of Claims**

The making and acceptance of final payment shall constitute:

- (1) a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.09 or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein; however, it shall not constitute a waiver by OWNER of any rights in respect of CONTRACTOR's continuing obligations under the Contract Documents; and
- (2) a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

#### **14.14 Late Payments**

All monies not paid when due hereunder, except monies involving Federal and/or State Loans or Grants or other sources which are delinquent because of no fault of the OWNER, shall bear interest at the maximum rate allowed by law at the place of the Project.

### **Article 15 Suspension of Work and Termination**

#### **15.01 OWNER May Suspend Work**

OWNER may, at any time and without cause, suspend the Work or any portion thereof for a period as he may deem necessary by notice in writing to CONTRACTOR and ENGINEER. If it should become necessary to stop work for an indefinite period, the CONTRACTOR shall store all materials in such manner that they will not become an obstruction, nor become damaged in any

way, and he shall take every precaution to prevent damage or deterioration of the Work performed; provide suitable drainage by opening ditches and drains, and erect temporary structures where necessary. CONTRACTOR may request an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if he makes a claim therefor as provided in paragraph 10.05.

#### **15.02 OWNER May Terminate for Cause**

Upon the occurrence of any one or more of the following events:

- (1) if CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating;
- (2) If a petition is filed against CONTRACTOR under any chapter of the Bankruptcy Code as now or hereinafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency,
- (3) if CONTRACTOR makes a general assignment for the benefit of creditors;
- (4) if a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of CONTRACTOR is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of CONTRACTOR's creditors;
- (5) if CONTRACTOR admits in writing an inability to pay its debts generally as they become due;
- (6) if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.05 as revised from time to time);
- (7) if CONTRACTOR disregards Laws and Regulations of any public body having jurisdiction;
- (8) if CONTRACTOR disregards the authority of ENGINEER; or,
- (9) if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

OWNER may, after giving CONTRACTOR (and the surety, if there be one) seven (7) days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient.

In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, damages and expenses sustained by OWNER arising out of or resulting from completing the Work such excess will be paid to CONTRACTOR. If such claims, costs, losses, damages and expenses

exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, damages and expenses incurred by OWNER will be reviewed as to reasonableness by ENGINEER and when so approved, incorporated in a Change Order, but when exercising any rights or remedies under this paragraph, OWNER shall not be required to obtain the lowest price for the Work Performed.

Where CONTRACTOR's services have been so terminated by OWNER, the termination shall not affect any rights or remedies of OWNER against CONTRACTOR or its Surety then existing or which may thereafter accrue. Any retention or payment of monies due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

### **15.03 Termination for Convenience**

Upon seven (7) days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy, elect to terminate the Agreement. In such case, CONTRACTOR shall be paid (without duplication of any items):

- (2) for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
- (3) for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
- (4) for all claims, costs, losses, damages and expenses incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and
- (5) for reasonable expenses directly attributable to termination.

CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

### **15.04 CONTRACTOR May Stop Work or Terminate**

If ENGINEER has failed to act on an Application for Payment or OWNER has failed to pay CONTRACTOR any sum finally determined to be due in accordance with the time limits specified in paragraph 14.04, CONTRACTOR may upon seven (7) days notice to OWNER and ENGINEER, stop the Work until payment of all amounts then due.

If through no act or fault of CONTRACTOR, the Work is suspended for a period of more than 90 days by OWNER or under an order of court or other public authority, then CONTRACTOR may, upon seven (7) days written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Agreement and recover from OWNER payment on the same terms as provided in paragraph 15.03.

The provisions of this paragraph shall not relieve CONTRACTOR of his obligations under paragraph 6.22 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.



## **Article 16 Miscellaneous**

### **16.01 Giving Notice**

Whenever any provision of the Contract Documents requires the giving of written notice it shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at, or sent by registered or certified mail postage prepaid to, the last business address known to the giver of the notice.

### **16.02 Computation of Time**

When any period of time is referred to in the Contract Documents by days, it shall be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day shall be omitted from the computation.

### **16.03 Dispute Resolution**

In the event of any dispute between the Owner and the Contractor which is not amicably resolved and which results in litigation, the parties agree that the Court of Common Pleas of the county in which the project resides is the sole legal forum and shall have exclusive and sole jurisdiction and venue over such litigation.

### **16.04 General**

Should OWNER or CONTRACTOR suffer injury or damage to his person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 16.03 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and shall not be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Law or Regulation, by special warranty or guarantee or by other provisions of the Contract Documents. The provisions of this paragraph shall be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

All representations, warranties and guarantees made in the Contract Documents shall survive final payment and termination or completion of this Agreement.

### **16.05 Professional Fees and Court Costs Included**

Whenever reference is made to "claims, costs, losses, damages and expenses," it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs.

### **16.06 Nondiscrimination of Employment**

The CONTRACTOR shall covenant not to discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to his hire, tenure, terms, conditions or privileges of employment, or any matter directly, or indirectly related to employment, because of his race, color, sex, age, religion, national origin or ancestry, height,

weight, or marital status, or any other classification protected by law, and to require a similar covenant on the part of any Subcontractor employed in the performance of the Contract.

#### **16.07 Post Completion Date Engineering and Inspection Costs**

All engineering and inspection costs incurred after the specified completion date shall be paid by the CONTRACTOR to the OWNER prior to final payment authorization. However, the CONTRACTOR shall not be charged with any post completion date engineering and inspection costs when the delay in completion of the Work is due to the following and the CONTRACTOR has promptly given written notice of such delay to the OWNER or ENGINEER;

- (1) to any preference, priority or allocation order duly issued by the OWNER;
- (2) to unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another contractor in the performance of a Contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and,
- (3) to any delays of subcontractors occasioned by any of the causes specified in Items 1 and 2 of this Article.

Charges after the specified completion date shall be made at such times and in such amounts as the ENGINEER shall invoice the OWNER, provided, however said charges shall be in accordance with the ENGINEER's current rate schedule at the time the costs are incurred. The engineering and inspection costs so incurred shall be deducted from the CONTRACTOR's progress payments.

End of Section

## **Section 00 7300 Supplementary Conditions**

These Supplementary Conditions amend or supplement Section 00 7200, General Conditions, as indicated below. All provisions which are not amended or supplemented by this section remain in full force and effect. The terms used in these Supplementary Conditions have the meanings assigned to them in the General Conditions.

### **SGC-2.02      Copies of Documents**

Amend the first sentence of paragraph 2.02 by adding "Electronic copies of the Contract Documents, in pdf format, will be provided to the CONTRACTOR upon written request to the ENGINEER."

### **SGC-4.01      Availability of Lands**

Add a new paragraph 4.01 which is to read as follows:

Easement lines shown on the Contract Drawings are approximate and were provided to establish a basis for bidding. Upon receiving the final easement descriptions, CONTRACTOR shall compare them to the lines shown on the Contract Drawings. If CONTRACTOR considers the final easements provided to differ materially from the representations on the Contract Drawings, CONTRACTOR shall within five (5) calendar days and before proceeding with the Work, notify ENGINEER in writing of any extra costs or time of performance associated with the differing easement line locations and the claim shall be administered in accordance with the Conditions of the Contract.

### **SGC-4.02      Physical Conditions - Investigations and Reports**

The following are drawings and reports of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the site of the Work that are available for viewing at the Plant site:

1.        1967 Original Drawings – Monessen and Donner Pumping Stations
2.        Long Term Control Plan Phase I – Pump Station Improvements Drawings

### **SGC-5.03.D**

#### **Additional Insured**

Add the following language at the end of Article 5.03.D. of the General Conditions:

The name insured on the OWNER's and CONTRACTOR's Protective Policy shall be:

Mon Valley Sewage Authority

Additional named insured on the General Liability, Workers Compensation and Automotive Policies and the OWNER's and CONTRACTOR's Protective Policy shall include:

Wade Trim, Inc.  
Commonwealth of Pennsylvania

**SGC-5.04 Insurance Limits of Liability**

The required limits of liability for insurance coverages requested in Section 5.03 shall be not less than the following:

**SGC-5.04.A Worker's Compensation**

Coverage A – Compensation	Statutory
Coverage B – Employer's Liability	
Each Accident	\$ 100,000
Disease – Policy Limit	\$ 100,000
Disease – Each Employee	\$ 100,000

**SGC-5.04.B Comprehensive General Liability**

General Aggregate	\$2,000,000
Products – Com/Ops Aggregate	\$1,000,000
Personal and Advertising Injury	\$ 500,000
Each Occurrence	\$ 500,000
Fire Damage (any one fire)	\$ 100,000
Medical Expense (any one person)	\$ 10,000

**SGC-5.04.C Comprehensive Automobile Liability**

Bodily Injury (each person)	\$ 500,000
Property Damage or combined single limit	\$1,000,000

**SGC-5.04.D OWNER's Protective – Coverage shall be Occurrence Form**

General Aggregate	\$2,000,000
Each Occurrence	\$1,000,000

**SGC-5.04.E Builder's Risk-Installation Floater** Cost to Replace at Time of Loss

**SGC-5.04.F Umbrella or Excess Liability** \$2,000,000

**SGC-6.07 Permit and Licenses**

Add a new paragraph immediately after paragraph one which is to read as follows:

In those instances where a certificate of occupancy must be obtained before the Work under this Contract can be occupied and placed into service by OWNER, it shall be the responsibility of CONTRACTOR to arrange, coordinate, and pay any costs of obtaining said certificate.

**SGC-6.14 Record Documents**

At the end of 6.14 add the following language:

The CONTRACTOR shall submit to the OWNER's representative and the ENGINEER on a monthly basis, copies of redline drawings completed for that month. The CONTRACTOR's payment request for that month may not be considered if said redline drawings are not produced or considered adequate for the work completed in that month. CONTRACTOR to make one, final reproducible copy of said record drawings and deliver to ENGINEER for OWNER prior to issuance of the final contract payment.

**SGC-13.03 Tests and Inspections**

Add a new paragraph immediately after paragraph one, which is to read as follows:

CONTRACTOR shall submit the name of the independent testing laboratory CONTRACTOR intends to use for the Project to ENGINEER for approval. ENGINEER will not withhold approval except for cause.

**SGC-16.07 Liquidated Damages**

Add a new Section 16.07 titled "Liquidated Damages" which shall read as follows:

If CONTRACTOR shall fail to substantially complete the work within the contract time, or extension of time granted by OWNER, then CONTRACTOR will pay to the OWNER the amount of liquidated damages as specified in the Agreement for each calendar day that CONTRACTOR shall be in default after the time stipulated in the Contract Documents. The liquidated damages charged shall be deducted from CONTRACTOR's progress payments.

CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in substantial completion of the Work is due to the following and CONTRACTOR has given written notice of such delay within seven (7) calendar days of the event to OWNER and ENGINEER:

1. To any preference, priority or allocation order duly issued by OWNER;
2. To unforeseeable causes beyond the control and without the fault or negligence of CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of OWNER, acts of another CONTRACTOR in the performance of a Contract with OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and abnormal and unforeseeable weather; and
3. To any delays of Subcontractors occasioned by any of the causes specified in Items 1 and 2

End of Section

## Section 00 7346 Wage Determination Schedule

### Part 1 General

#### 1.01 General

- A. Rates of wages and fringe benefits to be paid to each class of construction employees by CONTRACTOR, subcontractors, and their subcontractors and all employees employed by the CONTRACTOR, shall not be less than the wage and fringe benefit rates per the Pennsylvania Department of Labor and Industry Services schedule of occupational classification and wage and fringe benefit for the locality in which the work is to be performed.
1. The term "Contractor" shall include all general contractors, prime Contractors, project manager, or trade Contractors, and all of their Contractors or subcontractors and persons in privity of contract with them.
- B. CONTRACTOR shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates as prescribed in the contract and the address and telephone number of the Pennsylvania Department of Labor and Industry's office responsible for enforcement and shall keep an accurate record showing the name and occupation of the actual wage and benefits paid to each construction mechanic employed in connection with said contract. This record shall be available for reasonable inspection by the Bureau of Labor Law Compliance and the Pennsylvania Department of Labor and Industry.
- C. In case there is an omission of any trade from the list of wage and fringe benefit rates to be paid to each class of mechanic by CONTRACTOR, it shall be understood that the trades omitted shall also be paid not less than the wage and fringe benefit rates prevailing in the locality in which the work is to be performed.
- D. A finding by the Bureau of Labor Law Compliance that CONTRACTOR or subcontractor is in violation of the requirements of the contract shall be final.
- E. CONTRACTOR may obtain Prevailing Wage Rates for the county in which the project is located by contacting the Pennsylvania Department of Labor and Industry at (717) 787-5279, or by visiting <https://www.dli.pa.gov/Individuals/Labor-Management-Relations/lc/prevailing-wage/Pages/Prevailing-Wage-App.aspx>.

### Part 2 Products (Not Used)

### Part 3 Execution (Not Used)

End of Section

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

Project Name:	Monessen Pump Station Mechanical Bar Screen
Awarding Agency:	Mon Valley Sewage Authority
Contract Award Date:	4/8/2024
Serial Number:	24-02371
Project Classification:	Building
Determination Date:	3/11/2024
Assigned Field Office:	Pittsburgh
Field Office Phone Number:	(412)565-5300
Toll Free Phone Number:	(877)504-8354
Project County:	Westmoreland County

Not To Be Used For Bidding Purposes

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02371 - Building</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Asbestos & Insulation Workers	8/1/2022		\$41.40	\$28.51	\$69.91
Asbestos & Insulation Workers	8/1/2023		\$42.40	\$29.01	\$71.41
Boilermakers	6/1/2016		\$40.90	\$27.61	\$68.51
Bricklayer	12/1/2022		\$36.55	\$24.71	\$61.26
Carpenters - Piledriver/Welder	1/1/2023		\$40.63	\$21.22	\$61.85
Carpenters - Piledriver/Welder	1/1/2024		\$42.13	\$21.97	\$64.10
Carpenters - Piledriver/Welder	1/1/2025		\$43.38	\$22.72	\$66.10
Carpenters - Piledriver/Welder	1/1/2026		\$44.63	\$23.47	\$68.10
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2023		\$39.69	\$19.93	\$59.62
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2024		\$41.49	\$19.93	\$61.42
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2025		\$43.34	\$19.93	\$63.27
Cement Mason/Concrete Finisher	6/1/2019		\$31.27	\$19.39	\$50.66
Cement Masons	6/1/2022		\$32.57	\$22.59	\$55.16
Cement Masons	6/1/2023		\$33.07	\$23.59	\$56.66
Drywall Finisher	6/1/2022		\$32.00	\$21.89	\$53.89
Drywall Finisher	6/1/2023		\$32.39	\$23.75	\$56.14
Drywall Finisher	6/1/2024		\$34.01	\$24.88	\$58.89
Electricians & Telecommunications Installation Technician	12/26/2022		\$48.31	\$29.29	\$77.60
Electricians & Telecommunications Installation Technician	12/22/2023		\$48.61	\$31.80	\$80.41
Electricians & Telecommunications Installation Technician	12/27/2024		\$51.76	\$31.80	\$83.56
Electricians & Telecommunications Installation Technician	12/26/2025		\$55.06	\$31.80	\$86.86
Elevator Constructor	1/1/2023		\$56.14	\$42.83	\$98.97
Elevator Constructor	1/1/2024		\$58.55	\$43.87	\$102.42
Glazier	9/1/2021		\$32.61	\$27.19	\$59.80
Glazier	9/1/2023		\$35.65	\$30.05	\$65.70
Iron Workers	6/1/2022		\$38.39	\$34.27	\$72.66
Iron Workers	6/1/2023		\$38.89	\$35.02	\$73.91
Laborers (Class 01 - See notes)	1/1/2023		\$25.82	\$19.46	\$45.28
Laborers (Class 01 - See notes)	1/1/2024		\$26.82	\$19.46	\$46.28
Laborers (Class 01 - See notes)	1/1/2025		\$27.32	\$19.96	\$47.28
Laborers (Class 01 - See notes)	1/1/2026		\$27.82	\$20.46	\$48.28
Laborers (Class 02 - See notes)	1/1/2023		\$25.97	\$19.46	\$45.43
Laborers (Class 02 - See notes)	1/1/2024		\$26.97	\$19.46	\$46.43
Laborers (Class 02 - See notes)	1/1/2025		\$27.47	\$19.96	\$47.43
Laborers (Class 02 - See notes)	1/1/2026		\$27.97	\$20.46	\$48.43
Laborers (Class 03 - See notes)	1/1/2023		\$28.97	\$19.46	\$48.43
Laborers (Class 03 - See notes)	1/1/2024		\$29.97	\$19.46	\$49.43
Laborers (Class 03 - See notes)	1/1/2025		\$30.47	\$19.96	\$50.43
Laborers (Class 03 - See notes)	1/1/2026		\$30.97	\$20.46	\$51.43
Laborers (Class 04 - See notes)	1/1/2021		\$23.57	\$19.32	\$42.89



**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02371 - Building</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Landscape Laborer (Skilled)	1/1/2023		\$23.79	\$18.28	\$42.07
Landscape Laborer (Skilled)	1/1/2024		\$24.79	\$18.53	\$43.32
Landscape Laborer (Skilled)	1/1/2025		\$25.79	\$18.78	\$44.57
Landscape Laborer (Skilled)	1/1/2026		\$26.79	\$19.03	\$45.82
Landscape Laborer (Tractor Operator)	1/1/2023		\$24.09	\$18.28	\$42.37
Landscape Laborer (Tractor Operator)	1/1/2024		\$25.09	\$18.53	\$43.62
Landscape Laborer (Tractor Operator)	1/1/2025		\$26.09	\$18.78	\$44.87
Landscape Laborer (Tractor Operator)	1/1/2026		\$27.09	\$19.03	\$46.12
Landscape Laborer	1/1/2023		\$23.37	\$18.28	\$41.65
Landscape Laborer	1/1/2024		\$24.37	\$18.53	\$42.90
Landscape Laborer	1/1/2025		\$25.37	\$18.78	\$44.15
Landscape Laborer	1/1/2026		\$26.37	\$19.03	\$45.40
Millwright	6/1/2020		\$41.68	\$20.32	\$62.00
Operators (Class 01 - see notes)	6/1/2022		\$38.89	\$23.69	\$62.58
Operators (Class 01 - see notes)	6/1/2023		\$40.89	\$23.89	\$64.58
Operators (Class 01 - see notes)	6/1/2024		\$41.89	\$24.39	\$66.08
Operators (Class 02 -see notes)	6/1/2022		\$32.82	\$23.69	\$56.51
Operators (Class 02 -see notes)	6/1/2023		\$34.62	\$23.89	\$58.51
Operators (Class 02 -see notes)	6/1/2024		\$35.62	\$24.39	\$60.01
Operators (Class 03 - See notes)	6/1/2022		\$30.03	\$23.69	\$53.72
Operators (Class 03 - See notes)	6/1/2023		\$31.83	\$23.89	\$55.72
Operators (Class 03 - See notes)	6/1/2024		\$32.83	\$24.39	\$57.22
Painters Class 6 (see notes)	6/1/2022		\$29.50	\$22.82	\$52.32
Painters Class 6 (see notes)	6/1/2023		\$30.56	\$24.01	\$54.57
Painters Class 6 (see notes)	6/1/2024		\$32.14	\$24.93	\$57.07
Painters Class 6 (see notes)	6/1/2025		\$34.16	\$25.81	\$59.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2023		\$58.70	\$21.22	\$79.92
Pile Driver Divers (Building, Heavy, Highway)	1/1/2024		\$60.95	\$21.97	\$82.92
Pile Driver Divers (Building, Heavy, Highway)	1/1/2025		\$62.82	\$22.72	\$85.54
Pile Driver Divers (Building, Heavy, Highway)	1/1/2026		\$64.70	\$23.47	\$88.17
Piledrivers	1/1/2023		\$39.13	\$21.22	\$60.35
Piledrivers	1/1/2024		\$40.63	\$21.97	\$62.60
Piledrivers	1/1/2025		\$41.88	\$22.72	\$64.60
Piledrivers	1/1/2026		\$43.13	\$23.47	\$66.60
Plasterers	6/1/2022		\$31.44	\$19.74	\$51.18
Plasterers	6/1/2023		\$32.14	\$20.54	\$52.68
Plumbers and Steamfitters	6/1/2023		\$38.57	\$26.26	\$64.83
Pointers, Caulkers, Cleaners	12/1/2022		\$35.47	\$20.88	\$56.35
Roofers	6/1/2022		\$36.04	\$19.13	\$55.17
Roofers	6/1/2023		\$37.00	\$19.92	\$56.92
Sheet Metal Workers	7/1/2021		\$38.76	\$30.00	\$68.76
Sheet Metal Workers	7/1/2022		\$39.50	\$31.43	\$70.93
Sheet Metal Workers	8/1/2023		\$41.00	\$32.94	\$73.94
Sign Makers and Hangars	7/15/2022		\$30.54	\$24.35	\$54.89

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02371 - Building</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Sign Makers and Hangars	7/15/2023		\$31.76	\$24.63	\$56.39
Sprinklerfitters	4/1/2023		\$44.33	\$28.04	\$72.37
Steamfitters	6/1/2022		\$44.15	\$27.32	\$71.47
Steamfitters	6/1/2023		\$46.10	\$28.37	\$74.47
Stone Masons	12/1/2022		\$38.56	\$23.61	\$62.17
Terrazzo Finisher	12/1/2022		\$36.13	\$18.03	\$54.16
Terrazzo Mechanics	12/1/2022		\$35.49	\$20.32	\$55.81
Tile Finisher	12/1/2022		\$28.76	\$17.34	\$46.10
Tile Setter	12/1/2022		\$35.64	\$21.81	\$57.45
Truckdriver class 1(see notes)	1/1/2023		\$33.18	\$22.21	\$55.39
Truckdriver class 1(see notes)	1/1/2024		\$34.93	\$22.71	\$57.64
Truckdriver class 1(see notes)	1/1/2025		\$36.43	\$23.21	\$59.64
Truckdriver class 1(see notes)	1/1/2026		\$37.93	\$23.71	\$61.64
Truckdriver class 2 (see notes)	1/1/2023		\$33.64	\$22.52	\$56.16
Truckdriver class 2 (see notes)	1/1/2024		\$35.39	\$23.02	\$58.41
Truckdriver class 2 (see notes)	1/1/2025		\$36.89	\$23.52	\$60.41
Truckdriver class 2 (see notes)	1/1/2026		\$38.39	\$24.02	\$62.41
Truckdriver class 3 (see notes)	1/1/2016		\$28.23	\$16.98	\$45.21
Window Film / Tint Installer	10/1/2019		\$25.00	\$2.63	\$27.63

Not To Be Used For Bidding Purposes

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

Project: 24-02371 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter	1/1/2023		\$38.60	\$20.59	\$59.19
Carpenter	1/1/2024		\$40.10	\$21.34	\$61.44
Carpenter	1/1/2025		\$41.35	\$22.09	\$63.44
Carpenter	1/1/2026		\$42.60	\$22.84	\$65.44
Carpenter Welder	1/1/2023		\$40.10	\$20.59	\$60.69
Carpenter Welder	1/1/2024		\$41.60	\$21.34	\$62.94
Carpenter Welder	1/1/2025		\$42.85	\$22.09	\$64.94
Carpenter Welder	1/1/2026		\$44.10	\$22.84	\$66.94
Carpenters - Piledriver/Welder	1/1/2023		\$40.63	\$21.22	\$61.85
Carpenters - Piledriver/Welder	1/1/2024		\$42.13	\$21.97	\$64.10
Carpenters - Piledriver/Welder	1/1/2025		\$43.38	\$22.72	\$66.10
Carpenters - Piledriver/Welder	1/1/2026		\$44.63	\$23.47	\$68.10
Cement Finishers	1/1/2023		\$34.14	\$25.05	\$59.19
Cement Finishers	1/1/2024		\$35.14	\$26.30	\$61.44
Cement Finishers	1/1/2025		\$35.34	\$27.50	\$63.44
Cement Masons	1/1/2020		\$32.84	\$21.10	\$53.94
Electric Lineman	5/27/2019		\$47.38	\$26.30	\$73.68
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2020		\$37.29	\$32.87	\$70.16
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2023		\$38.89	\$35.02	\$73.91
Laborers (Class 01 - See notes)	1/1/2023		\$29.95	\$25.50	\$55.45
Laborers (Class 01 - See notes)	1/1/2024		\$32.20	\$25.50	\$57.70
Laborers (Class 01 - See notes)	1/1/2025		\$33.70	\$26.00	\$59.70
Laborers (Class 01 - See notes)	1/1/2026		\$34.70	\$27.00	\$61.70
Laborers (Class 02 - See notes)	1/1/2023		\$30.11	\$25.50	\$55.61
Laborers (Class 02 - See notes)	1/1/2024		\$32.36	\$25.50	\$57.86
Laborers (Class 02 - See notes)	1/1/2025		\$33.86	\$26.00	\$59.86
Laborers (Class 02 - See notes)	1/1/2026		\$34.86	\$27.00	\$61.86
Laborers (Class 03 - See notes)	1/1/2023		\$30.50	\$25.50	\$56.00
Laborers (Class 03 - See notes)	1/1/2024		\$32.75	\$25.50	\$58.25
Laborers (Class 03 - See notes)	1/1/2025		\$34.25	\$26.00	\$60.25
Laborers (Class 03 - See notes)	1/1/2026		\$35.25	\$27.00	\$62.25
Laborers (Class 04 - See notes)	1/1/2023		\$30.95	\$25.50	\$56.45
Laborers (Class 04 - See notes)	1/1/2024		\$33.20	\$25.50	\$58.70
Laborers (Class 04 - See notes)	1/1/2025		\$34.70	\$26.00	\$60.70
Laborers (Class 04 - See notes)	1/1/2026		\$35.70	\$27.00	\$62.70
Laborers (Class 05 - See notes)	1/1/2023		\$31.36	\$25.50	\$56.86
Laborers (Class 05 - See notes)	1/1/2024		\$33.61	\$25.50	\$59.11
Laborers (Class 05 - See notes)	1/1/2025		\$35.11	\$26.00	\$61.11
Laborers (Class 05 - See notes)	1/1/2026		\$36.11	\$27.00	\$63.11
Laborers (Class 06 - See notes)	1/1/2023		\$28.20	\$25.50	\$53.70
Laborers (Class 06 - See notes)	1/1/2024		\$30.45	\$25.50	\$55.95
Laborers (Class 06 - See notes)	1/1/2025		\$31.95	\$26.00	\$57.95
Laborers (Class 06 - See notes)	1/1/2026		\$32.95	\$27.00	\$59.95

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02371 - Heavy/Highway</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Laborers (Class 07 - See notes)	1/1/2023		\$30.95	\$25.50	\$56.45
Laborers (Class 07 - See notes)	1/1/2024		\$33.20	\$25.50	\$58.70
Laborers (Class 07 - See notes)	1/1/2025		\$34.70	\$26.00	\$60.70
Laborers (Class 07 - See notes)	1/1/2026		\$35.70	\$27.00	\$62.70
Laborers (Class 08 - See notes)	1/1/2023		\$32.45	\$25.50	\$57.95
Laborers (Class 08 - See notes)	1/1/2024		\$34.70	\$25.50	\$60.20
Laborers (Class 08 - See notes)	1/1/2025		\$36.20	\$26.00	\$62.20
Laborers (Class 08 - See notes)	1/1/2026		\$37.20	\$27.00	\$64.20
Millwright	6/1/2023		\$45.50	\$23.72	\$69.22
Millwright	6/1/2024		\$47.59	\$23.72	\$71.31
Millwright	6/1/2025		\$49.72	\$23.72	\$73.44
Operators (Class 01 - see notes)	1/1/2023		\$36.79	\$23.58	\$60.37
Operators (Class 01 - see notes)	1/1/2024		\$38.59	\$24.03	\$62.62
Operators (Class 01 - see notes)	1/1/2025		\$40.39	\$24.23	\$64.62
Operators (Class 02 -see notes)	1/1/2023		\$36.33	\$23.58	\$60.11
Operators (Class 02 -see notes)	1/1/2024		\$38.33	\$24.03	\$62.36
Operators (Class 02 -see notes)	1/1/2025		\$40.13	\$24.23	\$64.36
Operators (Class 03 - See notes)	1/1/2023		\$32.88	\$23.58	\$56.46
Operators (Class 03 - See notes)	1/1/2024		\$34.68	\$24.03	\$58.71
Operators (Class 03 - See notes)	1/1/2025		\$36.48	\$24.23	\$60.71
Operators (Class 04 - See notes)	1/1/2023		\$32.42	\$23.58	\$56.00
Operators (Class 04 - See notes)	1/1/2024		\$34.22	\$24.03	\$58.25
Operators (Class 04 - See notes)	1/1/2025		\$36.02	\$24.23	\$60.25
Operators (Class 05 - See notes)	1/1/2023		\$32.17	\$23.58	\$55.75
Operators (Class 05 - See notes)	1/1/2024		\$33.97	\$24.03	\$58.00
Operators (Class 05 - See notes)	1/1/2025		\$35.77	\$24.23	\$60.00
Operators Class 1-A	1/1/2023		\$39.79	\$23.58	\$63.37
Operators Class 1-A	1/1/2024		\$41.59	\$24.03	\$65.62
Operators Class 1-A	1/1/2025		\$43.39	\$24.23	\$67.62
Operators Class 1-B	1/1/2023		\$38.79	\$23.58	\$62.37
Operators Class 1-B	1/1/2024		\$40.59	\$24.03	\$64.62
Operators Class 1-B	1/1/2025		\$42.39	\$24.23	\$66.62
Painters Class 1 (see notes)	6/1/2022		\$34.45	\$22.82	\$57.27
Painters Class 2 (see notes)	6/1/2019		\$35.25	\$20.06	\$55.31
Painters Class 2 (see notes)	6/1/2023		\$36.01	\$24.01	\$60.02
Painters Class 2 (see notes)	6/1/2024		\$38.09	\$24.93	\$63.02
Painters Class 2 (see notes)	6/1/2025		\$40.36	\$25.81	\$66.17
Painters Class 3 (see notes)	6/1/2022		\$36.77	\$22.82	\$59.59
Painters Class 3 (see notes)	6/1/2023		\$38.33	\$24.01	\$62.34
Painters Class 3 (see notes)	6/1/2024		\$40.66	\$24.93	\$65.59
Painters Class 3 (see notes)	6/1/2025		\$43.69	\$25.81	\$69.50
Painters Class 4 (see notes)	6/1/2019		\$28.20	\$20.06	\$48.26
Painters Class 5 (see notes)	6/1/2019		\$22.91	\$20.06	\$42.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2023		\$58.70	\$21.22	\$79.92

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02371 - Heavy/Highway</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Pile Driver Divers (Building, Heavy, Highway)	1/1/2024		\$60.95	\$21.97	\$82.92
Pile Driver Divers (Building, Heavy, Highway)	1/1/2025		\$62.82	\$22.72	\$85.54
Pile Driver Divers (Building, Heavy, Highway)	1/1/2026		\$64.70	\$23.47	\$88.17
Piledrivers	1/1/2023		\$39.13	\$21.22	\$60.35
Piledrivers	1/1/2024		\$40.63	\$21.97	\$62.60
Piledrivers	1/1/2025		\$41.88	\$22.72	\$64.60
Piledrivers	1/1/2026		\$43.13	\$23.47	\$66.60
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2022		\$48.43	\$40.28	\$88.71
Truckdriver class 1(see notes)	1/1/2023		\$33.18	\$22.21	\$55.39
Truckdriver class 1(see notes)	1/1/2024		\$34.93	\$22.71	\$57.64
Truckdriver class 1(see notes)	1/1/2025		\$36.43	\$23.21	\$59.64
Truckdriver class 1(see notes)	1/1/2026		\$37.93	\$23.71	\$61.64
Truckdriver class 2 (see notes)	1/1/2023		\$33.64	\$22.52	\$56.16
Truckdriver class 2 (see notes)	1/1/2024		\$35.39	\$23.02	\$58.41
Truckdriver class 2 (see notes)	1/1/2025		\$36.89	\$23.52	\$60.41
Truckdriver class 2 (see notes)	1/1/2026		\$38.39	\$24.02	\$62.41
Truckdriver class 3 (see notes)	1/1/2019		\$29.59	\$19.82	\$49.41

Not To Be Used For Bidding Purposes

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

Project Name:	Donner Pump Station Mechanical Bar Screen
Awarding Agency:	Mon Valley Sewage Authority
Contract Award Date:	4/8/2024
Serial Number:	24-02369
Project Classification:	Building
Determination Date:	3/11/2024
Assigned Field Office:	Pittsburgh
Field Office Phone Number:	(412)565-5300
Toll Free Phone Number:	(877)504-8354
Project County:	Washington County

Not To Be Used For Bidding Purposes

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02369 - Building</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Asbestos & Insulation Workers	8/1/2022		\$41.40	\$28.51	\$69.91
Asbestos & Insulation Workers	8/1/2023		\$42.40	\$29.01	\$71.41
Boilermakers	6/1/2016		\$40.90	\$27.61	\$68.51
Bricklayer	12/1/2022		\$36.99	\$24.95	\$61.94
Carpenters - Piledriver/Welder	1/1/2023		\$40.63	\$21.22	\$61.85
Carpenters - Piledriver/Welder	1/1/2024		\$42.13	\$21.97	\$64.10
Carpenters - Piledriver/Welder	1/1/2025		\$43.38	\$22.72	\$66.10
Carpenters - Piledriver/Welder	1/1/2026		\$44.63	\$23.47	\$68.10
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2023		\$39.69	\$19.93	\$59.62
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2024		\$41.49	\$19.93	\$61.42
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2025		\$43.34	\$19.93	\$63.27
Cement Masons	6/1/2023		\$33.07	\$23.59	\$56.66
Drywall Finisher	6/1/2022		\$32.00	\$21.89	\$53.89
Drywall Finisher	6/1/2023		\$32.99	\$23.75	\$56.74
Drywall Finisher	6/1/2024		\$34.01	\$24.88	\$58.89
Electricians & Telecommunications Installation Technician	12/26/2022		\$48.31	\$29.29	\$77.60
Electricians & Telecommunications Installation Technician	12/22/2023		\$48.61	\$31.80	\$80.41
Electricians & Telecommunications Installation Technician	12/27/2024		\$51.76	\$31.80	\$83.56
Electricians & Telecommunications Installation Technician	12/26/2025		\$55.06	\$31.80	\$86.86
Elevator Constructor	1/1/2023		\$56.14	\$42.83	\$98.97
Elevator Constructor	1/1/2024		\$58.55	\$43.87	\$102.42
Glazier	9/1/2021		\$32.61	\$27.19	\$59.80
Glazier	9/1/2023		\$35.65	\$30.05	\$65.70
Iron Workers	6/1/2023		\$38.89	\$35.02	\$73.91
Laborers (Class 01 - See notes)	1/1/2023		\$25.82	\$19.46	\$45.28
Laborers (Class 01 - See notes)	1/1/2024		\$26.82	\$19.46	\$46.28
Laborers (Class 01 - See notes)	1/1/2025		\$27.32	\$19.96	\$47.28
Laborers (Class 01 - See notes)	1/1/2026		\$27.82	\$20.46	\$48.28
Laborers (Class 02 - See notes)	1/1/2023		\$25.97	\$19.46	\$45.43
Laborers (Class 02 - See notes)	1/1/2024		\$26.97	\$19.46	\$46.43
Laborers (Class 02 - See notes)	1/1/2025		\$27.47	\$19.96	\$47.43
Laborers (Class 02 - See notes)	1/1/2026		\$27.97	\$20.46	\$48.43
Laborers (Class 03 - See notes)	1/1/2023		\$28.97	\$19.46	\$48.43
Laborers (Class 03 - See notes)	1/1/2024		\$29.97	\$19.46	\$49.43
Laborers (Class 03 - See notes)	1/1/2025		\$30.47	\$19.96	\$50.43
Laborers (Class 03 - See notes)	1/1/2026		\$30.97	\$20.46	\$51.43
Laborers (Class 04 - See notes)	1/1/2021		\$23.57	\$19.32	\$42.89
Landscape Laborer (Skilled)	1/1/2020		\$21.64	\$16.98	\$38.62
Landscape Laborer (Skilled)	1/1/2023		\$23.79	\$18.28	\$42.07
Landscape Laborer (Skilled)	1/1/2024		\$24.79	\$18.53	\$43.32

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

Project: 24-02369 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Landscape Laborer (Skilled)	1/1/2025		\$25.79	\$18.78	\$44.57
Landscape Laborer (Skilled)	1/1/2026		\$26.79	\$19.03	\$45.82
Landscape Laborer (Tractor Operator)	1/1/2020		\$21.94	\$16.98	\$38.92
Landscape Laborer (Tractor Operator)	1/1/2023		\$24.09	\$18.28	\$42.37
Landscape Laborer (Tractor Operator)	1/1/2024		\$25.09	\$18.53	\$43.62
Landscape Laborer (Tractor Operator)	1/1/2025		\$26.09	\$18.78	\$44.87
Landscape Laborer (Tractor Operator)	1/1/2026		\$27.09	\$19.03	\$46.12
Landscape Laborer	1/1/2023		\$23.37	\$18.28	\$41.65
Landscape Laborer	1/1/2024		\$24.37	\$18.53	\$42.90
Landscape Laborer	1/1/2025		\$25.37	\$18.78	\$44.15
Landscape Laborer	1/1/2026		\$26.37	\$19.03	\$45.40
Millwright	6/1/2020		\$41.68	\$20.32	\$62.00
Operators (Class 01 - see notes)	6/1/2023		\$40.69	\$23.89	\$64.58
Operators (Class 01 - see notes)	6/1/2024		\$41.69	\$24.39	\$66.08
Operators (Class 02 -see notes)	6/1/2023		\$34.62	\$23.89	\$58.51
Operators (Class 02 -see notes)	6/1/2024		\$35.62	\$24.39	\$60.01
Operators (Class 03 - See notes)	6/1/2023		\$31.83	\$23.89	\$55.72
Operators (Class 03 - See notes)	6/1/2024		\$32.83	\$24.39	\$57.22
Painters Class 6 (see notes)	6/1/2022		\$29.50	\$22.82	\$52.32
Painters Class 6 (see notes)	6/1/2023		\$30.56	\$24.01	\$54.57
Painters Class 6 (see notes)	6/1/2024		\$32.14	\$24.93	\$57.07
Painters Class 6 (see notes)	6/1/2025		\$34.16	\$25.81	\$59.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2023		\$58.70	\$21.22	\$79.92
Pile Driver Divers (Building, Heavy, Highway)	1/1/2024		\$60.95	\$21.97	\$82.92
Pile Driver Divers (Building, Heavy, Highway)	1/1/2025		\$62.82	\$22.72	\$85.54
Pile Driver Divers (Building, Heavy, Highway)	1/1/2026		\$64.70	\$23.47	\$88.17
Piledrivers	1/1/2023		\$39.13	\$21.22	\$60.35
Piledrivers	1/1/2024		\$40.63	\$21.97	\$62.60
Piledrivers	1/1/2025		\$41.88	\$22.72	\$64.60
Piledrivers	1/1/2026		\$43.13	\$23.47	\$66.60
Plasterers	6/1/2022		\$31.44	\$19.74	\$51.18
Plasterers	6/1/2023		\$32.14	\$20.54	\$52.68
plumber	6/1/2022		\$49.35	\$21.77	\$71.12
plumber	6/1/2023		\$48.65	\$25.87	\$74.52
plumber	6/1/2024		\$51.75	\$25.87	\$77.62
plumber	6/1/2025		\$54.95	\$25.87	\$80.82
plumber	6/1/2026		\$58.05	\$25.87	\$83.92
plumber	6/1/2027		\$61.15	\$25.87	\$87.02
Plumbers and Steamfitters	6/1/2023		\$38.57	\$26.26	\$64.83
Pointers, Caulkers, Cleaners	12/1/2022		\$35.47	\$20.88	\$56.35
Roofers	6/1/2022		\$36.04	\$19.13	\$55.17
Roofers	6/1/2023		\$37.00	\$19.92	\$56.92
Sheet Metal Workers	7/1/2022		\$39.50	\$31.43	\$70.93
Sheet Metal Workers	8/1/2023		\$41.00	\$32.94	\$73.94



**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02369 - Building</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Sign Makers and Hangars	7/15/2022		\$30.54	\$24.35	\$54.89
Sign Makers and Hangars	7/15/2023		\$31.76	\$24.63	\$56.39
Sprinklerfitters	4/1/2023		\$44.33	\$28.04	\$72.37
Steamfitters	6/1/2022		\$44.15	\$27.32	\$71.47
Steamfitters	6/1/2023		\$46.10	\$28.37	\$74.47
Stone Masons	12/1/2022		\$38.56	\$23.61	\$62.17
Terrazzo Finisher	12/1/2022		\$36.13	\$18.03	\$54.16
Terrazzo Mechanics	12/1/2022		\$35.49	\$20.32	\$55.81
Tile Finisher	12/1/2022		\$28.76	\$17.34	\$46.10
Tile Setter	12/1/2022		\$35.64	\$21.81	\$57.45
Truckdriver class 1(see notes)	1/1/2023		\$33.18	\$22.21	\$55.39
Truckdriver class 1(see notes)	1/1/2024		\$34.93	\$22.71	\$57.64
Truckdriver class 1(see notes)	1/1/2025		\$36.43	\$23.21	\$59.64
Truckdriver class 1(see notes)	1/1/2026		\$37.93	\$23.71	\$61.64
Truckdriver class 2 (see notes)	1/1/2023		\$33.64	\$22.52	\$56.16
Truckdriver class 2 (see notes)	1/1/2024		\$35.39	\$23.02	\$58.41
Truckdriver class 2 (see notes)	1/1/2025		\$36.89	\$23.52	\$60.41
Truckdriver class 2 (see notes)	1/1/2026		\$38.39	\$24.02	\$62.41
Truckdriver class 3 (see notes)	1/1/2016		\$28.23	\$16.98	\$45.21
Window Film / Tint Installer	10/1/2019		\$25.00	\$2.63	\$27.63

Not To Be Used For Bidding Purposes

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02369 - Heavy/Highway</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Carpenter	1/1/2023		\$38.60	\$20.59	\$59.19
Carpenter	1/1/2024		\$40.10	\$21.34	\$61.44
Carpenter	1/1/2025		\$41.35	\$22.09	\$63.44
Carpenter	1/1/2026		\$42.60	\$22.84	\$65.44
Carpenter Welder	1/1/2023		\$40.10	\$20.59	\$60.69
Carpenter Welder	1/1/2024		\$41.60	\$21.34	\$62.94
Carpenter Welder	1/1/2025		\$42.85	\$22.09	\$64.94
Carpenter Welder	1/1/2026		\$44.10	\$22.84	\$66.94
Carpenters - Piledriver/Welder	1/1/2023		\$40.63	\$21.22	\$61.85
Carpenters - Piledriver/Welder	1/1/2024		\$42.13	\$21.97	\$64.10
Carpenters - Piledriver/Welder	1/1/2025		\$43.38	\$22.72	\$66.10
Carpenters - Piledriver/Welder	1/1/2026		\$44.63	\$23.47	\$68.10
Cement Finishers	1/1/2023		\$34.14	\$25.05	\$59.19
Cement Finishers	1/1/2024		\$35.14	\$26.30	\$61.44
Cement Finishers	1/1/2025		\$35.34	\$27.50	\$63.44
Cement Masons	1/1/2020		\$32.84	\$21.10	\$53.94
Electric Lineman	5/27/2019		\$47.38	\$26.30	\$73.68
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2023		\$38.89	\$35.02	\$73.91
Laborers (Class 01 - See notes)	1/1/2023		\$29.95	\$25.50	\$55.45
Laborers (Class 01 - See notes)	1/1/2024		\$32.20	\$25.50	\$57.70
Laborers (Class 01 - See notes)	1/1/2025		\$33.70	\$26.00	\$59.70
Laborers (Class 01 - See notes)	1/1/2026		\$34.70	\$27.00	\$61.70
Laborers (Class 02 - See notes)	1/1/2023		\$30.11	\$25.50	\$55.61
Laborers (Class 02 - See notes)	1/1/2024		\$32.36	\$25.50	\$57.86
Laborers (Class 02 - See notes)	1/1/2025		\$33.86	\$26.00	\$59.86
Laborers (Class 02 - See notes)	1/1/2026		\$34.86	\$27.00	\$61.86
Laborers (Class 03 - See notes)	1/1/2023		\$30.50	\$25.50	\$56.00
Laborers (Class 03 - See notes)	1/1/2024		\$32.75	\$25.50	\$58.25
Laborers (Class 03 - See notes)	1/1/2025		\$34.25	\$26.00	\$60.25
Laborers (Class 03 - See notes)	1/1/2026		\$35.25	\$27.00	\$62.25
Laborers (Class 04 - See notes)	1/1/2023		\$30.95	\$25.50	\$56.45
Laborers (Class 04 - See notes)	1/1/2024		\$33.20	\$25.50	\$58.70
Laborers (Class 04 - See notes)	1/1/2025		\$34.70	\$26.00	\$60.70
Laborers (Class 04 - See notes)	1/1/2026		\$35.70	\$27.00	\$62.70
Laborers (Class 05 - See notes)	1/1/2023		\$31.36	\$25.50	\$56.86
Laborers (Class 05 - See notes)	1/1/2024		\$33.61	\$25.50	\$59.11
Laborers (Class 05 - See notes)	1/1/2025		\$35.11	\$26.00	\$61.11
Laborers (Class 05 - See notes)	1/1/2026		\$36.11	\$27.00	\$63.11
Laborers (Class 06 - See notes)	1/1/2023		\$28.20	\$25.50	\$53.70
Laborers (Class 06 - See notes)	1/1/2024		\$30.45	\$25.50	\$55.95
Laborers (Class 06 - See notes)	1/1/2025		\$31.95	\$26.00	\$57.95
Laborers (Class 06 - See notes)	1/1/2026		\$32.95	\$27.00	\$59.95
Laborers (Class 07 - See notes)	1/1/2023		\$30.95	\$25.50	\$56.45
Laborers (Class 07 - See notes)	1/1/2024		\$33.20	\$25.50	\$58.70

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02369 - Heavy/Highway</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Laborers (Class 07 - See notes)	1/1/2025		\$34.70	\$26.00	\$60.70
Laborers (Class 07 - See notes)	1/1/2026		\$35.70	\$27.00	\$62.70
Laborers (Class 08 - See notes)	1/1/2023		\$32.45	\$25.50	\$57.95
Laborers (Class 08 - See notes)	1/1/2024		\$34.70	\$25.50	\$60.20
Laborers (Class 08 - See notes)	1/1/2025		\$36.20	\$26.00	\$62.20
Laborers (Class 08 - See notes)	1/1/2026		\$37.20	\$27.00	\$64.20
Millwright	6/1/2020		\$41.68	\$20.32	\$62.00
Millwright	6/1/2023		\$45.50	\$23.72	\$69.22
Millwright	6/1/2024		\$47.59	\$23.72	\$71.31
Millwright	6/1/2025		\$49.72	\$23.72	\$73.44
Operators (Class 01 - see notes)	1/1/2023		\$36.79	\$23.58	\$60.37
Operators (Class 01 - see notes)	1/1/2024		\$38.59	\$24.03	\$62.62
Operators (Class 01 - see notes)	1/1/2025		\$40.39	\$24.23	\$64.62
Operators (Class 02 -see notes)	1/1/2023		\$36.53	\$23.58	\$60.11
Operators (Class 02 -see notes)	1/1/2024		\$38.33	\$24.03	\$62.36
Operators (Class 02 -see notes)	1/1/2025		\$40.13	\$24.23	\$64.36
Operators (Class 03 - See notes)	1/1/2023		\$32.88	\$23.58	\$56.46
Operators (Class 03 - See notes)	1/1/2024		\$34.68	\$24.03	\$58.71
Operators (Class 03 - See notes)	1/1/2025		\$36.48	\$24.23	\$60.71
Operators (Class 04 - See notes)	1/1/2023		\$32.42	\$23.58	\$56.00
Operators (Class 04 - See notes)	1/1/2024		\$34.22	\$24.03	\$58.25
Operators (Class 04 - See notes)	1/1/2025		\$36.02	\$24.23	\$60.25
Operators (Class 05 - See notes)	1/1/2023		\$32.17	\$23.58	\$55.75
Operators (Class 05 - See notes)	1/1/2024		\$33.97	\$24.03	\$58.00
Operators (Class 05 - See notes)	1/1/2025		\$35.77	\$24.23	\$60.00
Operators Class 1-A	1/1/2023		\$39.79	\$23.58	\$63.37
Operators Class 1-A	1/1/2024		\$41.59	\$24.03	\$65.62
Operators Class 1-A	1/1/2025		\$43.39	\$24.23	\$67.62
Operators Class 1-B	1/1/2023		\$38.79	\$23.58	\$62.37
Operators Class 1-B	1/1/2024		\$40.59	\$24.03	\$64.62
Operators Class 1-B	1/1/2025		\$42.39	\$24.23	\$66.62
Painters Class 1 (see notes)	6/1/2022		\$34.45	\$22.82	\$57.27
Painters Class 2 (see notes)	6/1/2019		\$35.25	\$20.06	\$55.31
Painters Class 2 (see notes)	6/1/2023		\$36.01	\$24.01	\$60.02
Painters Class 2 (see notes)	6/1/2024		\$38.09	\$24.93	\$63.02
Painters Class 2 (see notes)	6/1/2025		\$40.36	\$25.81	\$66.17
Painters Class 3 (see notes)	6/1/2022		\$36.77	\$22.82	\$59.59
Painters Class 3 (see notes)	6/1/2023		\$38.33	\$24.01	\$62.34
Painters Class 3 (see notes)	6/1/2024		\$40.66	\$24.93	\$65.59
Painters Class 3 (see notes)	6/1/2025		\$43.69	\$25.81	\$69.50
Painters Class 4 (see notes)	6/1/2019		\$28.20	\$20.06	\$48.26
Painters Class 5 (see notes)	6/1/2019		\$22.91	\$20.06	\$42.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2023		\$58.70	\$21.22	\$79.92
Pile Driver Divers (Building, Heavy, Highway)	1/1/2024		\$60.95	\$21.97	\$82.92

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02369 - Heavy/Highway</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Pile Driver Divers (Building, Heavy, Highway)	1/1/2025		\$62.82	\$22.72	\$85.54
Pile Driver Divers (Building, Heavy, Highway)	1/1/2026		\$64.70	\$23.47	\$88.17
Piledrivers	1/1/2023		\$39.13	\$21.22	\$60.35
Piledrivers	1/1/2024		\$40.63	\$21.97	\$62.60
Piledrivers	1/1/2025		\$41.88	\$22.72	\$64.60
Piledrivers	1/1/2026		\$43.13	\$23.47	\$66.60
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2022		\$48.43	\$40.28	\$88.71
Truckdriver class 1(see notes)	1/1/2023		\$33.18	\$22.21	\$55.39
Truckdriver class 1(see notes)	1/1/2024		\$34.93	\$22.71	\$57.64
Truckdriver class 1(see notes)	1/1/2025		\$36.43	\$23.21	\$59.64
Truckdriver class 1(see notes)	1/1/2026		\$37.93	\$23.71	\$61.64
Truckdriver class 2 (see notes)	1/1/2023		\$33.64	\$22.52	\$56.16
Truckdriver class 2 (see notes)	1/1/2024		\$35.39	\$23.02	\$58.41
Truckdriver class 2 (see notes)	1/1/2025		\$36.89	\$23.52	\$60.41
Truckdriver class 2 (see notes)	1/1/2026		\$38.39	\$24.02	\$62.41
Truckdriver class 3 (see notes)	1/1/2019		\$29.59	\$19.82	\$49.41

Not To Be Used For Bidding Purposes

# Section 01 1100

## Summary of Work

### Part 1 General

#### 1.01 Work Covered by Contract Documents

The project will consist of the following improvements to the Monessen and Donner Pump Stations:

1. Installation of a new Mechanical Bar Screen, Washer Compactor, Debris Chute, Screenings Waste Receptacle, and associated appurtenances, as well as completion of structural, electrical, and process modifications to accommodate the new system components at each of the two pump stations.
2. Construction of building additions on the side of the building to house new Screenings Waste Receptacles at each of the two pump stations.
3. Removal of the existing comminutors and associated appurtenances/electrical connections at each of the two pump stations.
4. Removal of existing access hatches and monorails at each of the two pump stations.
5. Conversion of the channel that diverts water to the former location of the comminutor into a bypass channel and installation of a manual bar screen on the influent side of this channel at each of the two pump stations.
6. Modification of the existing influent channel floor to accommodate the new Mechanical Bar Screen system at each of the two pump stations.
7. Reconfiguration of the access stairs on the Upper Intermediate Floor to accommodate the new Mechanical Bar Screen system.
8. Installation of new access hatches.
9. Installation of a weir in the influent channel downstream of the Mechanical Bar Screen that maintains a minimum water depth of 1 ft. in the channel at each of the two pump stations.
10. Complete all electrical work necessary for operation of equipment and install lighting in the building additions at each of the two pump stations.

Additional appurtenances and equipment to be installed as part of this project include Mechanical Bar Screen system accessories, Washer Compactor system accessories, a heat-traced Debris Chute connecting the Washer Compactor outlet to the Screenings Waste Receptacle, interior pump station improvements, and exterior improvements. Interior pump station improvements include removal of the existing comminutor, hydraulic controls, manual bar screen, and I-beam, demolition of the existing hatch and monorail I-beam, saw cutting of floor slabs, Mechanical Bar Screen and Washer Compactor system installation, installation of additional hatch, grating, weir, installation of a new manual bar screen, supply/drain piping installation, installation of a new monorail I-beam, reconfiguration of stairs at the upper intermediate floor, and electrical / process control requirements. Exterior improvements include an additional building concrete pad, a building addition to house the Screenings Waste Receptacle, a Screenings Waste Receptacle, and building HVAC & electrical requirements.

#### 1.02 Contract Method

- A. Work hereunder will be constructed with a lump sum contract as described above and as described in more detail in the Contract Documents.
- B. All conditions in the Contract Documents shall apply to any and all subcontractors on this project. It shall be the Contractors responsibility to coordinate the Work with their respective subcontractors.

### 1.03 Jurisdiction

- A. Agencies having jurisdiction over construction of this project include but are not limited to:
  - 1. The Environmental Protection Agency
  - 2. The Pennsylvania Department of Environmental Protection
  - 3. The Westmoreland County Conservation District
  - 4. City of Monessen
  - 5. Mon Valley Sewage Authority
- B. CONTRACTOR shall secure any permits associated with construction as required by the agency(s) having jurisdiction, shall abide by all rules and regulations of each and shall pay all costs in connection with the permits. CONTRACTOR shall pay for such permits and inspection fees to ensure compliance with their requirements. OWNER will obtain and pay the fees for the WQM Part II Permit from the PaDEP.

### 1.04 Notices

- A. CONTRACTOR's are required to comply with the Pennsylvania One Call requirements prior to digging.
- B. CONTRACTOR shall review with the various utility companies the construction methods and work to be done in the vicinity of utilities. When temporary relocation is necessary sufficient advance notice shall be given by CONTRACTOR to the utility involved.

### 1.05 Coordination

- A. It shall be responsibility of CONTRACTOR to coordinate his operations and those of his subcontractors in such a manner so as to avoid interference or delays and ensure the orderly progress of Work in the areas of common or interdependent construction activities. Limits of the Contract are indicated on the Plans and specified herein. However, these limits may be altered by mutual agreement of CONTRACTOR with the OWNER, with the written Agreement of Owner's Representative, in order to facilitate the work operations.
- B. The work of this Contract may involve coordination with other utility companies or agencies, either performing connection repair or maintenance service on their own facilities. CONTRACTOR shall coordinate and cooperate with all utility companies and other contractors working in the same area that this Contract entails. This shall include, but not be limited to, the telephone company; the electric power company; the gas company; all subcontractors; and any other contractors who are performing work within the area of this Contract.

### 1.06 Availability of Land

- A. Work is located within the property lines of OWNER. In areas where work will extend beyond right-of-ways or the property lines, OWNER will secure a construction easement to facilitate the work.
- B. Nothing in this Contract shall imply that CONTRACTOR has exclusive use of roadways or public and/or private land employed to perform the work.
- C. CONTRACTOR shall coordinate staging, layout and equipment storage areas with OWNER and other CONTRACTORS and subcontractors on site. CONTRACTOR shall

be responsible for the complete restoration of areas used by CONTRACTOR for such purposes, the cost of which is to be included as incidental to the work and in the Lump Sum for this Project.

#### **1.07 Salvage of Material and Equipment**

- A. No items shall be salvaged and reused without permission from OWNER or Owner's Representative unless specifically stated otherwise in the Bid Form.
- B. OWNER reserves the right of first refusal to salvage any item from the project. If so directed by Owner's Representative, CONTRACTOR shall deliver to a location on the plant site any items to be salvaged by OWNER.

#### **1.08 Storage of Materials**

- A. Storage conditions shall be acceptable to OWNER for all materials and equipment not incorporated into the Work but included in applications for payment. Such storage arrangements and conditions shall be presented in writing and shall afford adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to OWNER and Owner's Representative. Stored materials shall be insured for full value. Certificates of Insurance coverage must be submitted to OWNER or OWNER'S REPRESENTATIVE with the request for payment by the CONTRACTOR.
- B. All arrangements and costs for storage facilities shall be paid by CONTRACTOR.

#### **1.09 Construction Sequence**

- A. The Contract Documents include a detailed construction sequence to be used as a guideline during the performance of the Work. The intent of the construction sequence is to minimize the length of time during which the Donner or Monessen Pump Stations must be taken offline temporarily.
- B. After Contract award, CONTRACTORS shall submit a construction sequencing plan for the Improvements that are part of his/her Contract. The sequencing plan may follow the plan provided in the Contract Documents or could be a variation of that plan. CONTRACTOR is ultimately responsible for its own means, methods and materials in the completion of the Contract. CONTRACTOR sequencing plan is to be submitted to ENGINEER for review in accordance with the requirement of Section 01 3300 of these Specifications. Approval of the sequencing plan does not relieve CONTRACTOR from its responsibility to perform the Work in accordance with the Contract Documents.

#### **Part 2 Products (Not Used)**

#### **Part 3 Execution (Not Used)**

End of Section

## **Section 01 2513 Substitution Procedures**

### **Part 1 General**

#### **1.01 Section Includes**

- A. Options for making product or process selections.
- B. Procedures for proposing equivalent construction products or processes, including preapproved, prequalified, and approved products or processes.

#### **1.02 Definitions**

- A. Product: Means materials, equipment, or systems incorporated into the Project. Product does not include machinery and equipment used for production, fabrication, conveying, and erection of the Work. Products may also include existing materials or components designated for reuse.
- B. Process: Any proprietary system or method for installing system components resulting in an integral, functioning part of the Work. For this Section, the word Product includes Processes.

#### **1.03 Selection Options**

- A. Preapproved Products: Construction products of certain manufacturers or suppliers designated in the Specifications as "preapproved." A list of preapproved products is maintained by OWNER. Preapproved products for this Project are designated as preapproved in the Specifications. Products of other manufacturers or suppliers will not be acceptable for this Project and will not be considered under the submittal process for approving alternate products.
- B. Prequalified Products: Construction products of certain manufacturers or suppliers designated in the Specifications as "prequalified." Prequalified products for this Project are designated as prequalified in the Specifications. Products of other manufacturers or suppliers will not be acceptable for this Project and will not be considered under the submittal process for approving alternate products.
- C. Approved Products: Construction products or processes of certain manufacturers or suppliers designated in the Specifications followed by the words "or approved equal." Approval of alternate products or processes not listed in the Specifications may be obtained through provisions for product options and substitutions in Document 00 7200 - General Conditions, and by following the submittal procedures specified in 01 3300 - Submittal Procedures. The procedure for approval of alternate products is not applicable to preapproved or prequalified products.
- D. Product Compatibility: To the maximum extent possible, provide products that are of the same type or function from a single manufacturer, make, or source. Where more than one choice is available as a CONTRACTOR's option, select a product which is compatible with other products already selected, specified, or in use by OWNER.

#### **1.04 CONTRACTOR's Responsibility**

- A. CONTRACTOR's responsibility related to product options and substitutions is defined in Section 00 7200 - General Conditions.



- B. Furnish information ENGINEER deems necessary to judge equivalency of the alternate product.
- C. Pay for laboratory testing, as well as any other review or examination costs, needed to establish the equivalency between products in order to obtain information upon which ENGINEER can base a decision.
- D. If ENGINEER determines that an alternate product is not equal to that named in the Specifications, CONTRACTOR shall furnish one of the specified products.

**1.05 ENGINEER's Review**

- A. Alternate products or processes may be used only if approved in writing by ENGINEER. ENGINEER's determination regarding acceptance of a proposed alternate product is final.
- B. Alternate products will be accepted if the product is judged by ENGINEER to be equivalent to the specified product or to offer substantial benefit to OWNER.
- C. OWNER retains the right to accept any product or process deemed advantageous to OWNER, and similarly, to reject any product or process deemed not beneficial to OWNER.

**1.06 Substitution Procedure**

- A. Collect and assemble technical information applicable to the proposed product to aid in determining equivalency as related to the approved product specified.
- B. Submit a written request for a construction product to be considered as an alternate product.
- C. Submit the product information after the effective date of the Agreement and within the time period allowed for substitution submittals given in Section 00 7200, General Conditions. After the submittal period has expired, requests for alternate products will be considered only when a specified product becomes unavailable because of conditions beyond CONTRACTOR's control.
- D. Submit six (6) copies of each request for alternate product approval. Include the following information:
  - 1. Complete data substantiating compliance of proposed substitution with Contract Documents.
  - 2. For products:
    - a. Product identification, including manufacturer's name and address.
    - b. Manufacturer's literature with product description, performance and test data, and reference standards.
    - c. Samples, as applicable.
    - d. Name and address of similar projects on which product was used and date of installation. Include the name of OWNER, ENGINEER, and CONTRACTOR.

3. For construction methods:
    - a. Detailed description of proposed method.
    - b. Drawings illustrating methods.
  4. Itemized comparison of proposed substitution with product or method specified.
  5. Data relating to changes in construction schedule.
  6. Relation to separate contracts, if any.
  7. Accurate cost data on proposed substitution in comparison with product or method specified.
  8. Other information requested by ENGINEER.
- E. Approved alternate products will be subject to the same review process as the specified product would have been for shop drawings, product data, and samples.

**Products (Not Used)**

**Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 3119 Project Meetings

### Part 1 General

#### 1.01 Preconstruction Meeting

- A. Prior to the delivery of materials or the start of any construction, CONTRACTOR shall request a Preconstruction Meeting from ENGINEER. A minimum three (3) working days' notification to meeting participants shall be required.
- B. Schedule:
1. ENGINEER will establish the meeting place, time and date, distribute agenda, notify participants, and administer the meeting. CONTRACTOR shall notify major Subcontractors.
- C. Attendance:
1. OWNER
  2. ENGINEER
  3. CONTRACTOR
  4. Major Subcontractors
  5. Utility Companies
  6. Safety Representatives
  7. Governmental Agencies
- D. Agenda:
1. Distribution by CONTRACTOR and discussion, review and acceptance of:
    - a. List of names and telephone numbers for superintendent, foreman and other key personnel.
    - b. List of major Subcontractors and Suppliers.
    - c. Projected construction preliminary progress schedules.
    - d. Preliminary schedule of Shop Drawings and Sample submittals.
    - e. Estimated monthly payment schedule and schedule of values
  2. Critical Work sequencing.
  3. Major equipment deliveries and priorities.
  4. Project coordination.
  5. Responsibilities of OWNER, ENGINEER, CONTRACTOR and other agencies.
  6. Procedures and processing of:
    - a. Field decisions.
    - b. Proposal requests.
    - c. Submittals.
    - d. Change Orders.
    - e. Applications for Payment.

7. Adequacy of distribution of Contract Documents.
8. Procedures for maintaining Record Documents.
9. Use of premises.
10. Construction facilities, controls and construction aids.
11. Temporary utilities.
12. Safety and first aid procedures.
13. Security procedures.
14. Housekeeping procedures.
15. Testing

E. Minutes:

1. ENGINEER will prepare and distribute copies to participants within seven (7) days of meeting. Participants shall report corrections and comments within ten (10) days of receipt of minutes.

**1.02 Progress Meetings**

A. Periodic Progress Meetings will be held as required by the progress of the Work.

B. Schedule:

1. ENGINEER will establish the meeting place, time and date, distribute agenda, notify participants and administer the meeting. CONTRACTOR shall notify major Subcontractors.

C. Attendance:

1. ENGINEER
2. CONTRACTOR
3. Subcontractor as appropriate to the agenda.
4. Suppliers as appropriate to the agenda.
5. Others

D. Agenda:

1. Review minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Review field observations, problems, and conflicts.
4. Review problems which impede Construction Schedules.
5. Review of off-site fabrication, delivery schedules.
6. Review corrective measures and procedures to regain projected schedule.
7. Review revisions to Construction Schedules.
8. Review plan progress, schedule, during succeeding Work period.
9. Review coordination of schedules.
10. Review submittal schedules; expedite as required.
11. Review 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. Other business.

E. Minutes:

1. ENGINEER will prepare and distribute copies to participants and OWNER within seven (7) days of meeting for review at the next meeting.

**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 3300 Submittal Procedures

### Part 1 General

#### 1.01 Submittals - General

- A. CONTRACTOR shall submit Shop Drawings, product data, and Samples, as required by the individual Specification Sections, to ENGINEER for review in accordance with the provisions of paragraphs 6.19 through 6.20, inclusive, of the General Conditions.

#### 1.02 Progress Schedules

- A. CONTRACTOR shall submit two (2) copies of Progress Schedules indicating the starting and completion dates of the various stages of the Work and estimated payments during the next three (3) months to ENGINEER.
- B. Proposed Progress Schedules shall be submitted to ENGINEER prior to the preconstruction meeting. CONTRACTOR shall distribute copies of the Progress Schedules during the preconstruction meeting for discussion.
- C. Progress Schedules shall be updated by CONTRACTOR and submitted to ENGINEER, as a part of applications for progress payments, through completion of the Work. *Failure to update progress schedule may be the basis for rejection of applications for progress payments.*

#### 1.03 Shop Drawing Schedule

- A. CONTRACTOR shall submit two (2) copies of Shop Drawing Schedules indicating the individual items and submission dates to ENGINEER. A preliminary Schedule in accordance with the requirements in the General Conditions shall be submitted by CONTRACTOR prior to the preconstruction meeting. Copies of this preliminary Schedule shall be made available by CONTRACTOR during the preconstruction meeting. A final Schedule shall be submitted by CONTRACTOR at least ten (10) days prior to submitting the first Application for a Payment.

#### 1.04 Schedule of Values

- A. CONTRACTOR, if applicable, shall submit two (2) copies of Schedules of Value of the Work to ENGINEER. A preliminary Schedule of Values shall be submitted by CONTRACTOR prior to the preconstruction meeting. A final Schedule of Values, prepared in accordance with Paragraph 14.01 of the General Conditions and presented in sufficient detail to serve as the basis for payments during construction, shall be submitted to OWNER and ENGINEER for review and approval at least ten (10) days prior to submitting the first Application for Payment.

#### 1.05 Staking Schedule

- A. CONTRACTOR shall submit two (2) copies of the Staking Schedule, in accordance with the "Construction Layout" specification section prior to the Start of Construction. This Staking Schedule should be updated as outlined in the specifications and submitted by CONTRACTOR to ENGINEER through completion of the Work.

#### **1.06 Applications for Payment**

- A. CONTRACTOR shall submit Applications for Payment to ENGINEER in accordance with the provisions of Article 14 of the General Conditions. Applications for Payment shall be made on forms provided by or approved by the ENGINEER.
- B. Sample CONTRACTOR's Application/Declaration, Payment Schedule and ENGINEER's Certificate forms for this purpose are included in the Contract Documents. Copies of these forms, with Project specific information completed by the ENGINEER, will be given to the CONTRACTOR at the preconstruction meeting or, if applicable, after approval of the final Schedule of Values.
- C. CONTRACTOR shall submit a completed Payment Schedule with an executed Contractor's Application for Payment and Contractor's Declaration to ENGINEER not more often than once per month.
- D. CONTRACTOR shall also submit with each payment, beginning with the second payment request, the Sworn Statement (Section 00 06520) regarding partial waiver of liens.
- E. ENGINEER will certify payments with the use of ENGINEER's Certificate for Payment.

#### **1.07 Shop Drawings**

- A. Shop Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to Plan Sheet Number and Detail, and Specification Section Number and Page Number. A standard shop drawing submittal form will be provided by ENGINEER prior to the start of the Work.

#### **1.08 Product Data**

- A. Product data shall be presented in a clear and thorough manner identified the same as the Shop Drawings. Included with the information shall be performance characteristics and capacities depicting dimensions and clearances required.
- B. Manufacturer's standard schematic drawings and diagrams shall be modified to delete information which is not applicable to the Work. Manufacturer's standard information shall be supplemented to provide information specifically applicable to the Work.

#### **1.09 Samples**

- A. Samples shall be of sufficient size and quantity to clearly illustrate functional characteristics of the product with integrally related parts and attachment devices depicting full range of color, texture and pattern.

#### **1.10 Submission Requirements**

- A. CONTRACTOR shall make submittals in accordance with the approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other Contractor. No damages will be awarded or extension of time granted due to the Shop Drawing and product data review process.
- B. CONTRACTOR shall submit an entire package of Shop Drawings and product data information for major items of Work so that ENGINEER can review the package as a unit.

- C. The number of submittals required shall be one (1) digital copy in .pdf format, three (3) reproducible paper copies and three (3) prints per Shop Drawings and four (4) copies of each product data information sheet. Submittals shall contain the following information:
1. Field dimensions, clearly identified as such.
  2. Relation to adjacent or critical features of the Work or materials.
  3. Applicable standards, such as ASTM or Federal Specification Numbers.
  4. Identification of deviations from Contract Documents.
  5. Identification of revisions on resubmittals.
  6. CONTRACTOR's stamp indicating as a minimum the Project Title, Date of Submission, Date of Previous Submission, and Specification Section number.
    - a. CONTRACTOR's stamp shall be initialed or signed, certifying the CONTRACTOR's review and approval of submittal per General Conditions paragraph 6.20, verification of products, field measurements, field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
- D. ENGINEER shall affix a stamp and initials or signature and indicate confirmation or requirements for resubmittal. ENGINEER shall return to CONTRACTOR one (1) of the reproducibles and three (3) copies of the product data information for distribution or for resubmission.
- E. REVIEW SCHEDULE: The following review times are expected for prompt review so as not to delay the work:
1. First Submission- Return comments to CONTRACTOR within:
    - a. OWNER: Fourteen (14) consecutive calendar days from receipt of first submission.
    - b. ENGINEER: Fourteen (14) consecutive calendar days from receipt of first submission.
  2. Resubmission/Rejection-
    - a. CONTRACTOR: If first submission is returned with a rejected or revise and resubmit or if additional information is requested by the OWNER or ENGINEER, revise and return to the ENGINEER within fourteen (14) consecutive calendar days.
    - b. OWNER/ENGINEER: Review and provide comment to CONTRACTOR: Return to ENGINEER within seven (7) consecutive calendar days of the receipt of the resubmission or request for additional information.
  3. Additional (more than one (1)) Resubmission/Rejections of same shop drawing:
    - a. CONTRACTOR: Upon receipt from ENGINEER, provide updated shop drawings or additional information, as requested, within seven (7) consecutive calendar days.



### 1.11 Resubmission Requirements

- A. CONTRACTOR shall make all corrections or changes in the submittals required by ENGINEER and resubmit. CONTRACTOR shall indicate any changes which have been made other than those requested by ENGINEER.

### 1.12 Specification Section Requirements

- A. Miscellaneous schedules, field reports, test reports, affidavits, certificates, permits, agreements and other items identified in the Specification Sections, or as requested by ENGINEER shall be submitted to ENGINEER in duplicate. As a minimum, these submittals should be identified with the Project title, date of submission, and Specification section reference.

### 1.13 Manufacturer's Operation and Maintenance Data

- A. CONTRACTOR shall furnish one (1) digital file in .pdf format and four (4) copies of all operation and maintenance data required per the various Specification Sections. Prior to 50% completion of the Project, CONTRACTOR shall have submitted one (1) acceptable copy to ENGINEER for review.
- B. Operation and maintenance data shall be bound in a suitable number of 3-inch or 4-inch, 3-ring hard cover binders. Permanently imprinted on the cover shall be the words "Manufacturer's Operation and Maintenance Data", Project title, location of the Project, and the date. A table of contents shall be provided in the front of each binder to list the various sections in the manual.
- C. Information to be provided in each section of the manual, for each piece of equipment and project component shall include, but not be limited to, detailed equipment drawings; sections cut through all of the major equipment and subassemblies; installation and operational procedures; complete wiring and piping schematics; lubrication materials and procedures; maintenance procedures; and parts lists complete enough to permit identification of parts by nomenclature, manufacturer's part number and use.
- D. At the front of each section a maintenance schedule shall be provided for each piece of equipment in the section. The schedule shall display the daily, weekly, monthly, semi-annual, annual or fraction thereof, lubrication and preventative maintenance required in order to meet warranty conditions and the manufacturer's recommendations for optimum performance and life of the unit. A common schedule format is to be developed and used for all of the sections. Photocopies or reproductions of the manufacturer's literature will not be accepted.
- E. O&M Manual review schedule shall follow the same schedule as the shop drawings schedule in 1.10.E of this Specification Section, unless otherwise instructed by the ENGINEER.

### 1.14 Photographs

- A. Preconstruction Photographs:
  - 1. CONTRACTOR shall furnish ENGINEER with digital photos of each major project area, including staging areas and areas for ingress and egress of the Project site, to record the existing conditions of the Project areas prior to commencement of construction activities. OWNER shall have the authority to designate areas for which coverage may be added or omitted. Digital photos shall be taken prior to mobilization to the site and/or placement of materials

or equipment on the construction area and furnished one (1) week prior to the preconstruction meeting. Photos will be provided on disc.

B. Construction Photographs:

1. CONTRACTOR shall furnish to ENGINEER digital color photos of the construction progress on a disc. At a minimum, ten (10) photos of each main construction area, or areas directed by OWNER and/or ENGINEER, shall be taken. Digital photographs of all underground facilities are to be taken in sufficient detail to allow visual confirmation as to their locations. Each photo is to be numbered and each number is to correspond to a separate photo identification sheet, in Word format, included on the disc. The photo information shall include, at a minimum, the photo number, date taken and description of the photo view. CONTRACTOR shall submit the digital photographs monthly along with the Application for progress Payment as described in Article 14 of the General Conditions.

**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 4500 Quality Control

### Part 1 General

#### 1.01 General Requirements

- A. Sampling of materials will be made by CONTRACTOR in accordance with the methods designated by the Specifications. CONTRACTOR shall furnish such facilities as ENGINEER may require for collecting, storing, and forwarding samples to the CONTRACTORS Laboratory. CONTRACTOR in all cases shall furnish the required samples to OWNER without charge.

#### 1.02 Tests of Materials

- A. Materials in the Work shall meet the requirements of the Contract Documents.
- B. Tests of materials will be made as specified herein. ENGINEER shall have access to materials intended for use in the Work as well as to the plants where such materials are produced. Plant inspection may be made if the quantities are sufficient to warrant such inspection and if it is to the best interest of OWNER. In any case materials may be either inspected or tested when received on the Project.
- C. Materials shall not be used until approval has been received from ENGINEER. Approval of materials at the producing plant does not constitute a waiver of ENGINEER's right for re-examination at the Project site.
- D. Standards for testing materials, unless otherwise specified, shall be as established by the American Society for Testing and Materials (ASTM). Tests of materials will be made in accordance with the methods described or designated in the Specifications.
- E. Sampling and testing of materials not specifically mentioned shall be done by generally accepted methods, unless otherwise specified by ENGINEER.

#### 1.03 Certification of Materials

- A. At the request of ENGINEER, CONTRACTOR shall provide ENGINEER with certification that the various materials to be used conform to the standards referred to in the Contract Documents.

#### 1.04 Source Quality Control

- A. Testing identified in the Specifications as Source Quality Control, which is required to establish quality of materials, equipment or fabricated items, shall be paid for by CONTRACTOR.

#### 1.05 Inspector Days

- A. Resident Project Representative(s) will be assigned to the Project by ENGINEER, as necessary (in the opinion of ENGINEER) to adequately monitor CONTRACTOR's work. When multiple CONTRACTOR crews are working on the Project, multiple Resident Project Representatives may be assigned to the Project.

- B. If the quantity of Work under the Contract is changed, the number of "Inspector Days" shall be increased or decreased as determined by Article 10 or 11 of the General Conditions. This revision in the number of Inspector Days shall be agreed upon at the time the Contract quantities are revised.
- C. CONTRACTOR shall give ENGINEER at least 48 hours notice, exclusive of Saturdays, Sundays or holidays, when the Project requires an increase or decrease in the number of Resident Project Representatives.
  - 1. Failure to observe this requirement will either necessitate the charging of 4 hours show-up time if the Resident Project Representative appears on the Project, or the halting of all additional operations until a Resident Project Representative is available.
- D. Unless the Resident Project Representative is notified in advance, Inspector days will be charged when a Resident Project Representative appears on a project and CONTRACTOR decides not to work.
- E. A separate Inspector Day or a partial Inspector Day shall be charged for each and every Resident Project Representative working on a project for monitoring purposes.

**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 5000 Temporary Facilities and Controls

### Part 1 General

#### 1.01 Site Access and Parking

- A. CONTRACTOR shall 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. Access drives and parking areas shall be hard surfaced unless otherwise approved by ENGINEER.
- B. CONTRACTOR shall maintain driveways a minimum of 15 feet (5 m) wide between and around combustible materials in storage and mobilization areas.
- C. CONTRACTOR shall maintain traffic areas as free as possible of excavated materials, construction equipment, products, snow, ice, and debris.
- D. CONTRACTOR shall not utilize existing parking facilities for construction personnel or for CONTRACTOR's vehicles or equipment, unless written permission from owner of parking facility is obtained.

#### 1.02 Trucking Route and Public Road Maintenance

- A. Prior to the start of construction, CONTRACTOR shall submit for review a schedule and list indicating the streets and roads within the municipality that his equipment will use off the Project site.
- B. CONTRACTOR shall comply with all safety requirements, weight restrictions and speed limits.
- C. Paved streets shall be maintained in a reasonable state of cleanliness and CONTRACTOR shall remove accumulations of debris, dirt or mud caused by his operations. Removal shall be done in such a manner as to prevent the release of dust. This shall be done at least every day at the close of each day's operation or additionally when requested by ENGINEER.
- D. Roads or streets damaged by CONTRACTOR's operations, shall be repaired or removed and replaced to satisfactions of the agency having jurisdiction at no additional cost to the Project.
- E. In order to insure adequate street maintenance and restoration as outlined above, CONTRACTOR may be required to deposit with the Agency having jurisdiction a cash Road Protection Bond.
  - 1. This Bond, if required, will be held in escrow until final release is given by the Agency having jurisdiction. In the event CONTRACTOR fails or neglects to maintain or restore the streets to the satisfaction of the Agency having jurisdiction, the Agency having jurisdiction shall have the required maintenance or restoration work done and the cost incurred shall be deducted from the Road Protection Bond.
  - 2. At the completion of the Project, the Agency having jurisdiction shall return the Road Protection Bond less any monies expended by the Agency having jurisdiction and shall render to CONTRACTOR an accounting of all monies so expended.

- F. CONTRACTOR shall not store any equipment, supplies, construction material or excess excavated material on any roads or streets unless otherwise approved by ENGINEER.

### **1.03 Emergency Access**

- A. CONTRACTOR shall provide emergency access to property in the vicinity of the construction for police vehicles, fire equipment, ambulances or other emergency vehicles to protect life, health and property. Any areas damaged by emergency vehicles shall be restored by CONTRACTOR at no additional cost to OWNER.

### **1.04 Telephone**

- A. CONTRACTOR is required to provide telephone service for contacting emergency services. Such emergency telephone service shall also be available for the use of OWNER and ENGINEER whether or not a field office is required for the Project. Emergency phone numbers are required to be posted and copies provided to OWNER and ENGINEER.
- B. CONTRACTOR shall pay all costs for installation, maintenance and removal, and service charges for local calls to provide service for his construction site office as well as for ENGINEER's field office. Toll charges for calls relating to Project business shall be at CONTRACTOR'S expense.

### **1.05 Medical Services and First Aid**

- A. CONTRACTOR shall furnish first aid supplies and a person trained in first aid with a valid first aid certificate available for use of construction personnel including OWNER and ENGINEER. CONTRACTOR shall also furnish a communication system for contacting emergency services. Telephone numbers of the physician, hospital, or emergency services shall be conspicuously posted at the job site.

### **1.06 Bypass Pumping**

- A. CONTRACTOR shall maintain flow in existing sewers at all times by pumping, bypassing, or fluming as necessary. The average flow to be maintained is approximately 2.0 MGD, while the anticipated peak flow is approximately 9.4 MGD for the Monessen Pump Station and 0.75 MGD / 3.5 MGD respectively for the Donner Pump Station. During wet weather events, the flow in the sewer will rise rapidly and may become surcharged. CONTRACTOR shall maintain flow in such a manner as the existing flow can be adequately transported including wet weather flow. CONTRACTOR shall furnish, install, operate, and maintain temporary pumping facilities to service the upstream area including piping, temporary channels, pumps, sumps, controls, temporary plugs, and bulkheads.
- B. For sanitary sewerage, by-pass piping shall be PVC Schedule 80, ABS truss pipe, or equivalent with solvent welded joints, or HDPE with butt fused joints. Flexible hoses of whatever types are not acceptable. Bypassed flow shall be discharged to a sanitary sewer of acceptable size to handle the bypassed and existing flows. CONTRACTOR shall plan his operation such that there will be no backups, leaks, or discharges of pollutants.
- C. CONTRACTOR shall also furnish and have available, redundant pumping facilities in case of any failure of the pumping system including pumps, piping, electrical, connections, etc. Redundant pumping facilities also include having a backup power generator in case the primary power source fails. CONTRACTOR shall provide an adequate labor force, when required, to oversee the by-pass pumping including

providing labor to maintain 24 hour per day operation and emergency backup service.

- D. Costs for pumping and bypassing flow shall be included in the lump sum bid for other items of Work unless otherwise specified in the Proposal.
- E. CONTRACTOR shall submit a by-pass pumping/diversion scheme to OWNER and ENGINEER for approval not less than 15 days prior to any anticipated by-pass pumping/diversion. Bypass plan shall include pumping capacity and expected flow rates.

**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 5713 Temporary Erosion and Sediment Control

### Part 1 General

#### 1.01 Scope of Work

- A. This Section includes furnishing, installing, maintaining, and removing at project completion, Soil Erosion and Sedimentation Control devices. Devices include silt fence, straw bales, turbidity barriers, temporary gravel construction entrance/exits, inlet filters, ditch sediment traps, etc.

#### 1.02 Requirements of Regulatory Agencies

- A. CONTRACTOR, at his expense, shall secure all permits, and post all bonds or deposits required to comply with the accepted Erosion and Sediment Control Plan and the National Pollution Discharge Elimination System (NPDES) Rules for storm water discharges from construction activity.
- B. Comply with all requirements of the agency having jurisdiction. OWNER may withhold payment to CONTRACTOR equivalent to any fines resulting from non-compliance with applicable regulations.

#### 1.03 Performance Requirements

- A. Employ Best Management Practices as defined by standard EPA 832-R-92-005 and DEP Erosion and Sediment Pollution Control Manual.
- B. Put preventative measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- C. Control increased storm water runoff due to disturbance of surface cover due to construction activities for this Project. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall event that might occur in 10 years.
- D. Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this Project.
- E. Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this Project. Prevent windblown soil from leaving the project site. Comply with fugitive dust ordinances of agencies having jurisdiction. Prevent tracking or flowing of mud and sediment onto public or private roads, sidewalks or pavements outside of the site.
- F. Prevent sedimentation of waterways on or off the project site, including rivers, streams, lakes, ponds, open drainage ditches, storm sewers, and sanitary sewers. If sedimentation occurs, install or correct preventative measures immediately at no cost to OWNER. Comply with requirements of agencies having jurisdiction.
- G. Maintain temporary preventative measures until permanent measures have been established.



- H. If erosion or sedimentation occurs due to non-compliance with these requirements, remove deposited sediment or restore eroded areas at no cost to OWNER.

#### **1.04 Submittals**

- A. Submit schedule of Soil Erosion and Sedimentation Control activities to agency having jurisdiction. Include events (with days and/or dates of the various activities) for review and approval prior to obtaining a permit, if required.

## **Part 2 Products**

### **2.01 Straw Bales**

- A. Rectangular straw bales, 14 by 18-inch (355 mm x 457 mm) minimum, bound with wire or string along long dimension. Secure with wood stakes minimum 2 by 2-inch (50 mm x 50 mm) in cross section and length as required to securely fix position of bale.

### **2.02 Silt Fence**

- A. Polypropylene geotextile fabric, resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; meeting the following requirements:
1. Average Opening Size: 30 U.S. Std. Sieve (600  $\mu$ m), maximum; ASTM D4751.
  2. Permittivity: 0.05  $\text{sec}^{-1}$ , minimum; ASTM D4491.
  3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength; ASTM D4355 after 500 hours exposure.
  4. Tensile Strength: 100 lb-f (445 N) minimum, in cross-machine direction; 124 lb-f (551 N) minimum in machine direction; ASTM D4632
  5. Elongation: 15 to 30 percent; ASTM D4632.
  6. Tear Strength: 55 lb-f (244 N) minimum; ASTM D4533
- B. Posts shall be 2 by 2-inch (50 mm x 50 mm) cross section hardwood stakes, minimum 3-feet (1.0 m) long.

### **2.03 Turbidity Barrier**

- A. Geotextile fabric curtain suspended from flotation devices at the water surface and held in a vertical position by a ballast chain in the lower hem. Turbidity barrier curtain shall meet the following minimum requirements unless otherwise specified on the plans.
1. Consist of vinyl laminate on 1000 denier polyester fabric weighing 18 ounce per square yard (610  $\text{g}/\text{m}^2$ ) minimum.
  2. Tensile strength of fabric shall be 220 lbs (100 kg) minimum.

3. Edges of fabric to be reinforced with minimum 5/8-inch (16 mm) diameter polypropylene rope.
4. Ballast chain minimum 5/16-inch (8 mm) galvanized steel.
5. Buoyancy blocks providing buoyancy of 18lbs/l.f (27 kg/m).
6. Length of curtain (water depth) 5-feet (1.5 m).

#### **2.04 Dewatering Discharge Filter Bag**

- A. UV-stabilized, non-woven geotextile bag to filter sediment from water prior to discharging. Geotextile fabric shall meet the following minimum average roll requirements:
  1. Tensile Strength: 180 lb-f (200 N) minimum; ASTM D4632
  2. Elongation: 50 percent minimum; ASTM D4632
  3. Puncture Strength: 105 lb-f (667 N) minimum; ASTM D4833
  4. Mullen Burst: 350 psi (2413 kPa) minimum; ASTM D3786-87
  5. Trapezoidal Tear: 70 lb-f (310 N) minimum; ASTM D4533
  6. Flow Rate: 80 gal/min/sf. (54 l/s/m<sup>2</sup>) Minimum; ASTM D4491
  7. Permittivity: 1.4 sec<sup>-1</sup> minimum; ASTM D4491
  8. Apparent Opening Size: 100 U.S. Std. Sieve (150 µm) maximum; ASTM D4751
  9. UV-Stability: 70% retained strength; ASTM D4355 after 500 hours.

#### **2.05 Erosion Control Blankets**

- A. Machine produced blanket with a consistent thickness of evenly distributed straw or coconut fiber as specified. Unless otherwise specified on the Plans, the erosion control blanket shall have the following minimum properties:
  1. Double net 100% straw blanket
  2. Top and bottom photodegradable polypropylene netting, 1.64 lbs./ 1,000 sft. (0.8 kg/ m<sup>2</sup>) approximate weight.
  3. 100% agricultural straw 0.5 lbs. / sy. (.27 kg/m<sup>2</sup>)
  4. Stitch spacing: 1.5 inches (40 mm) on centers
- B. Pegs shall be 6-inch (150 mm) long, hardwood pegs.

#### **2.06 Bonded Fiber Matrix**

- A. Bonded fiber matrix (BFM) shall consist of long strand, residual, softwood fibers joined together by a high-strength, non toxic adhesive. The BFM shall be 100% biodegradable,

and be non toxic to fish, wildlife, and humans. Upon drying the matrix shall form a high strength, porous and erosion resistant mat that shall not inhibit the germination and growth of plants. The BFM shall retain its form despite re-wetting.

- B. Bonded fiber matrix shall consist of:
  - 1. Seed and Fertilizer per Section 32 9219, Seeding.
  - 2. Wood Fiber Mulch - Thermo-mechanically defibrated long, softwood fibers manufactured from select northern softwood wood chips.
  - 3. Polyacrylamide Binder - Site specific, fully biodegradable, polyacrylamides (PAM's) binders, with cross-linking long organic jute fibers
- C. Materials shall be mixed at the rate of 80 lbs/acre (90 kg/Ha) of PAM binder and 2500 lbs/acre (2800 kg/Ha) of wood fiber mulch.

## 2.07 Inlet Filter Fabric

- A. The filter fabric shall be constructed of 100% continuous polyester needle-punched non-woven engineering fabric and follow the guidelines in the American Society for Testing and Materials (ASTM) D1117-99; Standard Guide for Evaluating Nonwoven Fabrics. The filter fabric shall be fabricated to provide a direct fit with the drainage structure cover. The filter fabric shall have the following minimum physical properties:
  - 1. Tensile Strength: 80 lb-f (.355 kN) minimum; ASTM D4632
  - 2. Elongation: 50 percent minimum; ASTM D4632
  - 3. Puncture Strength: 45 lb-f (200 kN) minimum; ASTM D4833
  - 4. Mullen Burst: 350 psi (2413 kPa) minimum; ASTM D3786-87
  - 5. Trapezoidal Tear: 70 lb-f (310 N) minimum; ASTM D4533
  - 6. Flow Rate: 80 gal/min/sf. (54 l/s/m<sup>2</sup>) Minimum; ASTM D4491
  - 7. Permittivity: 1.4 sec<sup>-1</sup> minimum; ASTM D4491
  - 8. Apparent Opening Size: 100 U.S. Std. Sieve (150 µm) maximum; ASTM D4751
  - 9. UV-Stability: 70% retained strength; ASTM D4355 after 500 hours.

## 2.08 Acceptable Manufacturers

- A. Acceptable manufacturers include the following:
  - 1. Turbidity Barrier: Tough Guy Type II by Aer-flo Canvas Products, Inc.
  - 2. Wood Fiber Mulch: EcoFibre by Canfor Corporation.
  - 3. Polyacrylamide Binder: HydroTurboNet by Straw Net, Inc.

## **Part 3 Execution**

### **3.01 Examination**

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to the greatest extent possible.
- B. Except in areas to be cleared, do not remove, cut, deface, injure or destroy trees or shrubs without ENGINEER's approval.
- C. Protect existing trees or shrubs that are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations, with suitable fences or other means as approved by ENGINEER.

### **3.02 Preparation**

- A. Schedule work so that the soil surfaces are left exposed for the minimum amount of time. Place permanent soil and sedimentation control measures as soon as practical.

### **3.03 General**

- A. Do not discharge excavation ground water to the sanitary sewer, storm sewer, or to rivers, streams, etc. without authorization from the agency having jurisdiction. Construction site runoff will be prevented from entering any storm drain, river, stream, etc. directly by the use of silt fence, or other suitable methods. CONTRACTOR shall provide erosion protection of surrounding soils.
- B. Sedimentation control devices shall be installed prior to CONTRACTOR beginning Work. All Soil Erosion and Sedimentation Control Devices shall be maintained in an effective functioning condition at all times during the course of the Work.
- C. Immediately bring earthwork to final grade and protect sideslopes and backslopes from erosion. Plan and conduct earthwork to minimize duration of exposure of unprotected soils.

### **3.04 Dust Control**

- A. Keep dust down at all times, including during non-working periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming is not permitted.

### **3.05 Installation - General**

- A. Install silt fences, ditch sediment traps, check dams, inlet filters, temporary gravel construction entrance/exits, turbidity barriers, erosion control blankets and other soil erosion control devices as detailed on the plans.
- B. Maintain devices until permanent control measures are completed and effectively established.
- C. Remove and replace temporary control devices if they become ineffective at no additional cost to the OWNER.

- D. Install temporary erosion and sedimentation control devices per the manufacturer's recommendations. Advise ENGINEER of any discrepancies between the manufacturer's recommendations and the details on the plans and install per ENGINEER's resolution of discrepancy.

### **3.06 Maintenance**

- A. Inspect preventative measures a minimum of once per week and within a minimum of 24 hours after every rainfall. Any soil erosion control measures damaged or rendered ineffective shall be immediately repaired or removed and replaced at no additional cost.

### **3.07 Installation of Erosion Control Blankets**

- A. Erosion control blankets shall be pegged at the pattern and rate as recommended by the manufacturer, however, at a minimum, blankets shall be pegged at the rate of 1.75 pegs per square yard (2 pegs/m<sup>2</sup>) of blanket, unless otherwise indicated on the plans.

### **3.08 Application of Bonded Fiber Matrix**

- A. The slope shall be prepared and graded prior to application of bonded fiber matrix (BFM). Mixture of wood fiber mulch and polyacrylamide binder shall be blended, with the appropriate amount of seed and fertilizer per Section 32 9219, Seeding, according to manufacturer's recommendations.
- B. The BFM shall be hydraulically applied to the soil as a viscous mixture, creating a continuous, three-dimensional blanket that adheres to the soil surface. The BFM shall be mixed and applied at the rate as specified in Article 2.06 unless otherwise indicated on the Plans. The resulting coverage must be at least 1/8 inch (3 mm) thick over the entire surface area. The BFM shall be applied in two applications from alternate directions to eliminate shadowing, and shall be applied when no rain is expected for 12 hours.

### **3.09 Dewatering Discharge**

- A. Should it be necessary for CONTRACTOR to do any dewatering during the course of construction, CONTRACTOR shall filter all discharge through a discharge filter bag or other sediment control device that will filter all discharge water. No dewatering discharge shall be allowed to flow unfiltered from the construction site.

### **3.10 Project Completion**

- A. Remove temporary soil erosion and sedimentation control devices as soon as permanent measures have been established.

End of Section

## Section 01 6000 Product Requirements

### Part 1 General

#### 1.01 Transportation and Handling

- A. CONTRACTOR shall provide for expeditious transportation and delivery of materials and equipment to the Project site in an undamaged condition and on a schedule to avoid delay of the Work. Materials and equipment shall be delivered in original containers or packaging with identifying labels intact and legible.
- B. CONTRACTOR shall provide equipment and personnel at the site to unload and handle materials and equipment in a manner to avoid damage. Materials and equipment shall be handled only at designated lifting points by methods to prevent bending or overstressing.

#### 1.02 Storage and Protection

- A. CONTRACTOR shall store materials and equipment immediately on delivery and protect it until installed in the Work.
- B. Products subject to damage by elements shall be stored in weather-tight enclosures with temperature and humidity ranges as required by manufacturer's instructions.
- C. Loose granular materials shall be stored on solid surfaces to prevent mixing with foreign matter.
- D. The place of storage shall be located so as to minimize interference with traffic and to provide easy access for inspection. No material shall be stored closer than five (5) feet (1.5 m) to the edge of a pavement or traveled way open to the public.
- E. Materials that have been stored shall be subject to retest and shall meet the requirements of their respective specifications at the time they are to be used in the Work.
- F. CONTRACTOR shall provide protection of stored or installed materials and equipment as necessary to prevent damage from traffic and subsequent operations.
- G. Location of staging and storage areas will be developed and coordinated with OWNER so that the location of these areas does not interfere with the daily operations of OWNER's facilities.

#### 1.03 Manufacturer's Instructions

- A. When the Contract Documents require that installation of Work shall comply with manufacturer's instructions, CONTRACTOR shall obtain and distribute copies of such instructions to parties involved in the installation including two (2) copies to ENGINEER. CONTRACTOR shall handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements. Should Project conditions or specified requirements conflict with manufacturer's instructions, consult with ENGINEER for further instructions.

#### **1.04 Products List**

- A. Within four (4) days of request, CONTRACTOR shall submit a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor, if applicable, to ENGINEER.

#### **1.05 CONTRACTOR's Product Options**

- A. For products specified only by reference standard, CONTRACTOR shall select any product meeting that standard.
- B. For products specified by naming several products or manufacturer's CONTRACTOR shall select any one of the products or manufacturers named, which complies with the specifications.
- C. For products specified by naming one or more products or manufacturers and "or equal," CONTRACTOR must submit a Substitution Request Form for any product or manufacturer not specifically named, in accordance with paragraph 6.04 of the General Conditions.
- D. For products specified by naming only one product and manufacturer, there is no option.

#### **Part 2 Products (Not Used)**

#### **Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 7300 Operation and Maintenance Manuals

### Part 1 General

#### 1.01 Summary

- A. Section Includes: Requirements related to CONTRACTOR'S responsibility for submission of operation and maintenance manuals.
- B. Related Sections:
  - 1. Site Construction Performance Requirements: Section 01 8900.
- C. The general or particular section of the Specification covering the equipment states whether an operation and maintenance manual is required for the piece of equipment.

#### 1.02 Submittals

- A. Submit to ENGINEER for review and approval, five copies of manuals prepared by manufacturer/supplier or CONTRACTOR within eight weeks following receipt of approved Shop Drawings, but not later than six (6) weeks prior to confirming Site Construction Performance Requirements, as described in Section 01 8900. Additionally, submit to ENGINEER a digital copy of all manuals.
- B. Submission and approval of each set of manuals is considered an integral part of furnishing and installing respective equipment or system. Measurement for payment of equipment requiring an Operation and Maintenance Manual will not exceed 92 percent until Operation and Maintenance Manual meets requirements of Contract Documents.
- C. Submit all Operation and Maintenance Manuals relating to a particular process or system as one submittal package. Incomplete or inadequate manuals will be returned to CONTRACTOR for correction and resubmission.
- D. Contents:
  - 1. Table of contents and index.
  - 2. Brief description of each system and components.
  - 3. Erection or installation instructions.
  - 4. Starting and stopping procedures.
  - 5. Recommended and alternative procedures.
  - 6. Special operating instructions.
  - 7. Detailed maintenance procedures.
  - 8. Detailed schedule of preventive maintenance requirements (daily, weekly, monthly, quarterly, semiannually, annually, etc.).
  - 9. Schedule of lubrication requirements (where applicable).
  - 10. Manufacturer's printed operating and maintenance instructions.
  - 11. One copy of each wiring diagram (where applicable).
  - 12. One approved copy of each shop drawing and each CONTRACTOR'S coordination and layout drawing.
  - 13. Schedule of recommended spare parts to be stocked, complete with part number, inventory, quantity, and ordering information.
  - 14. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.
- E. Material:
  - 1. Loose leaf on 20 pound minimum, white, punched paper.
  - 2. Holes reinforced with plastic cloth or metal.
  - 3. Page size, 8-1/2 inches by 11 inches.
  - 4. Diagrams and illustrations, attached foldouts as required.
  - 5. Original quality, reproducible.
  - 6. Oil, moisture, and wear resistant covers 9 inches by 12 inches in size.



**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 7700 Closeout Procedures

### Part 1 General

#### 1.01 Cleaning

- A. CONTRACTOR shall perform periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and wind-blown debris, resulting from construction operations.
- B. Waste material, debris and rubbish shall be periodically removed from the site and disposed of at legal disposal areas away from the site.
- C. Prior to OWNER acceptance CONTRACTOR shall conduct an inspection of sight-exposed interior and exterior surfaces, and all Work areas, to verify that the entire Work is clean.
- D. CONTRACTOR shall broom clean exterior paved surfaces and rake clean other exterior surfaces of the site.

#### 1.02 Project Record Documents

- A. CONTRACTOR shall deliver one (1) copy of all Specifications, Plans, Addenda, Shop Drawings and Samples, annotated to show all changes made during the construction process, to ENGINEER upon completion of the Work. Submittal of the record documents shall be made with a transmittal letter containing:
  - 1. Date
  - 2. Project Title and Number
  - 3. CONTRACTOR's Name and Address
  - 4. Title and Number of each Record Document
  - 5. Certification that each Document as submitted is complete and accurate
  - 6. Documents shall be submitted in good order and in a legible condition.

#### 1.03 Operation and Maintenance Data

- A. Prior to final inspection or acceptance, CONTRACTOR shall fully instruct OWNER's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems specified.
- B. Operation and maintenance data required by the individual Specification sections and the manufacturer's operation and maintenance data required in Section 01 3300, Submittal Procedures, shall constitute the basis of such instruction.

#### 1.04 Start Up

- A. CONTRACTOR shall coordinate efforts between OWNER, ENGINEER, any equipment manufacturers, subcontractors and governing agencies in the start up of applicable portions of the Work.

#### 1.05 Substantial Completion

- A. Certification that the Work is substantially complete shall be in accordance with paragraph 14.07 of the General Conditions.

**1.06 Final Payment and Acceptance**

- A. The final inspection, final application for payment and acceptance shall be in accordance with paragraphs 14.09 thru 14.13 of the General Conditions.

**Part 2 Products (Not Used)**

**Part 3 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 7890 Project Record Documents

### Part 1 General

#### 1.01 Summary

- A. Section Includes: General requirements for maintaining a record copy of Contract Documents.

#### 1.02 Record Drawings

- A. Keep one record copy of Contract Documents, reference documents, and technical submittals on site, in order and annotated to show all changes made during the construction process. Keep annotations current. Make record copies available to ENGINEER during life of Project.
  - 1. At completion of Project and before final payment is made, furnish ENGINEER one set of reproducible documents reflecting all changes described. Record drawings to include changes made to locations of buried and exposed piping, equipment changes, substitution and variations from Contract Documents. Upon request, Owner will provide one set of copies of original Contract Drawings, at cost to CONTRACTOR.

### Part 2 Products (Not Used)

### Part 3 Execution (Not Used)

End of Section

Not To Be Used For Bidding Purposes

## Section 01 8200 Startup and Training

### Part 1 General

#### 1.01 Summary

- A. Section Includes:
  - 1. Requirements and procedures for equipment startup and the training of OWNER'S personnel in the operation and maintenance indicated to require demonstration and training in applicable Specification Sections of Divisions 11, 26, and 40.
- B. Related Sections
  - 1. Division 11: Equipment
  - 2. Division 26: Electrical
  - 3. Division 40: Process
- C. Payment Procedures: Include in the Lump Sum Bid every expense associated with the manufacturer's start-up and training services.

#### 1.02 Definitions

- A. Manday: An onsite eight-hour day coinciding with the OWNER's work day hours time period and work days schedule. The manday shall also include every expense associated with the manufacturer providing its qualified and authorized representative onsite.

#### 1.03 Quality Assurance

- A. Qualifications:
  - 1. Instructors: Employ qualified instructors familiar with the design, operation, maintenance, and troubleshooting of the relevant products and systems provided under this Contract.

#### 1.04 Manufacturer's Field Services

- A. Have equipment manufacturer provide a factory-trained engineer for seeing that equipment is properly installed, for supervising startup of equipment and instructing operating personnel.
  - 1. The equipment manufacturer's services shall consist of furnishing detailed instructions to personnel of the OWNER regarding equipment operation and maintenance (after personnel of the OWNER have had an opportunity to become familiar with the equipment) and making minor adjustments to the equipment if appropriate.
- B. Furnish services of equipment manufacturer's representatives for a minimum of 8 hours per day for periods as indicated in the various Specification Sections of Divisions 11, 26, and 40.
  - 1. Time Periods:
    - a. Initial Operation: Provide specified number of mandays for equipment inspection, installation, certification, start-up, and corrective adjustments.
    - b. Initial Mechanical Performance Test (IMPT): Provide specified number of mandays for operation during the IMPT.

- c. Training: Provide specified number of mandays, pursuant to satisfactory completion of the IMPT, for classroom training and for hands-on training of OWNER personnel.
  - (1) Training to include, but not be limited to the following:
    - (a) Start-up and shut-down procedures.
    - (b) Equipment adjustments.
    - (c) Troubleshooting.
    - (d) Review of the equipment Operation and Maintenance Manual. This portion of the training is to include classroom instruction, along with detailed discussions of the components and subsystems equipment.
    - (e) Supervision of OWNER operating personnel during total system operation.
    - (f) Preventive maintenance scheduling and procedures.
  - d. Final Mechanical Performance Test (FMPT): Provide specified number of mandays for satisfactory completion of the FMPT.
- 2. The listing of the number of days service of factory-trained manufacturer's representative for specific equipment in each of the Specification Sections does not relieve CONTRACTOR of providing sufficient service to place equipment in satisfactory operation, as determined by ENGINEER.

**Part 1 Products (Not Used)**

**Part 2 Execution (Not Used)**

End of Section

Not To Be Used For Bidding Purposes

## Section 01 8900 Site Construction Performance Requirements

### Part 1 General

#### 1.01 Scope of Work

- A. This Section includes general performance requirements for earthwork complete with reimbursement for crop damage, removal and disposal of structures and obstructions, protection of existing sewers, tiles and mains; protection of existing building and improvements, protection of trees and other types of vegetation, protection of utility lines, requirements for pavement replacement, restoration of driveways and parking areas, restoration of sidewalks, restoration of lawns and disturbed areas, transportation, and disposal of excess excavation.

#### 1.02 Related Work Specified Elsewhere

- A. Section 01 5713: Temporary Erosion and Sediment Control
- B. Section 31 2316: Structural Excavation and Backfill
- C. Section 31 2319: Dewatering
- D. Section 32 9219: Seeding

#### 1.03 Reference Standards

- A. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:
  - 1. PennDOT - Pennsylvania Department of Transportation, Pub 408 Construction Specifications, latest edition.

#### 1.04 Requirements of Regulatory Agencies

- A. CONTRACTOR shall comply with Pennsylvania One Call System (Pennsylvania811) prior to working on site.
- B. CONTRACTOR shall comply with Section 01 5713, Temporary Erosion and Sediment Control. CONTRACTOR, at his expense, shall secure all permits, and post all bonds or deposits required to comply with those requirements.
- C. CONTRACTOR shall comply with all requirements of the National Pollutant Discharge Elimination System (NPDES) Storm Water Program for Construction Activities.
- D. CONTRACTOR shall provide, maintain and remove such temporary and/or permanent soil erosion and sedimentation control measures as specified on the Plans or as determined by ENGINEER.
  - 1. Measures shall prevent surface runoff from carrying excavated materials into the waterways, to reduce erosion of the slopes, and to prevent silting in of waterways downstream of the Work.
  - 2. Measures should include provisions to reduce erosion by the wind of all areas stripped of vegetation, including material stockpiles.

### **1.05 Submittals**

- A. Written permission for the use of all disposal and borrow sites shall be obtained and copies shall be furnished to ENGINEER.

### **1.06 Protection of Plant Life**

- A. Trees, shrubs, and other types of vegetation not within the limits of the Work or not designated on the Plans or by ENGINEER to be removed, shall be carefully protected from damage or injury during the various construction operations.
- B. Any tree, shrub or other type of vegetation not designated to be removed but which is damaged by CONTRACTOR's operation shall be repaired or replaced by CONTRACTOR, at his expense, as determined by ENGINEER.

### **1.07 Protection of Existing Structures and Improvements**

- A. Existing culverts, sewers, drainage structures, manholes, water gate wells, hydrants, water mains, utility poles, overhead lines, underground conduits, underground cables, pavement, or other types of improvements within the construction limits, not designated on the Plans to be removed, shall be carefully protected from damage during the construction operations.
- B. Existing structure or improvement not designated to be removed, but which is damaged by CONTRACTOR's operations shall be repaired or replaced by the CONTRACTOR, to the satisfaction of the owner, at his expense.
- C. Deposits of dirt or debris in sewers, culverts, tiles, drainage structures, manholes, gate wells, etc. caused by CONTRACTOR shall be cleaned out at the CONTRACTOR's expense.

### **1.08 Maintaining Drainage**

- A. Existing open drains, field and roadway ditches, drainage tile, sewers, enclosed drains, natural and artificial watercourses, surface drainage or any other types of drainage within the limits of the Work shall be maintained and free to discharge during construction.
- B. Drainage facility not designated to be abandoned, but which is damaged, or any drainage interrupted by the CONTRACTOR's operation shall be immediately repaired, replaced, or cleared by the CONTRACTOR.
- C. Costs incurred shall be incidental to the excavating, backfilling and compacting or grading operations.

## **Part 2 Products**

### **2.01 Granular Material**

- A. Natural Sand conforming to the requirements for Fine Aggregate Type A as specified in PennDOT, Section 703.1.



## **2.02 Aggregate for Shoulders, Parking Areas, Driveways or Roads**

- A. Crushed Limestone, Natural Aggregate or Slag meeting the requirements of Driving Surface Aggregate (DSA), as specified by Dirt and Gravel Roads Maintenance Program, Penn State University.

## **Part 3 Execution**

### **3.01 Dewatering**

- A. Area within the vicinity of the new Work shall be dewatered prior to commencing any construction activities. The depth of the dewatering shall be sufficient to allow the Work area to remain in a dry condition during the various construction operations.
- B. Costs incurred for furnishing, installing, maintaining and removing the dewatering equipment shall be at CONTRACTOR's expense.
- C. Refer to Section 31 2319, Dewatering, for additional requirements.

### **3.02 General**

- A. Various construction operations shall be restricted to the existing right-of-way or the areas indicated on the Plans. If CONTRACTOR requires additional area, CONTRACTOR shall furnish the ENGINEER with written permission obtained from the property owner for any part of the operations he conducts outside of the right-of-way or limits indicated.

### **3.03 Existing Improvements**

- A. CONTRACTOR shall expose existing sewers and structures to which the new Work is to be connected and notify ENGINEER of same. ENGINEER will verify the vertical and horizontal locations of the existing system and shall inform CONTRACTOR as to the necessary adjustments required to align the new Work with the existing system.

### **3.04 Existing Utilities**

- A. When existing utilities are shown on the Plans, their locations are approximate only, as secured in the field investigation and/or from available public records. CONTRACTOR, prior to the start of construction, shall contact Pennsylvania One Call System and the public agency or utility having jurisdiction to request the verification of all utilities within the construction area.
- B. When existing utility lines, structures or utility poles are encountered during the performance of the Work, CONTRACTOR, at his expense, shall perform his operations in such a manner that the service will be uninterrupted.
- C. CONTRACTOR shall expose all existing utility lines prior to any excavation operation, to determine any conflict with the proposed improvement. CONTRACTOR shall be responsible for any relocation required as a result of any conflict of existing utilities shown on the plans, with the proposed improvement.
- D. Should it become necessary to move any utility structure, line or pole shown on the Plans or otherwise found necessary to be moved, CONTRACTOR shall make all arrangements with OWNER of the utility for the moving. Costs incurred for such moving shall be at CONTRACTOR's expense unless indicated otherwise. However,

before disturbing a utility line, structure or pole, CONTRACTOR shall furnish ENGINEER with satisfactory evidence, in writing, that proper arrangements have been made with the owner of the utility.

### **3.05 Utility Poles**

- A. CONTRACTOR shall be responsible for any removal or relocation required as a result of any conflict of existing utility poles (including street light poles, guy poles, telephone poles, etc.) with proposed improvements.
- B. CONTRACTOR shall make all arrangements for removing or relocating utility poles with the owner of the utility pole.
- C. Prior to disturbing any utility pole, CONTRACTOR shall provide ENGINEER with written evidence that proper arrangements have been made with the owner of the utility pole.
- D. When required by the Work, CONTRACTOR shall temporarily support poles in the vicinity of the Work at no additional cost to OWNER. Support shall be in accordance with and to the satisfaction of the utility company.

### **3.06 Existing Sewers, Tile, and Mains**

- A. Existing sanitary sewers, storm sewers, drain tile, septic tank bed tiles, water mains or building services or leads, that are encountered during the performance of the Work that require relocation or are damaged, shall be restored with new materials equal in quality and type to the materials encountered.
- B. New material shall be installed as specified in the Contract Documents and per the requirements of the local agencies. Bedding and backfill material, unless otherwise specified, shall be an approved granular material, compacted to 98% of its maximum unit weight.
- C. Seepage bed tile and water mains shall be replaced in accordance with the requirement of the agency having jurisdiction.
- D. Relocation or protection of existing sewers, tiles, tile field, water mains or building services and leads shall be at CONTRACTOR's expense, unless otherwise indicated in the Contract Documents.

### **3.07 Existing Structures**

- A. Existing surface and subsurface structures may be shown on the Plans, in locations considered most probable from information secured in the field investigation or from available public records.
- B. Neither the correctness nor completeness of such information is guaranteed or implied.
- C. Structures shall be protected, preserved or restored by CONTRACTOR, to the satisfaction of the structure owner, at no additional cost to the Project.

### **3.08 Existing Buildings**

- A. Existing buildings or structures may be encountered throughout the Project within limits of the presently established right-of-way or easement. Good construction methods

and procedures shall be employed by CONTRACTOR, at his expense, to protect the structures.

### **3.09 Removal of Sewers and Culverts**

- A. Unless otherwise specified in the Contract Documents, CONTRACTOR, at his expense, shall remove any abandoned culvert, pipe, sewer, structure or part of a structure which is to be replaced or rendered useless by the new construction.
- B. When a sewer or culvert is removed at a structure, CONTRACTOR shall install a masonry bulkhead in the structure.
- C. Removal of a culvert or sewer also includes the removal and disposal of end treatments or headwalls.

### **3.10 Removal of Structures**

- A. Removal of existing structures shall consist of removing and salvaging the existing frame and cover. The ends of the existing pipe shall be plugged and braced. The complete structure shall be removed entirely and disposed of. The excavation shall be backfilled with sand and compacted to 98% of its maximum unit weight. Maximum unit weight shall be determined by ASTM D698, Method B.
- B. If a structure is to be removed from a system that is to remain in service, a bypass system, approved by ENGINEER, shall be installed and maintained by the CONTRACTOR, during the rebuilding period.

### **3.11 Abandoning Structures**

- A. Structure shall be broken down to at least 36 inches (9050 mm) below the subgrade.
- B. Pipes connected to the structure shall be plugged with a brick, masonry or concrete bulkhead approved by ENGINEER.
- C. Structure shall be backfilled with flowable fill to 1-foot (300 mm) above the pipes and the remainder of the structure backfilled with sand-cement mixture at a 10 to 1 ratio to subgrade elevation or to 1-foot (300 mm) below finished grade.
- D. The remainder of the excavation shall be backfilled with a granular material, compacted to 98% of its unit weight, and shall meet with the approval of ENGINEER.
- E. Maximum unit weight shall be determined by ASTM D698, Method B.

### **3.12 Salvaged Material**

- A. Salvaged materials shall become the property of OWNER unless otherwise specified in the Contract Documents and shall be transported to a designated site on OWNER'S property or disposed of by CONTRACTOR, at his expense.

### **3.13 Trees**

- A. Trees excepting those specified on the Plans to be removed, shall be effectively protected by CONTRACTOR during his construction operations.

1. If in the opinion of ENGINEER, the methods of protection employed by CONTRACTOR are not adequate, CONTRACTOR shall carry on his operation by tunneling, or by other approved means, which will not cause undue damage to the trees.
- B. The requirements for tree tunneling are as follows:
  1. Depth of Cover:
    - a. Tunnels shall be placed at a minimum depth of 30 inches (0.75 m), measured from the ground surface to the top of the tunnel.
  2. Length of Tunnel:
    - a. Tunnel length in feet (meters) shall be in direct proportion to diameter of tree in inches (millimeters) for trees eight (8) inches (200 mm) or larger in diameter. One (1) foot of tunnel shall be constructed for each inch of tree diameter whenever the trench or any portion thereof approaches the tree trunk a distance in feet equal to one-half the tree diameter in inches. (Or one (1) meter of tunnel shall be constructed for every one hundred millimeters (100 mm) of tree diameter whenever any portion of the trench approaches the tree trunk a distance in meters equal to 1/200 of the tree diameter in millimeters).
    - b. Example: A tree 12 inches in diameter shall require a 12-foot tunnel whenever the trench or any portion thereof approaches within six (6) feet of said tree. (A tree 300 mm in diameter shall require a 3 m tunnel whenever any portion of the trench approaches within 1.5m of the tree trunk).
  3. Measurements:
    - a. Trees under eight inches (200 mm) in diameter will require the same length of tunnel as 8-inch (200 mm) trees. Measurements of tree diameters shall be taken four (4) feet (1 m) above the ground surface.
- C. Where the Plans indicate areas allowing the cutting of minor trees, care should be used to keep damage to adjacent trees to an absolute minimum. Where these areas are specifically indicated on the Plan, they are to be cleared and all trunks and branches shall be disposed of by CONTRACTOR. Debris shall not be bulldozed on to adjacent private property.
- D. Trees damaged by the construction operation shall be repaired so not to inhibit growth or replaced at the expense of CONTRACTOR. Repair or replacement shall be contingent upon agreement between the damaged tree owner and CONTRACTOR. In any event, limbs, branches and roots damaged by CONTRACTOR shall be properly pruned to the satisfaction of ENGINEER.
- E. Costs incurred for protection of trees, including tunneling, repair and replacement, if necessary, shall be at CONTRACTOR's expense.

### **3.14 Remove and Replace Tree**

- A. Tree removal and replacement may be accomplished in two ways:

1. CONTRACTOR may completely remove and dispose of the existing trees, and after the new improvement has been completed, tested, accepted and rough grading has been completed, CONTRACTOR shall plant new trees, in approximately the same location as the existing trees, of size and species per the following (existing trees to be replaced with like specie):
    - a. "Acer Rubrum" October Glory Red Maple, 2 ½-inch (65 mm) B&B (min)
    - b. "Fraxinus Americana" Autumn Applause White Ash, 2 ½-inch (65 mm) B&B (min)
    - c. "Malus Centzam" Centzam Crabapple, 2-inch (50 mm) B&B (min)
    - d. "Crataegus Phaenaopyrum" Washington Hawthorn, 8-foot (2.4 m) B&B (min)
    - e. "Pinus Nigra" Austrian Pine, 6-foot (1.8m) B&B (min)
    - f. "Picea Pungens" Colorado Spruce, 5-foot (1.5 m) B&B (min)
    - g. "Quercus Rubra" Red Oak, 2 ½-inch (65 mm) B&B (min)
    - h. "Pyrus Calleryana" Redspire Pear, 2-inch (50 mm) B&B (min)
  2. CONTRACTOR may remove and preserve the existing trees.
    - a. The trees shall be properly cared for and maintained in a healthy condition.
    - b. After the new improvement has been installed, tested, accepted and rough grading completed, the trees shall be replanted in approximately the same location. Any trees damaged, destroyed or which die, shall be replaced at no additional cost.
- B. Trees, whether replanted or planted new, shall be guaranteed for a period of two years from the date of substantial completion.

### 3.15 Removing Pavement

- A. Removal of concrete and bituminous pavement as called for on the Plans shall consist of removing and disposing of pavement and shall include base courses, surface courses, integral and separate curbs, integral and separate curb and gutters, sidewalks and end headers.
- B. Pavement shall be removed to an existing joint or cut parallel to the existing pavement joints.
- C. Cutting shall be accomplished by using a power-driven concrete saw approved by ENGINEER. Depth of the saw cut shall be a minimum of six (6) inches (150 mm), to insure that the removal of the old pavement will not disturb or damage the section of pavement remaining in place.

- D. Residual concrete pavement shall not be less than five feet (1.5 m) measured transversely, nor less than six feet (1.8 m) longitudinally measured from a joint.
- E. In removing a concrete base course, where part of the existing bituminous surface is to remain in place, the bituminous surface shall be cut the full depth by the use of a power-driven saw, approved by ENGINEER along a line parallel to and at least one foot (300 mm) from either side of the base course removal.
- F. Old pavement with a concrete cap shall be considered as only one (1) pavement, whether or not there is a separation layer of earth, aggregate, or bituminous material between the old material and the concrete cap.
1. Removal of Curb for Curb Drop:
    - a. Where curb is to be removed for a curb drop, the operation shall be performed by saw cutting or by cold milling, approved by ENGINEER, so as to leave a neat surface with a maximum 1-inch lip, without damage to the underlying pavement.
  2. Removal of Curb and Gutter:
    - a. Where curb and gutter are to be removed, the operation shall be performed by saw cutting. The limits of the removal shall be as called for on the Plans, or as approved by ENGINEER. However, in no case shall the width of removal be less than 18 inches (450 mm) for sections with rolled or straight curb or less than 24 inches (600 mm) for mountable curbs.
- G. If during the pavement removal operation any concrete or bituminous pavement or surfacing is damaged beyond the removal limits designated, the damaged pavement or surfacing shall be removed and replaced at CONTRACTOR's expense.
- H. Earth which may be removed during the pavement removal operation shall be replaced by backfilling to the proposed subgrade with a suitable material, approved by ENGINEER, at CONTRACTOR's expense.

### 3.16 Guiderail

- A. Beam guiderail shall be relocated or shall be removed as specified on the Plans or as determined by ENGINEER. If any of the existing material is damaged or destroyed, CONTRACTOR shall replace the material at his expense.
- B. Where guiderail is encountered during construction, and its removal was not called for on the Plans, it shall be replaced or restored, at CONTRACTOR's expense, to a condition comparable to that prior to construction.
- C. After the guardrail removal or relocation operations are complete, all surplus material shall be removed and disposed of by CONTRACTOR, at his expense, unless otherwise called for in the Contract Documents.
- D. Any holes or voids resulting from the guardrail removal operation shall be backfilled with granular material, approved by ENGINEER.

### **3.17 Fences**

- A. Fences shall be removed and replaced or shall be removed as indicated on the Plans. If any of the existing material is damaged or destroyed, CONTRACTOR shall replace the material at his expense.
- B. Where fencing is encountered during construction, and its removal was not called for on the Plans, it shall be replaced or restored, at CONTRACTOR's expense, to a condition comparable to that prior to construction.
- C. After the fence removal or relocation operations are complete, all surplus material shall be removed and disposed of by CONTRACTOR, at his expense, unless otherwise called for in the Contract Documents.
- D. Any holes or voids resulting from the fence removal operation shall be backfilled with a suitable material, approved by ENGINEER.
- E. Where fences are encountered that are being used to confine livestock or to provide security, the fence shall be immediately replaced following construction. During construction, CONTRACTOR, at his expense, shall provide, install and maintain a temporary fence, meeting the approval of ENGINEER.

### **3.18 Holes**

- A. Earth removed during any phase of the excavation or removal operations, resulting in a hole or void, shall be replaced by backfilling to the proposed subgrade with a suitable granular material. Material shall be placed by the controlled density method or other effective means having the approval of ENGINEER and shall be compacted to 95% of maximum unit weight.
- B. Furnishing, placing and compacting of the backfill material shall be at CONTRACTOR's expense.

### **3.19 Restoration in Right-of-Way and Yard Areas**

- A. The right-of-way and yard areas not paved or aggregate surfaced shall be restored in accordance with the type and location specified herein unless indicated otherwise on the Plans. The disturbed areas may be shaped by "Machine Grading" or another method approved by ENGINEER to achieve the cross section, line and grade shown on the Plans. Areas where slopes are 1 on 4 or flatter shall be restored with topsoil, seed and mulch. Slopes steeper than 1 on 4 shall be restored with sod.
- B. Any excess material from the restoration operation shall be disposed of by CONTRACTOR at his expense.
- C. Disturbed areas shall be graded to receive either topsoil and seed or topsoil and sod. Topsoil, seed, sod, fertilizer and mulch shall conform to the requirements specified on the Plans and in Section 32 9219, Seeding, or Section 32 9223, Sodding.
- D. CONTRACTOR, at his expense, shall furnish, place, and compact any additional fill, meeting the approval of ENGINEER, needed to restore the disturbed areas to the cross sections called for on the Plans or as determined by ENGINEER.

### 3.20 Restoration of Aggregate Surfaces

#### A. Shoulders:

1. The shoulder shall be regarded as the area between the edge of pavement and the ditch, or the area within ten (10) feet (3 m) of the pavement, whichever is the lesser.
2. Backfilling of trenches in the shoulder area shall be carried to within five (5) inches (125 mm) of the existing surface as specified under Trench "A" or Trench "B." The remaining depth shall be backfilled with a minimum of five inches (125 mm) of compacted DSA aggregate with calcium chloride applied, at the rate of six (6) pounds per Ton of aggregate (3 kg per metric ton of aggregate).
3. CONTRACTOR, at his expense, shall furnish, place and compact all materials necessary to complete the backfilling and restoration operation within the shoulder area.

#### B. Driveways and Parking Areas:

1. Aggregate driveway areas shall be regarded as the area from the right-of-way line to the edge of the traveled roadway and shall include the shoulder area.
2. Backfilling of trenches crossing aggregate surfaced driveways and parking areas shall be carried to the bottom of the proposed base course as specified under Trench "B". The remaining depth shall be backfilled with a minimum of six inches (150 mm) of compacted DSA aggregate, with calcium chloride applied at the rate of six (6) pounds per Ton of aggregate (3 kg per 1000 kg of aggregate).
3. Aggregate surfaced areas beyond the limits of the actual excavation which are disturbed, as determined by ENGINEER, by such operations as temporary storage of materials or passage of equipment, shall be resurfaced, at CONTRACTOR's expense.
  - a. Upper three (3) inches (75 mm) of disturbed areas shall be removed as necessary to allow the final elevation of the resurfacing course to be at the elevation of the drive or parking area which existed prior to excavation.
  - b. Disturbed area shall be resurfaced with a minimum of three (3) inches (75 mm) of compacted DSA aggregate, with calcium chloride applied at the rate of six (6) pounds per Ton of aggregate (3 kg per metric ton of aggregate).
4. CONTRACTOR, at his expense, shall furnish, place, and compact all materials necessary to complete the backfilling and restoration operations within the driveway and parking area.

#### C. Roads and Streets:

1. Backfilling of trenches crossing aggregate surfaced roads or streets shall be carried to within 12 inches (300 mm) of the existing surface as specified under Trench "B." The remaining depth shall be backfilled with two 6-inch (150 mm)



layers of compacted DSA aggregate, with calcium chloride applied at the rate of six (6) pounds per Ton of aggregate (3 kg per metric ton of aggregate).

2. CONTRACTOR, at his expense, shall furnish, place, and compact all materials necessary to complete the backfilling and restoration operations within the roadway or street area.
3. Also, any settlement of the aggregate surface shall be restored by placing additional aggregate, up to the original grade, and shall be done at the CONTRACTOR's expense.

D. Compaction:

1. Compaction of all aggregate shall be performed by a pneumatic-tired roller or a vibratory compactor until the material forms a stable surface.

**3.21 Restoration of Paved Surfaces**

A. CONTRACTOR, at his expense, shall provide the materials necessary to complete the backfilling and restoration operations, which shall include furnishing, compacting, forming, placing, rolling, floating, jointing, finishing, curing and providing protection against elements.

B. Restoration of any roadways that are partially damaged shall include a minimum replacement of one (1), full width lane of roadway. The length of replacement shall be at least equal to the width.

C. Concrete:

1. Backfilling of trenches crossing concrete driveways, sidewalks, roads, streets or parking areas shall be carried to the bottom of the proposed pavement as specified under Trench "B"
2. Unless otherwise specified on the Plans or as determined by ENGINEER, the concrete removed shall be replaced with 3,500 psi (24 MPa) concrete of the thickness removed and shall include reinforcing equal to the existing, if the existing pavement was reinforced.

D. Bituminous:

1. Backfilling of trenches crossing bituminous driveways, sidewalks, roads, streets or parking areas shall be carried to the bottom of the base course as specified under Trench "B."
2. Bituminous pavement or bituminous surface course with an aggregate base shall be replaced in accordance with Section 32 1216, Bituminous Paving.
3. Bituminous surfaced areas beyond the limits of the actual excavation which are disturbed by such operations, as temporary storage of materials or passage of equipment, shall be resurfaced with an approved bituminous mixture the same thickness as removed, but in no case less than two (2) inches (50 mm) in thickness. Replacement material shall extend to smooth-cut edges, shall be

uniform in direction and shall be at an elevation which provides a uniform surface between the undisturbed abutting surfaces.

4. Restoration of any bituminous chip seal shoulders that are damaged or partially damaged, as determined by ENGINEER, shall include complete replacement full width and length (extending a minimum of 25 linear feet (7.6 m) beyond the damaged area both ways).

### **3.22 Soil Erosion and Sedimentation Control**

- A. CONTRACTOR shall comply with the requirements of Section 01 5713, Temporary Erosion and Sediment Control. Prior to commencing any type of earthwork, CONTRACTOR shall obtain all necessary permits from the local enforcing Agency.
- B. CONTRACTOR, at his expense, shall obtain all approvals, secure all permits and post all bonds and deposits required to comply with the accepted Erosion and Sediment Pollution Control Plan.
- C. CONTRACTOR shall provide ENGINEER with a copy of the soil erosion permit issued by the local enforcing agency for the Project, prior to commencing any type of earthwork on the Project.

### **3.23 Excess Excavation**

- A. Excess excavation shall be defined as all surplus earth material realized from the construction that is free of brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material.
- B. CONTRACTOR, when requested by OWNER, shall transport all excess excavation to a site(s) designated by OWNER.
  1. Excess excavation shall be graded by CONTRACTOR to provide positive surface drainage of the site(s).
  2. Grading shall be done such that adjacent properties are not damaged or affected. The grading shall include removal of all surface irregularities to provide a smooth surface ( $\pm 0.25$  foot) ( $\pm 75$  mm).
- C. When the excess excavation has not been requested by OWNER, CONTRACTOR shall remove and properly dispose of the material at no additional cost to OWNER.
- D. Proper disposal of all excess excavation, including transportation, grading, and protection of adjacent properties shall be considered as a final cleanup item. No additional payment will be made for this item.
- E. Brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material from the construction shall become the property of CONTRACTOR, and shall be disposed of per all applicable Laws, rules or regulations. Removal and disposal of this material shall be considered as part of final cleanup. No additional payment will be made for this item.
- F. OWNER approval of the final site(s) condition in writing will be required prior to final payment authorization.

End of Section

## **Section 03 1100 Concrete Forming**

### **Part 1 General**

#### **1.01 Summary**

- A. This Section includes formwork for cast-in-place concrete, complete with furnishing, preparation, installation, coating, protection, adjustment, removal and accessories.

#### **1.02 Submittals**

- A. Submit manufacturer's literature for form coating.
- B. Submit formwork layout plans, design data and procedures if requested by the ENGINEER.

#### **1.03 Related Work Specified Elsewhere**

- A. Concrete Accessories: Section 03 1500
- B. Concrete Reinforcing: Section 03 2000
- C. Cast-In-Place Concrete: Section 03 3000
- D. Structural Excavation and Backfill: Section 31 2316

#### **1.04 Design Standards**

- A. The formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in "Recommended Practice for Concrete Formwork" ACI 347 and for design considerations, wind loads, allowable stresses and other applicable requirements of the local building code. The design and construction of the formwork shall be the responsibility of the CONTRACTOR.
- B. The formwork shall be true in every respect to produce hardened concrete to the required shape, size, grade and alignment as indicated on the Plan, and of sufficient strength, bracing and rigidity to maintain their position and shape under the loads and operations incidental to placing and curing the concrete, as well as all other forces resulting from the movement of the forms. Limit Panel Deflection to 1/360 of exact component span to achieve tolerances specified. The forms shall be mortar-tight at the time concrete is placed in them and shall be so constructed that the surfaces of the finished concrete will be reasonably free from ridges, fins, offsets, or similar defects. Adequate and suitable means for removing the forms without injury to the surfaces or edges of the finished concrete shall be provided

#### **1.05 Allowable Tolerances**

- A. Formwork shall be constructed such that the hardened surfaces shall conform to the tolerance limits of ACI 347, except where more stringent tolerances are required below:

1. Variation from plumb in lines and surfaces of piers, walls, or columns
  - a. In any ten (10) feet (3 m) of length: 1/4 inch (5 mm) Maximum for entire length: 1-inch (25 mm)
2. Variation from the level or from the grades
  - a. In any ten (10) feet (3 m) of length: 1/4 inch (5 mm) Maximum for entire length: 3/4 inch (20 mm)
3. Variation of distance between walls, columns and beams
  - a. In any ten (10) feet (3 m) of distance: 1/4 inch (5 mm) Maximum for entire distance: 1-inch (25 mm)
4. Variation of the linear lines from established position as indicated on the Plan
  - a. In any 20 feet (6 m) of length: 1/2 inch (10 mm) Maximum for entire length: 1-inch (25 mm)
5. Variation in sizes and locations of sleeves, floor openings, and wall openings
  - a. Minus: 1/4 inch (5 mm) Plus: 1/2 inch (10 mm)
6. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls
  - a. Minus: 1/4 inch (5 mm) Plus: 1/2 inch (10 mm)
7. Variations of footing dimensions from plan dimensions
  - a. Minus: 1/2 inch (10 mm) Plus: 2 inches (50 mm)
8. Thickness  $\pm$  5%, up to maximum of 1 inch (25 mm)

#### **1.06 Reference Standards**

- A. ACI - American Concrete Institute

#### **1.07 Storage And Handling**

- A. Store and handle form coating to prevent contamination of coating in accordance with manufacturer's recommendations.

#### **1.08 Sequencing**

- A. Sequence installation of formwork with the Work of Section 03 2000, Concrete Reinforcing; Section 03 1500, Concrete Accessories; and Section 03 3000, Cast-In-Place Concrete.

#### **1.09 Qualifications**

- A. Formwork Designer: Formwork, Falsework, and Shoring Design shall be an ENGINEER licensed in the State of Pennsylvania with at least five (5) years of experience designing similar systems.

## Part 2 Products

### 2.01 Form Materials

- A. Use lumber that is straight, uniform width and thickness, free from knots, offsets, holes, dents, warpage and other surface defects.
- B. Use plywood product of standard psi, waterproof, resin-bonded, exterior-type Douglas Fir, face adjacent to concrete shall be Grade B or better.
- C. Metal forms to be smooth metal plate free of surface irregularities.
- D. Circular columns: Fabricated Steel or fiber reinforced plastic with bolted together sections or spirally wound fiber form internally treated with release agent for height of column.
- E. Chamfer Strips: Use clear white pine, surface against concrete planed, 1-inch (25 mm) bevel width or cant strip.

### 2.02 Form Coating

- A. Use non-staining form oil or other mineral oil which will neither discolor nor otherwise injuriously affect the concrete.

### 2.03 Form Ties

- A. Use permanently embedded stainless steel body type with removable end cones on outer ends, permanently embedded portion shall be 1 ½ inch (25 mm) back from concrete face.

### 2.04 Forms - General

- A. Use forms that conform to ACI 347. Fabricate with facing materials that produce the specified tolerance requirements of Article 1.04 of this Section; produce true surfaces, sharp corners and true lines; and are free of offsets, ridges, bulging, waves and concave or convex areas.

### 2.05 Layout

- A. Use regular and uniform pattern; long dimension of panels vertical; joints horizontal, vertical and aligned; form ties uniformly spaced and aligned in horizontal and vertical rows. Provide 4 x 8 foot panels or larger to reduce form seam lines, except where restricted by location of openings, joints, or shape of the structure.

## Part 3 Execution

### 3.01 Preparation

- A. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. All surfaces of forms and embedded

materials shall be cleaned of any mortar from previous concreting and of all other foreign material or water before coating is placed in them.

- B. Forms shall be coated in accordance with manufacturer's recommendations before the form or reinforcement is placed in final position. Surplus coating on form surfaces, or any coating on reinforcing steel and construction joints shall be removed before placing concrete.

### 3.02 Installation

- A. Forms shall be sufficiently tight to prevent loss of mortar from the concrete set true to the lines and elevations indicated on the Plans, tied and braced to remain true during and after concrete placement within tolerances of Article 1.04 of this Section. The ENGINEER may at any time condemn any section or sections of forms found deficient in any respect, and such form shall be promptly removed and replaced.
- B. No wooden spreaders shall be allowed to remain in the concrete. No metal shall be within 1-inch (25 mm) of any surface.
- C. Place chamfer strips in forms to bevel all External corners, edges, joints and other structural elements exposed to view, including use of dummy chamfer and false joints to provide neat and uniform appearance. Exposed corners and edges shall have 3/4" x 3/4" -45 degree chamfers (20 mm x 20 mm x 45 degree), unless otherwise indicated on the Plan.
- D. Provide temporary openings at the base of wall forms and at the other points when necessary to facilitate cleaning and inspection immediately before depositing concrete.
- E. Secure in position wedges used for final alignment and items to be embedded in concrete.
- F. Forms for keyways shall be prepared in advance of pouring concrete. Keyway forms in slab edges and vertical wall joints shall be rigidly secured in place before the concrete is poured. Forms for keyways for horizontal joints in walls may be placed at the conclusion of the pour, but proper provision shall be made for obtaining and holding the full depth and form of the keyway. Raking, shoveling, or tooling in keyways is not acceptable.
- G. Provide openings and recesses and place sleeves in the concrete as may be required and furnished by other sections of these specifications or as shown on the drawings.

### 3.03 Adjustment of Forms

- A. Positive means of adjustment should be provided to permit realignment or readjustment of shores if excessive settlement occurs.
- B. A pair of wedges may be used at the top or bottom of shores, but not at both ends, to facilitate vertical adjustment, to correct uneven settlements, or to facilitate dismantling of the formwork.
- C. Screw jacks for pipe shores or scaffold-type shoring may be used at both top and bottom so long as they are secured by the shore or scaffold leg against loosening or falling out, to avoid lateral deflections.
- D. During and after concreting, but before initial set of the concrete, the elevations, camber, and plumbness of formwork systems shall be checked, using telltale devices.

Appropriate adjustments shall be promptly made where necessary. If, during construction, any weakness develops, and the formwork shows any undue settlement or distortion, the Work shall be stopped, the affected construction removed if permanently damaged, and the formwork strengthened.

### **3.04 Removal of Forms**

- A. Forms, wedges or shoring shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all superimposed dead, temporary construction, and live loads. When forms or shoring are removed, there shall be no excessive deflection or distortion of the concrete. Forms shall be removed in an orderly fashion; with care to avoid surface gouging, corner or edge breakage, or other damage or injury to the concrete surface or physical property; and without impact or shock, to permit the concrete to carry its share of the loads gradually and uniformly. Form removal shall not impair the safety and serviceability of the structure or concrete members.
- B. Forms and shoring in the formwork used to support the weight of concrete in beams, slabs, and other structural members shall remain in place a minimum of 10 days or until the concrete has reached a minimum of 80% of the design compressive strength. The cylinder strength shall be based on test specimens cured in the field under conditions which are not more favorable than the most unfavorable conditions for the portions of the concrete which the test specimens represent and shall be determined in accordance with Section 03 3000, Cast-In-Place Concrete.
- C. Formwork for columns, walls and other vertical members shall remain in place a minimum of two (2) days or until the concrete has attained a minimum of 75% of its design strength. Where such formwork also supports the formwork of beams and slabs, the removal times of the latter shall govern. Face and edge forms shall be removed as soon as practicable and permitted by the ENGINEER in order to facilitate effective repair of voids or broken corners before the surface has dried.
- D. Forms and shoring in the formwork shall not be removed without the approval of the ENGINEER. The minimum in-place times are for ordinary conditions and represent cumulative number of days, not necessarily consecutive, after the concrete was placed, during which the temperature of the air surrounding the concrete is above 50 degrees F (10° C). The times may be increased or decreased as directed by the ENGINEER, dependent on-air temperatures, cement type, concrete additives or other conditions of the Work in accordance with ACI 347.

### **3.05 Reshoring**

- A. When removing forms before structural members are strong enough to carry dead load and/or construction loads, reshores shall be installed to assure safe distribution of loading. Reshoring operations shall be planned in advance and shall be subject to the ENGINEER's review. During reshoring, no construction loads shall be permitted on the new construction. Reshores shall be placed as soon as practicable after form removal, but in no case later than the end of the working day on which form removal occurs and shall remain in place until the concrete has acquired the required strength.

End of Section

## **Section 03 1500 Concrete Accessories**

### **Part 1 General**

#### **1.01 Scope**

- A. This Section includes joint fillers, joint sealants, and miscellaneous embedded items in concrete.

#### **1.02 Related Work Specified Elsewhere**

- A. Concrete Forming: Section 03 1100
- B. Concrete Reinforcing: Section 03 2000
- C. Cast-In-Place Concrete: Section 03 3000

#### **1.03 Reference Standards**

- A. ASTM - American Society for Testing Materials
- B. CRD - U.S. Army Corps of Engineers Handbook for Concrete and Cement Specifications

#### **1.04 Submittals**

- A. Submit certified manufacturer's affidavits for expansion joint filler and joint sealant to verify compliance with the applicable Specifications.
- B. Submit a schedule of concrete pouring and indicate locations of proposed construction and expansion joints. This schedule is subject to approval of the ENGINEER.

#### **1.05 Environmental Requirements**

- A. Environmental requirements relative to temperature for placing joint sealants are specified in article 3.04 of this Section.

#### **1.06 Sequencing**

- A. The CONTRACTOR shall sequence installation of miscellaneous embedded items with the Work of Section 03 1100 Concrete Forming; Section 03 2000, Concrete Reinforcing; and Section 03 3000 Cast-In-Place Concrete.

### **Part 2 Products**

#### **2.01 Joint Filler**

- A. Preformed Expansion Joint Filler for Concrete (Bituminous Type) ASTM D994.
- B. Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) ASTM D1751.



- C. Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Concrete ASTM D1752.

## **2.02 Joint Sealer**

- A. Concrete Joint Sealer, Hot-Poured Elastic Type ASTM D1190.
- B. Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements ASTM D3405.
- C. Joint Sealants, Hot-Poured, Elastomeric Type, for Portland Cement Concrete Pavements ASTM D3406.

## **2.03 Concrete Anchors**

- A. General
  - 1. Select type and size to achieve required loading capacity using information provided by manufacturer. If required type is not indicated, select type appropriate to conditions and item being fastened.
  - 2. Maintain critical edge distance and spacing per manufacturer's recommendations for all anchors. Provide tamper proof hardware when called for on the plans.

## **2.04 Adhesive Anchors**

- A. Combination capsule adhesive and insert system; chisel pointed threaded rod with hex nut/washer, reinforcing bar, or internally threaded insert, installed into pre-drilled anchor hole using rotary hammer drill, crushing glass capsule containing two part epoxy acrylate resin (vinyl ester) with quartz aggregate and hardening agent, forming adhesive mortar.
- B. Threaded rod: ASTM A 193 Grade B7, ASTM A 194 Grade 2H or ASTM A 563 Grade DH nuts, and ASTM F 436 washers; plated in accordance with ASTM B 633, SC1, with Type II yellow chromate treatment or Type 304 stainless steel when specified on the plans.
- C. Threaded Insert: Carbon steel tubular insert, internally threaded, plated in accordance with ASTM B 633, SC1.

## **2.05 Wedge Type Anchors**

- A. One piece body with expansion mechanism installed in pre-drilled hole using matching tolerance bit.
- B. Carbon steel anchor body, washers, nuts and wedges, plated in accordance with ASTM B 633, SC1, Type III or Type 304 stainless steel anchor body, washers, nuts and wedges when so indicated on plans.

## **Part 3 Execution**

### **3.01 Contractor's Verification**

- A. Inspect the locations and surfaces to receive joint filler, joint sealer, or miscellaneous embedded items and correct defects or conflicts which will affect the proper performance of the item to be placed.

### **3.02 Preparation**

- A. All accessories to be embedded into concrete shall have contact surfaces free of dirt, curing compound, protrusions of hardened concrete or any other foreign material which would affect bond with concrete.
- B. Prime surfaces in accordance with manufacturer's recommendations.

### **3.03 Installation of Joint Fillers**

- A. Details, including materials and methods of installation of joint fillers shall be as indicated on the Plans and as approved by the ENGINEER.

### **3.04 Installation of Joint Sealants**

- A. Joints shall not be sealed when the sealant, air or concrete temperature is less than 40° F (4° C). Bond breaker and backup material shall be installed where required as indicated on the Plans or manufacturer's recommendations.

### **3.05 Concrete Anchors**

- A. Do not begin installation until substrates have been properly prepared. Do not proceed with installation if substrate preparation is unsatisfactory.
- B. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install in accordance with manufacturer's instructions and recommendations and as required by applicable code. Anchor applied items neatly, with item mounted plumb and level unless otherwise indicated.
- D. The ENGINEER reserves the right to require the anchor manufacturer's representative to demonstrate proper installation procedures for post-installed anchors and to observe CONTRACTOR's installation procedures, at no extra cost to OWNER. The ENGINEER reserves the right to require pullout or shear tests to determine adequacy of anchors, at no extra cost to OWNER.

### **3.06 Miscellaneous Embedded Items**

- A. All sleeves, inserts, anchor bolts, and other embedded items required for adjoining Work or for its support shall be placed prior to concreting.

- B. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

End of Section

Not To Be Used For Bidding Purposes

## Section 03 2000 Concrete Reinforcing

### Part 1 General

#### 1.01 Scope

- A. This Section includes the furnishing, fabrication, placement and care of material used as concrete reinforcement.

#### 1.02 Related Work Specified Elsewhere

- A. Concrete Forming: Section 03 1100
- B. Concrete Accessories: Section 03 1500
- C. Cast-In-Place Concrete: Section 03 3000

#### 1.03 Reference Specifications

- A. The latest or current ACI Standards and Code Requirements for "Concrete and Reinforced Concrete" shall govern all concrete Work except where otherwise specified herein. Copies of standards can be obtained from the American Concrete Institute.

#### 1.04 Testing Agency

- A. All testing agencies shall meet the requirements of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction, ASTM E329.

#### 1.05 Allowable Tolerances

- A. Fabrication
  1. Sheared length:  $\pm 1$ -inch (25 mm).
  2. Depth of truss bars: +0, -1/2 inch (+0, -10 mm).
  3. Stirrups, ties, and spirals:  $\pm 1/2$  inch ( $\pm 10$  mm)
  4. All other bends:  $\pm 1$ -inch ( $\pm 25$  mm).
- B. Placement
  1. Concrete cover to form surfaces:  $\pm 1/4$  inch ( $\pm 5$  mm).
  2. Minimum spacing between bars: -1/4 inch (-5 mm).
  3. Top bars in slabs and beams:
  4. Members eight (8) inches (200 mm) deep or less:  $\pm 1/4$  inch (5 mm).
    - a. Members more than eight (8) inches (200 mm) but not over two (2) feet (600 mm) deep:  $\pm 1/2$  inch ( $\pm 10$  mm).
    - b. Members more than two (2) feet (600 mm) deep:  $\pm 1$ -inch ( $\pm 25$  mm).
  5. Crosswise of members: Spaced evenly within two (2) inches (50 mm) of stated separation.

6. Lengthwise of members:  $\pm 2$  inches ( $\pm 50$  mm).
  - a. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 1-bar diameter, with approval from the ENGINEER.

#### **1.06 Source Quality Control**

- A. Reinforcing steel shall be subject to inspection at the source of supply, fabricator, or after delivery to the Project Site at the discretion of the ENGINEER.
- B. The CONTRACTOR may be required to furnish additional test of reinforcing steel for each 100 tons (90 metric ton) or fraction thereof. Testing for bend, pull, elongation and weight to assure compliance with Specifications shall be in accordance with ASTM A370.

#### **1.07 Reference Standards**

- A. ACI - American Concrete Institute
- B. ASTM - ASTM International
- C. CRSI - Concrete Reinforcing Steel Institute

#### **1.08 Submittals**

- A. The CONTRACTOR shall submit Shop Drawings indicating the size and dimensions for fabrication and placing of reinforcing steel, including bar schedules, stirrup spacing, and diameter of bend bars. Bar supports type and grade shall be indicated.
- B. The CONTRACTOR shall submit test certificates of the manufacturer's laboratory, identifying chemical and physical analysis of each load of reinforcing steel delivered.
- C. The CONTRACTOR shall submit test certificates of a qualified independent testing agency evaluation of the mechanical splice devices to assure compliance with ACI 318.

#### **1.09 Delivery, Storage, and Handling**

- A. Deliver reinforcement to Project site in bundles tagged and marked in accordance with "Manual of Standard Practice" of the CRSI.
- B. Reinforcing steel shall be stored above ground on platforms or other supports, in an orderly manner to facilitate inspection and checking, and be protected from physical injuries or contamination.

#### **1.10 Sequencing**

- A. The CONTRACTOR shall coordinate placement of the reinforcing in a manner which will not prevent the proper and timely completion of dependent construction phases.

### **Part 2 Products**

#### **2.01 Reinforcing Bars**

- A. All reinforcement shall be of the grade and type as specified herein unless otherwise indicated on the Plans or Shop Drawing.

1. Bars
  - a. Deformed and Plain Billet-Steel Bars: ASTM A615, Grade 60.
  - b. Rail-Steel Deformed and Plain Bars: ASTM A616, Grade 60.
  - c. Axle-Steel Deformed and Plain Bars: ASTM 617, Grade 60.
  - d. Low Alloy Steel Deformed Bars: ASTM A706.
2. Mats
  - a. Fabricated steel bar or rod mats of the clipped type shall conform to ASTM A184.

## 2.02 Welded Wire Fabric

- A. Welded wire fabric shall be in flat mats only.
  1. Plain
    - a. Conform to ASTM A185, 6 x 6 – w2.9 x w2.9 unless otherwise indicated on the Plans.
  2. Deformed
    - a. Conform to ASTM A496, 6 x 6 – w2.9 x w2.9 unless otherwise indicated on the Plans.

## 2.03 Tie Wire

- A. Plain
  1. Conform to Cold Drawn Steel Wire for Concrete Reinforcement, ASTM A82, 16-gage minimum size.
- B. Deformed
  1. Conform to Deformed Steel Wire for Concrete Reinforcement, ASTM A496, size D-4 minimum

## 2.04 Bar Supports

- A. All metal bar supports shall be fabricated from cold-drawn steel wire in accordance with current CRSI Standards.
- B. Stainless steel supports shall be of Type 1, with stainless steel wire conforming to ASTM A493 attached to the tips of the support so the non stainless wire will lie no closer than 1/4 inch (5 mm) from the form surface.
- C. Plastic coated supports shall be of Type 1, with plastic coating of polyethylene conforming to ASTM D1248 on the legs and tips.
- D. Precast concrete brick supports shall conform to ASTM C55, Type 1, Grade N.

## 2.05 Fabrication

- A. Bars shall be bent cold to the shapes and dimensions as indicated on the Plans, or as required by the current "Manual of Standard Practice" of the CRSI. Steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or improper bends shall not be used.
- B. The diameter of bend measured on the inside of the bar for standard hooks, other than stirrups and tie hooks, shall not be less than the values of the following table.

<b>Minimum Diameters of Bend</b>	
<b>Bar Size</b>	<b>Minimum Diameter</b>
#3 through #8 (#10M - #25M)	6 bar diameters
#9, #10, and #11 (#29M - #36M)	8 bar diameters
#14 and #18 (#43M - #57M)	10 bar diameters

- C. Bends for stirrups and ties with number 5 (#16M) bar and smaller shall not be less than four bar diameters. For bars larger than No. 5 (#16M), shall be according to the "Minimum Diameter of Bend" table above.
- D. Bends for stirrups and ties for welded wire fabric shall not be less than 4-bar diameters for deformed wire larger than D-6 and 2-bar diameters for all other wires. Bends with inside diameter of less than 8-bar diameters shall not be less than 4-bar diameters from nearest welded intersection.

### **Part 3 Execution**

#### **3.01 Contractor's Verification**

- A. The CONTRACTOR shall examine the areas in which the reinforcing steel is to be placed to assure proper lines and levels.

#### **3.02 Preparation**

- A. Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete or splicing method.
- B. The ends of bars to be butt spliced shall be cut square and smooth.

#### **3.03 Installation - General**

- A. Reinforcing shall be placed as indicated on the approved Shop Drawings, within allowable tolerances. Bar supports, as indicated on approved Shop Drawings, or in Specifications, shall be used for proper separation and support of reinforcing steel.

#### **3.04 Minimum Spacing**

- A. Unless otherwise indicated on the Plans, the minimum spacing of bars shall be the following:
1. Footings and other principal structural members in which the concrete is deposited against the ground shall have three (3) inches (75 mm) of concrete between the bar and the ground contact surface.
  2. Concrete surfaces which, after removal of the forms, are to be exposed to the weather or in contact with the ground or liquids, shall be protected with two (2) inches (50 mm) of concrete.

3. The concrete protective covering for any reinforcement at surfaces not exposed directly to the ground, liquids or weather shall be 3/4 inch (20 mm) for slabs and walls and 1-1/2 inches (40 mm) for beams and girders.
4. Column spirals or ties shall be protected everywhere by a covering of concrete cast monolithically with the core and shall be at least 1-1/2 inches (40 mm).
5. Concrete protection for reinforcement shall in all cases be at least equal to the diameter of bars, except for concrete slabs as noted above.
6. The minimum center to center distance between parallel bars shall be 2-1/2 times the diameter of the bars. In no case shall the clear spacing between bars be less than one inch (25 mm) nor less than 1-1/3 times the maximum size of the coarse aggregate. The maximum center to center distance in parallel bars shall be 18 inches (450 mm). Where reinforcement in beams and girders is placed in two (2) or more layers, the clear distance between layers shall be not less than 1-inch (25 mm), and the bars in the upper layers shall be placed directly above those in the bottom layer.
7. Welded wire fabric designated as load-carrying reinforcement shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires plus two (2) inches (50 mm). It shall be supported as required for reinforcing bars.

### 3.05 Splicing

- A. Splices shall be avoided at points of maximum stress. Splicing of bars shall be in accordance with ACI 318.
- B. Splicing of bars shall be done by overlapping in accordance with ACI Detailing Manual SP-66, and securely laced with wire unless indicated otherwise on the Plans or approved Shop Drawing.
- C. Lap adjoining wire mesh by no less than one (1) full mesh and lace securely with wire. Offset end laps in adjacent widths to prevent continuous splice.
- D. Welded wire fabric reinforcement shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than one full mesh spacing plus two (2) inches (50 mm). The fabric shall extend across supporting beams and walls and to within four (4) inches (100 mm) of concrete edges. It may extend through contraction joints where alternate wires are field cut. It shall be adequately supported during placing of concrete to insure its proper position in the slab either by the methods of Article 3.06 of this Section or by laying the fabric on a layer of the fresh concrete of the correct depth before placing the upper layer of the slab.
- E. Vertical bars in columns shall be offset at least 1-bar diameter at lapped splices. To insure proper placement, templates shall be furnished for all column dowels.
- F. Bars of size 14, 18 or larger (#43M #57M or larger), where size 11 (#36M) bars are butt spliced to larger sizes and/or when approved by the ENGINEER shall be welded in accordance with ACI 301 by full penetration butt welds. Adequate jigs and clamps or other devices shall be provided by the CONTRACTOR to support, align and hold the longitudinal centerline of the bars in a straight line.
- G. Bars larger than size eleven (#36M) may be butt spliced by mechanical devices approved by the ENGINEER, in accordance with ACI 318. Splices shall be made using



manufacturer's standard jigs, clamps, ignition devices and other required accessories to support, align and hold the longitudinal centerline of the bars in a straight line.

**3.06 Securing Reinforcement**

- A. Reinforcement shall be securely laced with wire to supports or reinforcing to prevent displacement during the concrete placement, as required by the current "Manual of Standard Practice" of the CRSI.

**3.07 Field Quality Control**

- A. The ENGINEER shall inspect the reinforcing steel after it has been installed, and the reinforcing steel placement shall be approved by the ENGINEER prior to placement of concrete.
- B. The CONTRACTOR shall avoid displacement of the reinforcing steel during concrete placement.

End of Section

Not To Be Used For Bidding Purposes

## **Section 03 3000 Cast-in-Place Concrete**

### **Part 1 General**

#### **1.01 Scope**

- A. This Section includes all monolithic cast-in-place concrete work complete with materials, mixes, installation, and testing.

#### **1.02 Related Work Specified Elsewhere**

- A. Concrete Forming: Section 03 1100
- B. Concrete Accessories: Section 03 1500
- C. Concrete Reinforcing: Section 03 2000
- D. Mortar and Masonry Grout: Section 04 0650

#### **1.03 Reference Standards**

- A. Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:
  - 1. ACI - American Concrete Institute
  - 2. ASTM - ASTM International
  - 3. PennDOT - Pennsylvania Department of Transportation, Pub 408 Construction Specifications (latest edition).

#### **1.04 Reference Specifications**

- A. The latest or current ACI Standards and Code Requirements for "Concrete and Reinforced Concrete" shall govern all concrete Work except where otherwise specified herein.

#### **1.05 Testing Agency**

- A. All inspections and tests required by this Section shall be performed by organizations acceptable to the ENGINEER.

#### **1.06 Allowable Tolerances**

- A. See Section 03 1100, Concrete Forming, for the allowable tolerances for concrete surfaces.

#### **1.07 Design Criteria**

- A. Mixes shall be designed and tested for each size and gradation of aggregates and for each consistency intended for use. Design quantities and test results of each mix shall be submitted for review.

- B. Necessary construction joints are shown on the Plans. Modification of location or placement of construction joints not indicated on the Plans shall be subject to approval of the ENGINEER. In general, they shall be located within the middle one-third of the span of slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam.
- C. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.
- D. Expansion joint locations and details shall be as shown on the Plans. In no case shall any fixed metal be continuous through a expansion joint.
- E. Keyways shall be provided in all joints where required to provide for either shear or water-tightness. Unless otherwise required, the width of keys shall be at least one-third the thickness of the section at that point and their depth at least one-third their width.

**1.08 Source Quality Control**

- A. Furnish tests of cement and aggregates. Material sampling shall conform to the following ASTM Standards:
  - 1. Cement C183
  - 2. Aggregates D75.
- B. Testing shall be in accordance with applicable ASTM Standards to assure compliance with Specifications.
  - 1. Make tests for the following quantities, or fraction thereof:

Cement	550 tons
Fine Aggregate	2,000 Tons
Coarse Aggregate	2,000 Tons

- C. Use same brand cement for any given structure produced by a single mill unless otherwise provided by authorization of the ENGINEER.

**1.09 Submittals**

- A. Submit Shop Drawings showing the location of joints. Included shall be a schedule of the concrete pouring. The location of joints and pouring schedule shall be subject to approval by the ENGINEER.
- B. The CONTRACTOR shall submit test reports for cement and aggregates to assure compliance with the Specifications.
- C. Concrete mixture designs and test data shall be submitted for review by the ENGINEER with a written request for approval. No concrete shall be placed until the CONTRACTOR has received such approval in writing.

- D. Each mixture report shall include:
1. Slump on which design is based.
  2. Total gallons of water per cubic yard.
  3. Brand, type, composition, and quantity of cement.
  4. Brand, type, composition, and quantity of pozzolan or other mineral admixtures.
  5. Brand, type, composition, and quantity of ground granulated blast furnace slag.
  6. Specific gravity and gradation of each aggregate.
  7. Ratio of fine to total aggregates.
  8. Weight (surface dry) of each aggregate, lbs./c.y.
  9. Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.
  10. Air content.
  11. Compressive strength based on 7-day and 28-day compression tests.
  12. Time of initial set.
- E. Submit manufacturer's literature of abrasive wear resistant floor finish and of chemical curing compound for review by the ENGINEER.
- F. Submit a sample concrete delivery ticket for review by the ENGINEER.
- G. Submit tickets collected at the site of concrete placement accompanying each load of concrete. A printout system for producing these tickets in connection with automatic batching will be permitted.
- H. Each ticket shall be serially numbered, show the charging time, quantity and grade of concrete, location of delivery and the signatures of inspectors at the plant and site. Transit mixed concrete tickets shall also include revolution counter reading at charging and mixing completion.
- I. Submit reports of the sampling and testing of slump, air content and strength performed.
- J. Submit reports of nondestructive, core and/or liquid retention testing required for acceptance of concrete in place.

#### **1.10 Material Storage and Handling**

- A. Materials shall be stored and handled in accordance with ACI 304 and as specified below.
- B. When permission is given to store cement in the open, a floor at least six (6) inches above the ground and a waterproof covering shall be provided and so placed as to insure runoff in case of rain.
- C. Cement sacks shall be thoroughly shaken when emptying sacks into the batch. Cement salvaged by the CONTRACTOR by cleaning sacks mechanically or otherwise, or from discarded sacks of cement, shall not be used in the Work. The use of a fractional sack

of cement will not be permitted unless the fractional part is measured by weight. At the time of its use in the Work, the cement shall be free from lumps.

- D. No aggregates which have become intermixed prior to proportioning shall be used. Sufficient aggregate shall be available at the site to preclude the possibility of damaging delays while placing the concrete.
- E. Cars used for shipping aggregates shall be clean and in good repair. The use of straw, marsh, hay or other similar materials for closing cracks or holes in cars will not be tolerated.
- F. Pozzolans and other cementitious materials shall be stored and handled in the manner of cement.
- G. Store and handle curing compound in a manner to prevent contamination.

### **1.11 Environmental Requirements**

- A. Environmental requirements shall be in accordance with ACI 305 for hot weather concreting, and ACI 306 for cold weather concreting. Specific temperature requirements are contained in Article 2.10 of this Section for mixing and Article 3.13 of this Section for placing.

## **Part 2 Products**

### **2.01 Materials - General**

- A. The materials shall meet the requirements of ACI 301, ACI 318, and PennDOT Section 700.
- B. Concrete materials shall be tested and inspected as the Work progresses. The review and/or check-test of the proposed materials, securing of production samples of materials at plant stockpiles and/or review of the manufacturer's reports for compliance will be performed at no cost to the CONTRACTOR.
- C. Testing and inspection required due to substitution or change of materials requested by the CONTRACTOR shall be at the CONTRACTOR's expense.

### **2.02 Cement**

- A. Cement shall be the type as indicated on the Plans or as specified.
  - 1. Type II, conforming to ASTM C150, air-entraining Portland cement for all work, unless otherwise specified.

### **2.03 Aggregates**

- A. Washing will be required to eliminate the dust, clay, or silt coating. Aggregates which have been washed shall not be used sooner than 24 hours after washing, unless approved by the ENGINEER.
- B. Coarse aggregate shall be gravel or crushed rock, conforming to PennDOT Section 703.2. Type A, No. 8 for members eight (8) inches (200 mm) or less in thickness and Type A, No. 57 or 67 for other construction.

- C. Gravel shall consist of hard, clean, durable particles of rock or pebbles and shall be free from lumps of clay.
- D. Crushed rock shall consist of angular fragments of crushed hard heads or boulders or crushed igneous rock free from weathered rock and of uniform quality.
- E. Fine aggregate shall be natural sand shall conform to PennDOT Section 703.1, Type A.
- F. Fine aggregates shall consist of sharp sand which shall be composed of clean, hard, durable grains and shall be free from lumps of clay and organic deleterious substances.

#### **2.04 Admixtures**

- A. Admixtures shall be used to achieve concrete as indicated on the Plans or specified herein. Calcium chloride shall not be used.
  - 1. Air-entraining, conforming to ASTM C260.
  - 2. Pozzolan and Fly Ash, conforming to ASTM C618, Class C or F.
  - 3. Water reducing, conforming to ASTM C494.
  - 4. Retarder, conforming to ASTM C494.
  - 5. Plasticizer, conforming to ASTM C494.
  - 6. Ground granulated blast furnace slag conforming to ASTM C989, grade 100.
- B. Abrasive wear resistant floor finish shall be packaged, dry combination of Portland cement, graded Quartz aggregate and dispersing agents formulated to produce an abrasive and wear resistant monolithic surface.

#### **2.05 Joint Filler**

- A. See Section 03 1500, Concrete Accessories.

#### **2.06 Water**

- A. Water shall be free from oil, acid, alkali, organic matter, and any other deleterious substances. Water approved by the Local Board of Health may be used without testing. Water from other sources shall be tested before using.

#### **2.07 Curing Compound**

- A. Shall be adequate to prevent checking, cracking and loss of moisture, conforming to ASTM C309.

#### **2.08 Mixes**

- A. Concrete shall consist of a mixture of air-entraining Portland cement, coarse and fine aggregate, and water with admixtures if required. Admixtures shall not be used without the ENGINEER's review. The mixture, combined in proportions, shall meet the requirements of PennDOT Section 704, and ACI 211.1.
- B. Provide concrete meeting requirements in Table 03 3000-1 unless otherwise shown on the plans.

Class	Location	Min. Compressive Strength at 287 days (psi)	Max. w/cm ratio	Requirements
A	Structural slabs, beams and near surface structures	5000	0.40	5%-10% silica fume or 25% max fly ash
B	Pavements, sidewalks	4000	0.45	-

- C. Aggregates shall be proportioned by weight, except for small structures and for incidental Work requiring less than ten (10) cubic yards of concrete, in which case they may be proportioned by volume when approved by the ENGINEER.
- D. Cement in bulk, when permitted, shall be proportioned by weight.
- E. When proportioned by volume, the amount of each aggregate required for a single batch shall be measured separately and accurately. Shovel methods of measuring will not be permitted. The unit of volumetric measurement shall be one (1) cubic foot.
- F. When proportioned by weight, the amount of each aggregate required for a single batch shall be weighed in a separate container. The equipment for weighing shall be of an approved type, and of such accuracy that there shall not be an error of more than one (1) percent in any one (1) batch.

## 2.09 Batching Admixtures

- A. The batching of admixtures to achieve and maintain production of the mix design of concrete shall be in accordance with ACI 212.
- B. If the air content is found to be less or greater than the specified amount, the CONTRACTOR shall immediately discontinue Work and correct the air content.
- C. Decreasing the air content may be accomplished by blending air-entraining Portland cement with Portland cement, manufactured at the same mill, in a ratio which will reduce the air content to a value within the specified limits, this blending shall be reviewed by the ENGINEER.
- D. Increasing the air content may be accomplished by adding to each batch a sufficient amount of air-entraining admixture to bring the air content up to the designed amount.
- E. Pozzolan and ground granulated blast furnace slag shall be proportioned based on the mix design approved by the ENGINEER per Article 1.09 of this Section to produce watertight concrete.
- F. Water Reducer can be used to reduce the water requirement of concrete to obtain consistency of slump, modify workability, increase strength or any other approved use.

## 2.10 Temperature Limits of Mixture

- A. The temperature of the cement, at the time of delivery to the mixer, shall not exceed 165 degrees F (74°C). It may be required that it be stored at the CONTRACTOR's expense until cooled to that temperature.
- B. The temperature limits of aggregates and water entering the mixer shall be as follows:

<b>Limits Of Temperatures</b>		
	Minimum	Maximum
Water	75°F	140°F
Fine Aggregate	65°F	140°F
Coarse Aggregate	65°F	110°F
Concrete (resulting)	60°F	90°F

## 2.11 Mixers and Mixing

- A. Concrete mixing operations shall be in accordance with ACI 304 and PennDOT, Section 704, and shall be subject to random inspection during the progress of the Work at no charge to the CONTRACTOR.
- B. Central Mixed Concrete
1. Mixers shall be capable of quickly and completely discharging without segregation or loss. The efficiency of the mixers shall be maintained at all times through repair or replacement of worn parts when necessary. They shall be provided with readily adjustable, automatic devices which will measure the cement and water within one (1) percent and admixtures within three (3) percent. The drum of the mixer shall be kept free from hardened concrete and shall be completely emptied before recharging. Retempering or remixing concrete that has partially set will not be permitted. The mixer shall be cleaned thoroughly each time when out of operation for more than 1/2 hour.
  2. Recommended mixing time is a minimum time of one (1) minute for one (1) cubic yard, with an additional 15 seconds for each additional cubic yard.
  3. The concrete shall be delivered to the site in clean, tight truck bodies designed for this purpose and painted with paraffin if necessary for easy dumping. The concrete at the point of delivery shall have the proper consistency and shall be free from segregation. Mechanical agitators in the truck bodies will be required if the period of time from the mixing plant to the point of dumping exceeds 30 minutes.
  4. No concrete shall be dumped if the elapsed time from the mixing plant to the point of dumping exceeds 60 minutes.
- C. Transit Mixed Concrete
1. Transit-mix concrete shall be in accordance with ASTM C94. If transit-mix concrete is used, it shall meet all the foregoing requirements specified for central mixed concrete and, in addition, the following:
    - a. The batched materials shall be properly proportioned and in a dry state. The proper amount of water shall be added to the mixer on the trucks, and no additional water shall be added. No admixtures or accelerators shall be added except as herein noted, without the approval of the ENGINEER. Trucks shall not be loaded beyond their rated capacity and shall have mixing drums cleaned of all set-up



materials at frequent intervals while in use. Trucks with leaking water valves shall not be used.

- b. Recommended mixing speed should be no less than 12 revolutions per minute, with a minimum of 90 revolutions or until the mix is satisfactory.
  - c. Mixing shall be continuous after water is added to the mix in the drum, but no concrete shall be placed in the forms more than 90 minutes after water is added to the mix.
  - d. Truck-mixed concrete shall be delivered to the site of the Work and discharged from the mixer within the maximum period of 1-1/2 hours from the first introduction of water to the mix. Any concrete which remains in the mixer after this period and any concrete which appears too stiff to be properly workable or which appears to have begun to take its initial set shall be rejected and removed from the site of the Work.
- D. The OWNER may employ an independent testing laboratory to provide a qualified inspector to be present at the plant where batching of concrete occurs. The inspector shall verify the compliance of the mix with the Specifications and shall sign a form indicating the quantity of concrete and the concrete mixture of each load.

#### **2.12 Change of Mixture**

- A. If the CONTRACTOR requests a change or substitution of approved batch proportioning, mixing, or delivery operations additional testing and/or inspection shall be at the CONTRACTOR's expense.

#### **2.13 Acceptable Manufacturers**

- A. Acceptable manufacturers of abrasive wear resistant floor finish include: Master Builders Company "Masteron Aggregate," Sonneborn Building Products "Harcol," or equal.

### **Part 3 Execution**

#### **3.01 Verification of Formwork, Reinforcing, and Subgrades**

- A. The CONTRACTOR shall inspect formwork, reinforcement and subgrades to confirm compliance with the related Work specified elsewhere.

#### **3.02 Embedded Items**

- A. The CONTRACTOR shall verify the location, from certified vendor or applicable engineering drawings, of all embedded items including anchor bolts, wall sleeves, wall casting, railing post sleeves and miscellaneous pipes and conduits and shall install the items accurately at the locations determined.

#### **3.03 Building in Other Work**

- A. The CONTRACTOR shall make all necessary provisions in concrete Work for other Work installed by this or other contractors, and build in all required steel beams,

frames, curbs, expansion joints, inserts, hangers, pipes, floor drains, pipe trench covers and frames, anchors, sleeves, floor ducts, fiber and steel conduit, pipe hanger sockets, and all other Work furnished by either this or other contractors.

- B. The CONTRACTOR shall build in all anchors, ties, etc., specified under brick and other Work, in faces of concrete Work which are to be faced with masonry, and any other Work shown or noted to be built into concrete. In addition, the CONTRACTOR shall provide all openings and holes in concrete Work as shown or as needed to accommodate other Work.

### **3.04 Special Concrete**

- A. The CONTRACTOR shall verify the use and/or locations of watertight concrete and/or high-early strength concrete.

### **3.05 Preparation**

- A. The CONTRACTOR shall notify the ENGINEER two (2) working days prior to placement of concrete.
- B. Before depositing new concrete on or against existing concrete the existing concrete shall be roughened, thoroughly cleaned of foreign matter and laitance and saturated with water. The cleaned and saturated surface of the hardened concrete, including vertical and inclined surfaces, shall be coated with a bonding agent or slushed with a minimum 2-inch thick coating of concrete without coarse aggregate grout against which the new concrete shall be placed before the mixture has attained its initial set.
- C. Before concrete is placed in any unit, the forms and the placing and fixing of all steel and incidental items shall be complete, and the forms, steel and adjacent concrete shall be thoroughly cleaned and wetted down.
- D. Where indicated on the Plans, the CONTRACTOR shall bridge the subgrade with at least 2,000 psi, 3-inch thick lean concrete before placing the reinforcement. This shall be at no extra cost.
- E. No concrete shall be deposited in any unit until the area has been completely dewatered in accordance with Section 31 2319, Dewatering, and not until after the CONTRACTOR has made satisfactory provisions to eliminate all possibility of water entering or flowing through the concrete while it is being poured or is taking its set. No concrete shall be placed under or on water.

### **3.06 Conveying**

- A. The concrete handling equipment shall be of such a nature and shall be so located that the concrete after leaving the mixer will reach its destination with a minimum lapse of time, with no segregation, and loss of slump. The use of drop chutes, except at or in the forms, is prohibited.
- B. The interior hopper slope of concrete buckets shall be not less than 60 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least five (5) times the nominal maximum size aggregate and the area of the gate opening shall be not less than two (2) square feet. The maximum dimension shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically or hydraulically operated except for buckets larger than two (2) cubic yards shall not be manually operated. The design of

the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

- C. Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete at the transfer points and the point of placing.
- D. Concrete may be conveyed by positive displacement pump when authorized by the ENGINEER. The pumping equipment shall be piston or squeeze pressure type. The pipeline shall be rigid steel pipe or heavy-duty flexible rubber hose. The inside diameter of the pipe shall be at least three (3) times the nominal maximum size coarse aggregate in the concrete mixture to be pumped. The maximum size coarse aggregate shall not be reduced to accommodate the pumps.
- E. The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms.

### 3.07 Placing

- A. All concrete shall be so deposited as to maintain the top surface level, unless otherwise shown on the Plans, and also as to avoid any appreciable flow in the mass.
- B. Where placing operations involve dropping the concrete more than three (3) feet in the forms, it shall be deposited through sheet metal or other approved spouts or pipes. These spouts or pipes shall have suitable receiving hoppers at the upper ends, and the lower ends shall be kept within six (6) inches of the newly placed concrete so as to prevent segregation and avoid spattering the reinforcing steel with mortar. Under no circumstances shall concrete that has partly hardened be deposited in the Work.
- C. Each layer of concrete shall be plastic when covered with the following layer and the forms shall be filled at a rate of vertical rise of not less than two (2) feet per hour. Concrete vibrators shall penetrate the initial layer when placing the following layer. Vertical construction joints shall be provided as necessary to comply with these requirements.
- D. Concrete shall be placed and compacted in wall or column forms before any reinforcing steel is placed in the system to be supported by such walls or columns. The portion of any wall or column placed monolithically with a floor or roof slab shall not exceed six (6) feet of vertical height. Concrete in walls or columns shall set at least two (2) hours before concrete is placed in the structural systems to be supported by such walls or columns.
- E. Concrete shall be set when top finished. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.
- F. No concrete shall be placed in contact with frozen ground. Time between charging and placement of concrete shall not exceed 1-1/2 hours.
- G. Concrete shall be compacted by continuous vibrating, tamping, spading or slicing. Care shall be taken to eliminate all voids and to provide full bond on reinforcing steel and embedded fixtures. Mechanical vibration shall be employed. Concrete shall be compacted and thoroughly worked with suitable tools combined with the use of

vibrators applied internally and providing a frequency not less than 7,000 revolutions per minute. All such vibrating, including the methods and equipment, shall be subject to the review of the ENGINEER.

- H. The time of vibrating in any area shall only be sufficient to get efficient compaction but shall in no case be carried to the point where there is segregation of the fine and coarse materials of the mix. There shall be an absolute minimum of direct vibration of the steel or forms during the process of vibrating. Vibrators shall be inserted and withdrawn from the concrete at numerous locations, from 18 to 30 inches apart, but shall not be used to transport concrete within the forms. The CONTRACTOR shall have a standby vibrator on the job site during all concrete pouring operations.

### **3.08 Finishing Unformed Surfaces**

- A. The unformed surfaces of all concrete shall be screeded and given an initial float finish followed by steel troweling.
- B. Screeding shall provide a concrete surface conforming to the proper elevation and contour with all aggregates completely embedded in mortar. All screeded surfaces shall be free of surface irregularities with a height or depth in excess of 1/4 inch as measured from a 10-foot straightedge.
- C. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float, or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface. Floating shall be performed with hand floats or suitable mechanical compactor floats.
- D. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks. The top surface of driveways, and sidewalks shall be given a broomed finish after troweling.
- E. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having 1/4-inch corner radius.

### **3.09 Finishing Formed Surfaces**

- A. After removal of forms, the finishing of all concrete surfaces shall be started as soon as its condition will permit. Grind all seams, fins or projections flush with the concrete surface. Fill and point all honeycomb, tie holes and voids. Dampen the surface with water and apply a cement and silica sand slurry to the entire surface to fill small defects and air voids. Remove excess slurry from concrete. Surfaces to be finished shall receive an application of dry Portland cement which shall be rubbed into the slightly dampened surface with a suitable cloth.
- B. After pointing and removal of projections as specified herein, exposed surfaces of concrete, including walls, columns, beams, pilasters and the undersides of slabs, shall be given a rubbed surface finish.

### **3.10 Floors**

- A. Concrete floor finish shall be applied to all building floors not receiving further floor finish. At these locations, the concrete shall be brought to the proper elevation and screeded. The surface shall be given two (2) steel trowelings when the concrete has set

sufficiently to finish smoothly. Floors shall be sloped uniformly toward floor drains at a slope of 1/8 inch per foot.

- B. The concrete finish on steps and loading platforms shall be wood troweled to true and uniform surface and then steel troweled. The surface shall then be slightly roughened with a broom or by dragging burlap across the surface.
- C. Concrete floors shall be finished with an abrasive resistant floor finish in the areas noted on the finish schedule on the Plans. Premixed floor hardener shall be applied to the surface of the freshly floated concrete floor, in strict accordance with the manufacturer's directions. Color to be selected by the OWNER.

### 3.11 Expansion Joints

- A. Comply with the requirements of Section 03 1500, Concrete Accessories. Expansion joints shall have removable polystyrene joint caps secured to the top thereof and shall be accurately positioned and secured against displacement to clean, smooth concrete surfaces. The joint caps shall be of the size required to install filler strips at the desired level below the finished concrete surface and to form the groove for the joint sealant to the size shown on the Plans. The joint caps shall not be removed until after the concrete curing period.

### 3.12 Concrete Curing

- A. All concrete shall be cured for a period not less than seven (7) consecutive days. The CONTRACTOR shall have adequate equipment and curing material on the job site before concrete placement begins, and it shall be adequate to prevent checking and cracking and loss of moisture from all the surfaces of the concrete. The concrete shall be protected from rain, flowing water, wind and the direct rays of the sun. Openings in concrete shall be sealed to prevent drying of the concrete during the curing period.
- B. Curing compounds shall not be used on surfaces to which additional concrete or other material are to be bonded.
- C. Curing compounds when used shall be applied in strict accordance with the manufacturer's recommendations.
- D. Concrete cured with water shall be kept wet by covering with ponded water or fog spraying to keep all surfaces continuously wet.
- E. Horizontal construction joints and finished surfaces cured with sand shall be covered a minimum thickness of 1-inch, uniformly, and kept saturated during the curing period.
- F. Burlap used for curing shall be treated to resist rot and fire and free of sizing or any substances that are injurious to Portland cement or cause discoloration. Strips shall be lapped by half widths. The burlap shall be saturated with water after placement and during the curing period.
- G. Straw or hay shall be in a layer no less than six (6) inches thick and held in place by screens, wire or other means to prevent dispersion by the wind. Care shall be observed to avoid discoloration of the concrete surface from the vegetable fibers and for the flammability of the material. The straw shall be saturated with water after placement and during the curing period.

### 3.13 Environmental Conditions

- A. The CONTRACTOR shall provide cold or hot weather protection in accordance with ACI and as specified herein. There shall be no additional cost for hot or cold weather protection of the concrete.
- B. Cold Weather Protection
  1. When placing concrete in cold weather, the CONTRACTOR shall plan and prosecute his Work in a manner which shall assure results free from damage through freezing, contraction, and loss of concrete strength.
  2. No concrete shall be poured when the surrounding temperature is below 40 degrees F, unless the aggregates and water are properly heated. Concrete which has been poured at higher temperatures but has not attained a strength equal to 75% of the required strength of the class of concrete involved, shall be housed and protected in accordance with the provisions of this Section whenever the surrounding temperature falls below 40 degrees F.
  3. Application of heat to the materials shall be made in a manner which will keep these materials clean and free from injurious substances.
  4. Aggregates may be heated only by steam coils or steam jets, except in the case of small quantities of concrete when other methods may be approved by the ENGINEER. A sufficient quantity of properly heated aggregates shall be on hand prior to starting the pouring of any unit.
  5. Concrete shall be properly housed with canvas, burlap, or other windproof material in such a manner that any necessary removal of the forms or finishing of the concrete can proceed without undue damage to the concrete from the elements. Heating of the housing shall be done in a manner which will maintain a temperature between 50 degrees F and 70 degrees F, at all times for at least five (5) days after the pour is complete and 12 hours before the pour begins. All supplemental heating units shall have exhaust vented to the exterior and shall not cause deleterious reactions or deposits to occur to concrete.
- C. Hot Weather Protection
  1. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperature shall be less than 90 degrees F.
  2. In hot weather, suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.

### 3.14 Addition of Water

- A. To increase workability, adding water to the mix shall be limited to a one-time addition of one (1) gallon of water per cubic yard of concrete and mixed with a minimum of 30 revolutions at a rate of 12 to 15 revolutions per minute. Addition of water shall be within the slump requirements.

### 3.15 Concrete Delivery Ticket

- A. A ticket system shall be used for recording the transportation of concrete from the batching plant to point of delivery. This ticket shall be issued to the truck operator at the point of loading and given to the ENGINEER upon delivery. The ticket shall as a

minimum indicate the time of mixer charging, quantity of concrete, type of mixture including amount of cement, and the plant where the concrete was batched.

### 3.16 Concrete Delivery Rejection

- A. Concrete not permitted for inclusion in the Work by the ENGINEER shall be removed from the site. Rejection of concrete will be determined through concrete testing and elapsed time from mixer charging to delivery.

### 3.17 Concrete Testing at Placement

- A. Tests shall be made of fresh concrete for each 50 cubic yards, or whenever consistency appears to vary. The sampling and testing of slump, air content and strength will be performed at no cost to the CONTRACTOR.
- B. Composite samples shall be secured in accordance with the Method of Sampling Fresh Concrete, ASTM C172.
- C. Slump Test:
  - 1. Slump Test shall be in accordance with ASTM C143. The CONTRACTOR shall use the least slump possible consistent with workability for proper placing of the various classifications of concrete.
  - 2. A tolerance of up to 1-inch above the indicated maximum slump shall be allowed for individual batches provided the average for all batches or the most recent ten (10) batches tested, whichever is fewer, does not exceed the maximum limit.
- D. Air Content:
  - 1. Air content of normal weight concrete will be determined in accordance with Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method, ASTM C231.
- E. Compressive Strength
  - 1. A set of cylinders for compressive strength tests will consist of four cylinders per each set.
  - 2. Molding and curing specimens from each set shall be in accordance with Method of Making and Curing Concrete Test Specimens in the Field, ASTM C31. Any deviations from the requirements of this Standard shall be recorded in the test report.
  - 3. Testing specimens will be in accordance with Method of Test for Compressive Strength of Cylindrical Concrete Specimens, ASTM C39. One (1) specimen shall be tested at seven (7) days for information and two (2) shall be tested at 28 days for acceptance. The acceptance test results shall be the average of the strengths of the two (2) specimens tested at 28 days. If one (1) specimen in test manifests evidence of improper sampling, molding or testing, it shall be discarded, and the strength of the remaining cylinder shall be considered the test result.
  - 4. The strength level of the concrete will be considered satisfactory so long as the averages of all 28-day strength test results equal or exceed the specified 28-day strength and no individual strength test result falls below the specified 28-day strength by more than 500 psi.

5. If the strength test is not acceptable, further testing shall be performed to qualify the concrete.
6. The temperature of concrete sample will be determined for each strength test.

### **3.18 Testing of Concrete in Place**

- A. Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements shall be at the expense of the CONTRACTOR.
- B. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by the ENGINEER to determine relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection.
- C. When required by the ENGINEER, cores at least two (2) inches in diameter shall be obtained and tested in accordance with Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, ASTM C42. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 degrees to 80 degrees F, relative humidity less than 60%) for seven (7) days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.
- D. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the ENGINEER so as to least impair the strength of the structure. If, before testing, one or more of the cores shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced.
- E. Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least 85% of and if no single core is less than 75% of the specified 28-day strength.
- F. Core holes shall be filled by low slump concrete or mortar.

### **3.19 Retention Testing**

- A. Tanks or structures designed to hold or retain water, wastewater or other liquids shall be retention tested. To test a tank or structure for leakage, the CONTRACTOR shall clean, disinfect (if required) and fill the tank or structure with water to its maximum level. The water shall be allowed to remain 24 hours with all associated valves and appurtenances tightly closed. During this 24-hour period, the water level as measured by a hook gage shall show no measurable loss. If this test fails, the CONTRACTOR shall dewater the tank or structure, make such repairs as necessary to achieve a watertight tank or structure, clean, disinfect (if required), and retest. Tests and repairs shall be repeated until the tank or structure is accepted by the ENGINEER.

### **3.20 Defective Concrete**

- A. If, in the opinion of the ENGINEER, the defects in the concrete are of such a nature as to warrant condemnation, that portion of the pour may be ordered replaced in its entirety and the CONTRACTOR shall promptly replace same without additional compensation.



- B. Defective concrete shall be repaired by cutting out the defective area and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely in place.

End of Section

Not To Be Used For Bidding Purposes

## Section 03 4100 Precast, Prestressed Concrete

### Part 1 General

#### 1.01 Scope

- A. This Section includes precast and precast prestressed structural concrete as indicated on the Plans complete with product design, manufacture, transportation, erection, and other related items such as anchorage, bearing pads, storage and protection.

#### 1.02 Related Work Specified Elsewhere

- A. Measurement and Payment: 01 1200
- B. Concrete Reinforcement: 03 2000
- C. Concrete Accessories: 03 1500
- D. Mortar and Masonry Grout: 04 0650

#### 1.03 Reference Standards

- A. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:
- B. AASHTO - American Association of State Highway and Transportation Officials
- C. ACI - American Concrete Institute
- D. AWS - American Welding Society
- E. ASTM - American Society for Testing and Materials
- F. PCI - Prestressed Concrete Institute

#### 1.04 Qualifications

- A. Manufacturer shall be a company specializing in providing precast and/or precast prestressed concrete products and services normally associated with the industry for at least five (5) years. When requested by the ENGINEER, submit written evidence to show experience, qualifications and adequacy of plant capability and facilities for performance of Contract requirements.
- B. Erector shall be regularly engaged for at least five (5) years in the erection of precast structural concrete similar to the requirements of this Project.

- C. Welders shall have qualified within the past year in accordance with AWS D 1.1.

#### 1.05 Design Criteria

- A. Submit design calculations by a registered professional engineer, registered in Pennsylvania, experienced in precast, prestressed concrete design.
- B. Use in the design, applicable codes, ACI 318, or AASHTO Standard Specifications for Highway Bridges. Include in the design loads: all dead and live loads as indicated on the Plans, initial handling and erection stresses, and all other loads specified for members where they are applicable.
- C. Watertight Precast reinforced concrete structures shall be designed in accordance with ASTM C890, for A-16(HS20) loading and installation conditions.

#### 1.06 Reference Specifications

- A. All local codes plus the following Specifications, standards, and codes are a part of these Specifications:
  - 1. ACI 318 - Building Code Requirements for Reinforced Concrete.
  - 2. AWS D1.1 - Structural Welding Code.
  - 3. AWS D1.4 - Reinforcing Steel Welding Code.
  - 4. AASHTO - Standard Specifications for Highway Bridges.

#### 1.07 Allowable Tolerances

- A. Design deviations may be permitted only after the ENGINEER's review of the manufacturer's proposed design supported by complete design calculations and drawings.
- B. Provide an installation equivalent to the basic intent of the Work without incurring additional cost to the OWNER.
- C. Length:  $\pm 1/8$  inch per 10 feet (1 mm per meter),  $\pm 1/4$  inch (5 mm) maximum.
- D. Cross sectional dimensions: less than 24 inches (600 mm)  $\pm 1/4$  inch, (5 mm) 24 to 36 inches (600 to 900 mm):  $\pm 3/8$  inch (9 mm) Over 36 inches (900 mm):  $\pm 1/2$ - inch (10 mm)
- E. Thickness:  $\pm 1/4$  inch (5 mm).
- F. Position of anchors and inserts:  $\pm 1/2$  - inch (10 mm) of centerline location shown on the Plans.
- G. Horizontal alignment or sweep:  $1/4$  inch (5 mm) total or  $1/8$  inch per to-foot length (1 mm per meter), whichever is greater. Maximum of  $1/2$ - inch (10 mm) gap between two (2) adjacent members due to sweep.
- H. End squareness:  $3/8$  inch (9 mm) maximum.

- I. Blockouts:  $\pm \frac{1}{2}$  - inch (10 mm) off centerline locations shown on the Plans.
- J. Out of square: 1/8 inch per six (6) feet (5 mm per 3 m) measured on the diagonal.
- K. Warpage, after installation: 1/8 inch per 6-foot (5mm per 3 m) length, or 3/8 inch (9 mm), whichever is greater.
- L. Vertical alignment:
  - 1. Bottom edges of members from line established at lower face:  $\pm \frac{1}{4}$  inch (5 mm).
  - 2. Bottom surface from straight line between supports: 1/240 of clear span.

#### **1.08 Source Quality Control**

- A. Comply generally with applicable provisions of Prestressed Concrete Institute MNL-116, Manual for Quality Control for Plants and Production of Precast, Prestressed Concrete Products.

#### **1.09 Submittals**

- A. The CONTRACTOR shall submit design calculations of products not completed and/or indicated on the Plans in accordance with the provisions of Article 1.5 of this Section.
- B. Submit erection or production drawings showing:
  - 1. Drawings and/or elevations locating and defining all material furnished by manufacturer.
  - 2. Sections and details showing connections, cast-in items and their relation to the structure.
  - 3. Description of all loose, cast-in and field hardware.
  - 4. Field installed anchor location drawings.
  - 5. Erection sequences and handling requirements.
  - 6. Elevation view of each member.
  - 7. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
  - 8. Lifting and erection inserts.
  - 9. Dimensions and finishes.
  - 10. Prestress for strand and concrete strengths.
  - 11. Estimated cambers.
  - 12. Method of transportation.
- C. Submit test certificates identifying chemical and physical analysis of materials used for fabrication and physical analysis of the precast product.

#### **1.10 Delivery and Handling**

- A. Perform transportation, site handling, and erection with acceptable equipment, methods, and by qualified personnel.

### **1.11 Storage**

- A. Store all units off ground.
- B. Place stored units so that identification marks are easily discernible.
- C. Separate stacked members by battens across full width of each bearing point.
- D. Stack so that lifting devices are accessible and undamaged.
- E. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

### **1.12 Site Access**

- A. Provide suitable access to the building and firm level bearing for the hauling and erection equipment to operate under its own power.

## **Part 2 Products**

### **2.01 Portland Cement**

- A. Shall be Type I or Type III: ASTM C150.

### **2.02 Aggregates**

- A. Lightweight aggregates for concrete: ASTM C330.
- B. Fine and coarse aggregate, other than lightweight aggregate: ASTM C33.

### **2.03 Admixtures**

- A. Air-entraining admixtures: ASTM C260.
- B. Water reducing, retarding, accelerating admixtures: ASTM C494.

### **2.04 Water**

- A. Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

### **2.05 Reinforcing Steel**

- A. Reinforcing bars and wire fabric: Per Section 03200, Concrete Reinforcement.
- B. Strand Wire or low relaxation strands: Grade 270K, conforming to uncoated 7-wire stress-relieved strand for prestressed concrete: ASTM A416.

## 2.06 Grout

- A. Grout: Per Section 04 0650, Grouting and complying with the following:
- B. Cement Grout: One (1) part Portland cement, 2-1/2 parts sand, sufficient water for placement and hydration.
- C. Nonshrink Grout: Premixed, packaged nonstaining, nonshrink grout.

## 2.07 Bearing Pads

- A. Use bearing pads of the type recommended by the manufacturer were indicated on the plans.

## 2.08 Welded Studs

- A. Shall be in accordance with A WS D 1.1.

## 2.09 Caulking

- A. Shall be a nonstaining 1-part polymer acrylic base sealant.

## 2.10 Concrete Mixes

- A. Precast, Prestressed: The mixture and mixing of concrete shall be in accordance with ACI 304. The mixture shall produce concrete with the 28-day compressive strength no less than 5,000 psi (34.4 MPa). The strength at initial prestress or form release shall be no less than 3,500 psi (24 MPa). Use of calcium chloride, chloride ions or other salts is not permitted.
- B. Precast: Shall be the same requirements of precast, prestressed, except the mixture shall produce concrete with the 28-day compressive strength no less than 5,000 psi (27.5 MPa).

## 2.11 Fabrication and Manufacture

- A. The fabrication and manufacture of precast and/or prestressed products shall comply with the PCI Manual of Practice, and as specified herein.
- B. Provide for those openings ten (10) inches (250 mm) round or square or larger as shown on the Plans. Other openings may be located and field drilled or cut after the precast prestressed products have been erected. Openings shall be approved by the ENGINEER before drilling or cutting. No tension reinforcement shall be cut.
- C. Patching will be acceptable providing the structural adequacy of 4le product and the appearance are not impaired.
- D. The manufacturer shall cast in structural inserts, bolts and plates as detailed or required by the Plans or shop drawings.
- E. No imperfections, honeycomb, or other defects shall be permitted. Provide smooth

and dense surfaces, free of voids and projections.

- F. Strands shall be recessed 1-inch (25 mm) and holes grouted. The ends of the member shall receive a smooth finish.
- G. Fabricate precast reinforced concrete structures in accordance with ASTM C913, to the dimensions indicated on the plans, and the specified design criteria.

## **2.12 Acceptable Manufacturers**

- A. Precast concrete shall be as manufactured by Price Brothers Company; Concrete Components, Inc.; Precast/Schokbeton; or equal.

## **Part 3 Execution**

### **3.01 Contractor's Verification**

- A. Examine the substrates and conditions under which the precast concrete is to be installed and notify the CONTRACTOR in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

### **3.02 Preparation**

- A. Providing true, level bearing surfaces on all field placed bearing walls and other field placed supporting members.
- B. Place and accurately align anchor bolts, plates or dowels in column footings, grade beams and other field placed supporting members.
- C. All shoring required for composite beams and slabs shall conform to all applicable building codes.

### **3.03 Installation - General**

- A. Installation of precast prestressed concrete shall be performed by the manufacturer or a competent erector subcontracted by the CONTRACTOR. 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.

### **3.04 Alignment**

- A. Members shall be properly aligned and leveled as required by the 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 ENGINEER.

### **3.05 Field Welding**

- A. Field welding is to be done by qualified welders using equipment and materials compatible to the base material.

### **3.06 Grouting and Caulking**

- A. After installation of precast units are complete, joints shall be grouted and/or caulked as indicated on the Plans or determined by the ENGINEER. Joints shall be completely filled with grout. Any grout which seeps through joints shall be removed and surfaces cleaned before the grout hardens.
- B. Caulking shall be used at all underside joints between members and along bearing walls or beams. Concurrently with the caulking and grouting operation, any chipped or damaged sections or areas adjacent to openings or otherwise imperfect surfaces shall be carefully patched to match the precast surface.

### **3.07 Attachments**

- A. Subject to the approval of the ENGINEER, precast prestressed products may be drilled or shot, provided no contact is made with the prestressing steel.

### **3.08 Field Quality Control**

- A. Final inspection and acceptance of erected precast and precast prestressed concrete shall be made by the ENGINEER to verify conformance with Plans and Specifications.

### **3.09 Schedules**

- A. Precast product quantity, location, surface finish and dimensions shall be as indicated on the Plans.

End of Section



## Section 04 0650 Mortar and Masonry Grout

### Part 1 General

#### 1.01 Summary

- A. This Section includes specifications related to the use of mortar and grout for masonry.

#### 1.02 Related Work Specified Elsewhere

- A. Concrete Accessories: Section 03 1500
- B. Concrete Reinforcing: Section 03 2000
- C. Cast-In-Place Concrete: Section 03 3000
- D. Precast, Prestressed Concrete: Section 03 4100
- E. Unit Masonry: Section 04 2000
- F. Structural Excavation and Backfill: Section 31 2316

#### 1.03 Reference Standards

- A. ACI 530/530.1/ERTA – Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.
- B. ASTM C5 – Standard Specification for Quicklime for Structural Purposes; 2010.
- C. ASTM C91/C91M – Standard Specification for Masonry Cement; 2012.
- D. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete; 2013.
- E. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar; 2011.
- F. ASTM C150/C150M – Standard Specification for Portland Cement; 2012.
- G. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- H. ASTM C270 – Standard Specification for Mortar for Unit Masonry; 2012.
- I. ASTM C387/C387M – Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.
- J. ASTM C404 – Standard Specification for Aggregates for Masonry Grout; 2011.
- K. ASTM C476 – Standard Specification for Grout for Masonry; 2010.
- L. ASTM C780 – Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.
- M. ASTM C979/C979M – Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- N. ASTM C1019 – Standard Test Method for Sampling and Testing Grout; 2013.

- O. ASTM C1148 – Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008).
- P. ASTM C1314 – Standard Test Method for Compressive Strength of Masonry Prisms; 2012
- Q. ASTM C1357 – Standard Test Methods for Evaluating Masonry Bond Strength; 2009.
- R. ASTM E514/E514M – Standard Test Method for Water Penetration and Leakage Through Masonry; 2011.

#### **1.04 Submittals**

- A. See Section 01 3300 – Submittal Procedures
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit manufacturer's full range of color samples for mortar color selection.
- D. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- E. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Instructions: Submit packaged dry mortar manufacturer's installation instructions.

#### **1.05 Quality Assurance**

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
  - 1. Maintain one copy of each document on project site.

#### **1.06 Delivery, Storage, and Handling**

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

#### **1.07 Field Conditions**

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
- B. Produce subsequent mortar batches within plus or minus 10 degrees F of the first batch of mixing mortar.

- C. Maintain mortar temperature on boards above freezing when air temperature falls below 25 degrees F.

## Part 2 Products

### 2.01 Mortar and Grout Applications

- A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.
  - 1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.
- B. Mortar Color: Natural gray unless otherwise indicated.
- C. Mortar Mix Designs: ASTM C270, Property Specification.
  - 1. Exterior Masonry Veneer: Type N.
  - 2. Exterior, Loadbearing Masonry: Type S.
  - 3. Exterior, Non-loadbearing Masonry: Type N.
  - 4. Interior, Loadbearing Masonry: Type S.
  - 5. Interior, Non-loadbearing Masonry: Type N.
  - 6. Glass Unit Masonry: Type N mortar and Type S pointing mortar.
- D. Grout Mix Designs:
  - 1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C94/C94M.
    - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
    - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
  - 2. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C94/C94M.
    - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
    - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

### 2.02 Materials

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
  - 1. Type: Types as scheduled in this section.
  - 2. Color: Mineral pigments added as required to produce approved color sample.
  - 3. Products:

- a. Amerimix, and Oldcastle brand; AMX 400: [www.amerimix.com](http://www.amerimix.com)
  - b. Substitutions: See Section 01 6000 – Product Requirements.
- B. Packaged Dry Material for Mortar for Repointing: Premixed Portland cement, hydrated lime, and graded sand; capable of producing Type O mortar in accordance with ASTM C270 with the addition of water only.
  - 1. Type: Fine.
  - 2. Products:
    - a. Amerimix, and Oldcastle brand; AMX 600: [www.amerimix.com](http://www.amerimix.com)
    - b. Substitutions: See Section 01 6000 – Product Requirements
- C. Grout Fine Aggregate: ASTM C33, fine aggregate.
- D. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
  - 1. Color(s): As selected by Architect from manufacturer's full range.
  - 2. Manufacturers:
    - a. Davis Colors: [www.daviscolors.com](http://www.daviscolors.com).
    - b. Lambert Corporation: [www.lambertusa.com](http://www.lambertusa.com).
    - c. Solomon Colors: [www.solomonscolors.com](http://www.solomonscolors.com).
    - d. Substitutions: See Section 01 6000 Product Requirements.
- E. Water: Clean and potable.
- F. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.
  - 1. Acceptable products: "DRY-BLOCK" by Forrer Industries/Grace Construction Products, "Rheapel Plus Mortar Admixture" by MasterBuildings/BASF Construction Chemicals or approved equal.
  - 2. Substitutions: See Section 01 6000.
- G. Integral Water Repellent Admixture: Polymeric liquid or powder admixture added to mortar and grout at the time of manufacture.
  - 1. Performance of Mortar and Grout with Integral Water Repellent:
    - a. Water Permeance: When tested per ASTM E514 and for a minimum of 72 hours:
      - 1) No water visible on back of wall above flashing at the end of 24 hours.
      - 2) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
      - 3) No more than 25% of wall area above flashing visibly damp at end of test.
    - b. Flexural Bond Strength: ASTM C1357; minimum 10% increase.
    - c. Compressive Strength: ASTM C1314; maximum 5% decrease.
    - d. Drying Shrinkage: ASTM C1148; maximum 5% increase in shrinkage.

2. Use only in combination with masonry units produced with integral water repellent admixture.

### **2.03 Mortar Mixing**

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- D. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- E. Do not use anti-freeze compounds to lower the freezing point of mortar.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.
- G. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 40 degrees F.

### **2.04 Grout Mixing**

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- D. Do not use anti-freeze compounds to lower freezing point of grout.

### **2.05 Preconstruction Testing**

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4000.
- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
- C. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.
- D. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
- E. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

## **Part 3 Execution**

### **3.01 Preparation**

- A. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

### **3.02 Application**

- A. Use masonry cement mortars or Portland/lime mortars at the Contractor's option.

### **3.03 Installation**

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 12 inches without consolidating grout by mechanical vibration during placement and reconsolidate after initial water loss has occurred and before plasticity is lost.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from group spaces.

### **3.04 Grouting**

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of contract documents.
- B. Low-Lift Grouting:
- C. Limit height of pours to 16 inches.
- D. Limit height of masonry to 16 inches above each pour.
- E. Pour grout only after vertical reinforcement is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
- F. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1 hour. If grout placement is stopped for 1 hour or longer, a horizontal construction joint shall be formed 1 inch below top of block except at top of wall.
- G. High-Lift Grouting:
- H. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
- I. Hollow Masonry: Limit lifts to maximum 5 feet and pours to maximum height of 24 feet.
- J. Place grout for spanning elements in single, continuous pour.

### **3.05 Field Quality Control**

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 4500.
- B. Test and evaluate mortar in accordance with ASTM C780 procedures.

1. Test with same frequency as specified for masonry units.
- C. Test and evaluate grout in accordance with ASTM C1019 procedures.
1. Test frequency: Take one sample for each 25 cubic yards of grout or fraction thereof being placed each day.

End of Section

Not To Be Used For Bidding Purposes

## Section 04 2000 Unit Masonry

### Part 1 General

#### 1.01 Scope of Work

- A. CONTRACTOR shall furnish tools, equipment, materials, and supplies and shall perform labor required to complete the unit masonry work as indicated on the Contract Drawings and specified herein.
- B. CONTRACTOR alone shall be fully responsible for the design, strength, safety and adequacy of shoring, bracing and methods of construction, and for the strength, consistency, finish and general quality of masonry.

#### 1.02 Related Work Specified Elsewhere

- A. Section 04 0650: Mortar and Masonry Grout
- B. Section 07 6000: Flashing and Sheet Metal
- C. Section 08 1300: FRP Faced Aluminum Doors and Aluminum Frames

#### 1.03 Quality Assurance

- A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6, *Specifications for Masonry Structures*, except as otherwise indicated herein.
- B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1.

#### 1.04 Submittals

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data:
  - 1. Product data for each different masonry unit, accessory, and other manufactured product indicated.
- C. Shop Drawings:
  - 1. Shop drawings for stone trim in form of cutting and setting drawings showing sizes, profiles, and locations of each stone trim unit required.



2. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315, *Details and Detailing of Concrete Reinforcing*, showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

D. Test Reports:

1. Material test reports from a qualified independent testing laboratory employed and paid by CONTRACTOR indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
  - a. Mortar complying with property requirements of ASTM C 270.
  - b. Grout mixes. Include description of type and proportions of grout ingredients.
  - c. Masonry units.

**1.05 System Performance Requirements**

- A. Provide unit masonry that develops the following installed compressive strengths ( $f_m$ ):
1. For concrete unit masonry:  $f_m = 1500$  psi

**1.06 Project Conditions**

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sill with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
  2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that comes in contact with such masonry.
1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

- D. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:
  - 1. Do not lay masonry units that are wet or frozen.
  - 2. Remove masonry damaged by freezing conditions.
- E. Hot-Weather Construction: Comply with referenced unit masonry standard.

**1.07 Delivery, Storage, And Handling**

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.
- C. Store cementitious materials off the ground, under cover, and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

**Part 2 Products**

**2.01 General**

- A. Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

**2.02 Concrete Masonry Units**

- A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.
  - 1. Provide special shapes where indicated and as follows:
    - a. For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
    - b. Square-edged units for outside corners, except where indicated as bullnose.
  - 2. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.
    - a. Concrete Masonry Units shall be manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.

3. Provide Type II, non-moisture-controlled units.
  4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
- B. Hollow Load-Bearing Concrete Masonry Units:
1. Standard: ASTM C 90.
  2. Unit Compressive Strength: Provide units with minimum average net area compressive strength not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
  3. Weight Classification: Lightweight.
- C. Solid Load-Bearing Concrete Masonry Units:
1. Standard: ASTM C 145.
  2. Unit Compressive Strength: Provide units with minimum average net area compressive strength not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
  3. Weight Classification: Lightweight.

### **2.03 Mortar and Grout Materials**

- A. Portland Cement: Comply with ASTM C 150. Type I or II; Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.
- B. Masonry Cement: Comply with ASTM C 91. For colored aggregate mortars use masonry cement of natural color or white as required to produce mortar color indicated.
- C. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
- D. Hydrated Lime: Comply with ASTM C 207, Type S.
- E. Aggregate for Mortar: Comply with ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.
- F. Aggregate for Grout: Comply with ASTM C 404.
- G. Water: Clean and potable.
- H. Available Products: Subject to compliance with requirements.

## 2.04 Reinforcing Steel

- A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.
- B. Steel Reinforcing Bars:
  - 1. Billet steel complying with ASTM A 615.
  - 2. Epoxy-coated billet steel complying with ASTM A 615 and ASTM A 775.
- C. Deformed Reinforcing Wire: Comply with ASTM A 496.
- D. Plain Welded Wire Fabric: Comply with ASTM A 185.
- E. Deformed Welded Wire Fabric: Comply with ASTM A 497.

## 2.05 Joint Reinforcement

- A. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this Section, formed from the following:
  - 1. Stainless steel wire, Type 304 complying with ASTM A 580, for exterior walls; and galvanized carbon steel wire, coating class as required by referenced unit masonry standard, for interior walls
- B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:
  - 1. Wire Diameter for Side Rods: 0.1875 inch.
  - 2. Wire Diameter for Cross Rods: 0.1875 inch.
- C. Subject to compliance with requirements, provide joint reinforcement by one of the following manufacturers:
  - 1. AA Wire Products Co.
  - 2. Dur-O-Wal, Inc.
  - 3. Heckman Building Products, Inc.
  - 4. Hohmann & Barnard, Inc.
  - 5. Masonry Reinforcing Corp. of America.
  - 6. National Wire Products Industries.
  - 7. Southern Construction Products, Inc.

## 2.06 Ties and Anchors, General

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.
- B. Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry standard for application indicated.
- C. Galvanized Carbon Steel Wire: Coating class shall be as required by referenced unit masonry standard for wire ties and anchors in interior walls and shall comply with ASTM A 82, unless otherwise indicated.

- D. Stainless Steel Wire: Type 304, for wire ties and anchors in exterior walls complying with ASTM A 580,
- E. Stainless Steel Wire: Type 304 with a diameter of 0.1875 inch and in compliance with ASTM A 580,
- F. Steel Plates and Bars: Hot-dip galvanized to comply with ASTM A 123 or ASTM A 153, Class B3, as applicable to size and form indicated.
- G. Subject to compliance with requirements, provide products by one of the following manufacturers:
  - 1. AA Wire Products Co.
  - 2. Dur-O-Wal, Inc.
  - 3. Heckman Building Products, Inc.
  - 4. Hohmann & Barnard, Inc.
  - 5. Masonry Reinforcing Corp. of America.
  - 6. National Wire Products Industries.
  - 7. Southern Construction Products, Inc.

#### **2.07 Bent Wire Ties**

- A. CONTRACTOR shall furnish and install individual units prefabricated from bent wire to comply with requirements indicated below:
  - 1. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with closed ends and not less than 4 inches wide.
  - 2. Tie Shape for Solid Masonry Unit Construction: Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long.
  - 3. Type for Masonry Where Coursing Between Wythes Align: Unit ties bent from one piece of wire.
  - 4. Type for Masonry Where Coursing Between Wythes Does Not Align: Adjustable ties composed of two parts, one with pintles, the other with eyes, maximum misalignment 1-1/4 inches.

#### **2.08 Miscellaneous Anchors**

- A. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated or required.
- B. Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336-inch (22-gage) sheet metal.

#### **2.09 Post-Installed Anchors**

- A. Anchors shall be capable of sustaining, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.
  - 1. For cast-in-place and post-installed anchors in concrete, anchors shall be capable of sustaining, without failure, a load equal to 4 times loads imposed by masonry.

2. For post-installed anchors in grouted concrete masonry units, anchors shall be capable of sustaining, without failure, a load equal to 6 times loads imposed by masonry.
- B. Corrosion Protection:
1. Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
  2. Stainless steel components complying with ASTM F 593 and ASTM F 594, Group 1 alloy 304 or 316 for bolts and nuts; alloy 304 or 316 for anchor.

## 2.10 Embedded Flashing Materials

- A. Sheet metal flashing shall be fabricated in accordance with the requirements specified in 07 6000, Flashing and Sheet Metal, and the following:
1. Stainless Steel: 0.0156 inch (28 gage) thick.
- B. Vinyl sheet flashing shall be flexible sheet flashing, especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and of thickness indicated below:
1. Thickness: 30 mils.
  2. Application: Use where flashing is fully concealed in masonry.

## 2.11 Miscellaneous Masonry Accessories

- A. Nonmetallic Expansion Joint Strips: Pre-molded filler strips complying with ASTM D 1056, Type 2 (closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression-deflection range of 2-5 psi), compressible up to 35 percent, of width and thickness indicated, formulated from the following material:
1. Neoprene.
  2. Urethane.
  3. Polyvinyl chloride.
- B. Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall:
1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.
  2. Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.
- C. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Plastic Weep Hole/Vent: One-piece flexible extrusion manufactured from ultraviolet-resistant polypropylene co-polymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.

## **Part 3 Execution**

### **3.01 Examination**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

### **3.02 Installation**

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.
- B. Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
- C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.
- E. Match coursing, bonding, color, and texture of new masonry with existing masonry where indicated.

### **3.03 Mortar Bedding and Jointing**

- A. Lay hollow concrete masonry units as follows:
  - 1. With full mortar coverage on horizontal and vertical face shells.
  - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
  - 3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Cut joints flush for masonry walls to be concealed or to be covered by other materials, unless otherwise indicated.

### 3.04 Horizontal Joint Reinforcement

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, pipe enclosures, and other special conditions.

### 3.05 Anchoring Masonry to Structural Members

- A. General: Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
  - 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

### 3.06 Movement (Control and Expansion) Joints

- A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
  - 1. Fit bond breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.
  - 2. Install preformed control joint gaskets designed to fit standard sash block.
  - 3. Install special shapes designed for control joints. Install bond breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
- C. Form expansion joints in brick made from clay or shale as follows:
  - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.
  - 2. Build flanges of factory-fabricated expansion joint units into masonry.
  - 3. Build in joint fillers where indicated.



4. Form open joint of width indicated but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealers." Maintain joint free and clear of mortar.
- D. Build in horizontal pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting nonmetallic 50 percent compressible joint filler of width required to permit installation of sealant and backer rod. Locate horizontal pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

### **3.07 Lintels**

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

### **3.08 Flashing/Weep Holes**

- A. General:
1. Install embedded flashing in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall.
    - a. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing.
    - b. Place through-wall flashing on sloping bed of mortar and cover with mortar.
    - c. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.
    - d. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.
  2. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashings and as follows:
    - a. Form weep holes with by keeping head joints free and clear of mortar; spacing holes 24 inches on center.
    - b. In insulated cavities/air spaces cover cavity/air space side of open weep holes with copper or plastic insect screening before placing insulation in cavity.

### **3.09 Installation of Reinforced Unit Masonry**

- A. General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.

- B. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
- C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
- D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

### 3.10 Repairing, Pointing, and Cleaning

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing:
  - 1. During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar.
  - 2. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
  - 4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
  - 5. Clean brick by means of bucket and brush hand-cleaning method using the following masonry cleaner:
    - a. Job-mixed detergent solution.
    - b. Job-mixed acidic solution.
    - c. Proprietary acidic cleaner; apply in compliance with directions of acidic cleaner manufacturer.

- D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

End of Section

Not To Be Used For Bidding Purposes

## Section 05 1200 Structural Steel Framing

### Part 1 General

#### 1.01 Scope of Work

- A. The extent of structural steel work is indicated on the Plans, including schedules, notes, and details to show size and location of members, typical connections, and type of steel required.

#### 1.02 Related Work Specified Elsewhere

- A. Section 03 3000: Cast-In-Place Concrete
- B. Section 04 0650: Mortar and Masonry Grout

#### 1.03 Reference Standards

- A. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:
  - 1. AISC - American Institute of Steel Construction
  - 2. ASTM- American Society for Testing and Materials
  - 3. AWS - American Welding Society

#### 1.04 Codes and Standards

- A. Comply with the provisions of the following, except as otherwise indicated.
  - 1. AISC - "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including the "Commentary and Supplements" thereto as issued.
  - 3. AISC - "Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
  - 4. AWS D1.1 - "Structural Welding Code."
  - 5. ASTM A6 - "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

#### 1.05 Qualifications for Welding Work

- A. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure." Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months. If recertification of welders is required, retesting will be the Contractor's responsibility.

### 1.06 Design of Members and Connections

- A. Details indicated on the Plans are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the Work.
- B. Connection details not shown on the plans shall be designed in accordance with the most current addition of the AISC "Manual of Steel Construction."
- C. Promptly notify ENGINEER whenever design of members and connections for any portion of the structure is not clearly indicated.

### 1.07 Allowable Tolerances

- A. Overall Length:
  - 1. Members with both ends milled for contact bearing: + 1/32 inch (0.8 mm).
  - 2. Members without ends milled for contact bearing which are framed to other members:
    - a. 30 feet (9 m) or less in length + 1/16 inch (1.5 mm).
    - b. Over 30 feet (9 m) in length + 1/8 inch (3 mm).
- B. Straightness:
  - 1. Structural members may vary from straightness within the tolerances allowed for wide flange shapes by ASTM Specification A6, except that the tolerance on deviation from straightness of compression members is 1/1,000 of the axial length between points which are to be laterally supported.
  - 2. Completed members should be free from twists, bends and open joints. Sharp kinks or bends are cause for rejection of material.
- C. Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1:500.

### 1.08 Source Quality Control

- A. Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
- B. Promptly remove and replace materials or fabricated components which do not comply.

### 1.09 Submittals

- A. For information only, submit two (2) copies of producer's or manufacturer's specifications and installation instructions for the following products including laboratory test reports and other data as may be required to show compliance with these specifications (including specified standards). Indicate by transmittal that copy

of each applicable instruction has been distributed to Fabricators, Installers, and Erectors.

1. Structural Steel, including certified copies of mill reports covering the chemical and physical properties.
  2. High-strength bolts including nuts and washers.
  3. Unfinished bolts and nuts.
  4. Structural steel primer paint.
  5. Shrinkage-resistant grout.
  6. Slide bearings.
- B. Submit shop drawings, prepared by a professional engineer registered in the state where the Work is located, including complete details and schedules for fabrication and shop assembly of members, connections, and details. Also include schedules, procedures, and diagrams showing the sequence of erection.
- C. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
- D. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.

#### **1.10 Delivery, Storage, and Handling**

- A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- C. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures as directed by ENGINEER.

#### **1.11 Sequencing with Related Work**

- A. Supply fabricated structural steel members and/or accessories to be installed by related Work. Bearing plates shall be furnished complete with anchor bolts, washers, nuts and setting diagrams or templates.

#### **1.12 Environmental Requirements**

- A. Allowances shall be made during erection of structural steel for ambient air temperatures specified under Article 3.07 of this Section.

## **Part 2 Products**

### **2.01 Structural Steel**

- A. Rolled Steel Wide Flange and Tee Shapes: ASTM A 992.
- B. Other Rolled Steel Plates, Shapes, and Bars: ASTM A572, G50, unless otherwise indicated on the plans.
- C. Hollow Structural Sections: ASTM A500, Gr B. Steel Pipe: ASTM A53, Type E or S, Grade B.
- D. Anchor Bolts: ASTM A307, non-headed type unless otherwise indicated on the Plans.

### **2.02 Washers, Bolts, and Nuts**

- A. Washers: ASTM F436
- B. Bolts and Nuts:
  - 1. Standard: Grade A ASTM A307, with nuts conforming to Grade A ASTM A563.
  - 2. High Strength: Type 1 ASTM A325, with heavy hex nuts conforming to Grade DH ASTM A563.
  - 3. Alloy Steel: Type 1 ASTM A490, with heavy hex ASTM A194.

### **2.03 Miscellaneous Structural Items**

- A. Electrodes for Welding: Comply with AWS Code; Use E 70 XX Series.
- B. Structural Steel Primer Paint: Inorganic Zinc-Rich Epoxy Primer Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C588, Type A.

### **2.04 Shop Fabrication and Assembly**

- A. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the final shop drawings. Provide camber in structural members were indicated on the Plans.
- B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- C. Where finishing is required, complete the assembly, including welding of units before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.

## 2.05 Connections

- A. Weld or bolt shop connections as indicated on the Plans.
- B. Bolt field connections except where welded connections or other connections are specified.
- C. Provide high-strength threaded fasteners for all principal bolted connections, except where unfinished bolts are indicated on the Plans.
- D. Provide unfinished threaded fasteners for only the bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erections.
- E. Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts."
- F. Comply with AWS Code for procedures, appearance, quality of welds, and methods used in correcting welding work.
- G. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

## 2.06 Holes for Other Work

- A. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members as indicated on the Plans and/or final shop drawings.
- B. Provide threaded nuts welded to framing, and other specialty items as indicated on the Plans, and/or final shop drawings to receive other work.
- C. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

## 2.07 Shop Painting

- A. Shop paint structural steel work, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on portions which are exposed and initial two (2) inches (50 mm) of embedded areas only.
- B. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
- C. After inspection and before shipping, clean all steel work whether painted or not. Remove loose rust, loose mill scale, spatter, slag, or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) SP-2 "Hand Tool Cleaning" and SP-3 "Power Tool Cleaning."
- D. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions and at a rate to provide a uniform



dry film thickness at 2.0 mils (50 µm). Use painting methods which will result in full coverage of joints, corners, edges, and all exposed surfaces.

## **Part 3 Execution**

### **3.01 CONTRACTOR'S Verification**

- A. CONTRACTOR must examine the areas and conditions under which structural steel work is to be installed and notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to CONTRACTOR.
- B. The inspection and verification of construction in place shall be sufficiently in advance of steel erection to allow for possible correction of the construction in place or fabrication.
- C. If the construction in place is not inspected by CONTRACTOR prior to erection, CONTRACTOR shall be responsible for removing and resetting construction in place or revisions in fabrication to correct discrepancies.

### **3.02 Erection - General**

- A. Comply with the AISC Specifications and Code of Standard Practice, and as herein specified.

### **3.03 Temporary Shoring and Bracing**

- A. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.

### **3.04 Temporary Planking**

- A. Provide temporary planking and working platforms as necessary to effectively complete the Work.

### **3.05 Anchor Bolts**

- A. Furnish anchor bolts and other connectors required for securing structural steel to foundations.
- B. Furnish templates and devices as necessary for presetting bolts and other anchors to accurate locations. Templates shall be 1/8" (3 mm) thick (min) steel plate.

### **3.06 Setting Bases and Bearing Plates**

- A. Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces.
- B. Clean the bottom surface of base and bearing plates.

- C. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
- D. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
- E. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain.
- F. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's installations, or as otherwise required.

### **3.07 Field Assembly**

- A. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact.
- B. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- C. Level and plumb individual members of the structure as specified in Article 1.07 of this Section unless otherwise specified by AISC tolerances.
- D. Establish required leveling and plumbing measurements on the mean operating temperature of the structure. Make allowances for the difference between temperature at time of erection and the mean temperature at which the structure will be when completed and in service.
- E. Splice members only where indicated on the Plans and/or final shop drawings.
- F. Erection bolts on exposed welded construction, shall be removed and holes filled with plug welds and ground smooth at exposed surfaces.
- G. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
- H. Do not enlarge undersized holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- I. Do not use cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to ENGINEER. Finish gas-cut sections equal to a sheared appearance when field cutting is permitted.

### **3.08 Touch-Up Painting**

- A. Immediately after erection clean field welds, bolted connections, and abraded areas of the shop paint. Apply paint to exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils (50  $\mu$ m).

### 3.09 Field Quality Control

#### A. General:

1. OWNER may engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports. Inspections will meet the requirements of the current building code at the place of the Work.
2. Testing agency shall conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviations therefrom.
3. Provide access for the testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
4. Testing agency may inspect structural steel at the plant before shipment; however, ENGINEER reserves the right, at any time before final acceptance to reject material not complying with specified requirements.
5. CONTRACTOR shall correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Performance of additional tests as may be necessary to reconfirm any noncompliance of the original work, and as may be necessary to show compliance of corrected work will be at CONTRACTOR'S expense.
6. Work determined to be defective by ENGINEER and/or local agencies regardless of all previous inspections, shall be corrected to the satisfaction of ENGINEER at no extra cost to OWNER. CONTRACTOR shall be responsible for the cost and delay of replacing defective Work both in regard to his own Contract and as such cost or delay affects the Work of others.

#### B. Connections:

1. Inspect shop bolted connections in accordance with AISC Specifications. Inspect and test not less than five (5) percent of the shop and field welds during fabrication and erection of structural steel assemblies as follows:
  - a. Certify welders and conduct inspections and tests as required.
  - b. Record types and locations of all defects found in the work.
  - c. Record work required and performed to correct deficiencies.
  - d. Perform visual inspection of all welds complying with ASTM E164.
2. Inspection of field bolted connections will be in accordance with AISC Specifications.

End of Section

## Section 05 5300 Metal Gratings

### Part 1 General

#### 1.01 Scope of Work

- A. This Section includes prefabricated custom-design aluminum bar gratings as indicated on the Contract drawings complete with materials, fabrication, and installation.

#### 1.02 Related Work Specified Elsewhere

- A. Section 03 3000: Cast-in-Place Concrete

#### 1.03 Quality Assurance

- A. ASTM B221 Aluminum Extruded Bars and Shapes
- B. ANSI/NAAMM-MBG-531-09 Metal Bar Grating Manual
- C. Manufacturer's Qualifications:
  - 1. Design connections and components not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Pennsylvania.
- D. Inspection:
  - 1. Work done in accordance with this specification shall be subject to inspection. OWNER or ENGINEER shall have access to all places of manufacture where materials are being produced or fabricated, or where tests are being conducted and shall be accorded full facilities for inspection and observation.

#### 1.04 Submittals

- A. Product Data:
  - 1. The contractor shall submit the manufacturer's catalog pages including load tables, anchor details and standard installation details.
- B. Shop Drawings:
  - 1. The contractor shall submit for approval shop drawings for the fabrication and erection of all gratings, based on construction drawings of current issue. Include plans, elevations, and details of sections and connections as required. Show type and location of all fasteners.
- C. Samples of grating and anchorage system shall be submitted for approval.

## Part 2 Products

### 2.01 Manufacturers

- A. Acceptable manufacturers include Ohio Gratings Inc. 5299 Southway St. SW, Canton, Ohio 44706, or engineer approved equal.

### 2.02 Manufactured Units

- A. Description: Aluminum I-Bar swage lock grating type 19-SGI-4: Fabricated by assembled square cross bars through diamond shaped hole in rectangular bearing bars and are permanently locked in place by swaging.
  - 1. Bearing bar spacing: 1-3/16" on center.
  - 2. Bearing bar depth: based on loading requirements and clear span.
  - 3. Bearing bar flange thickness: 1/4" to provide 15/16" space between bars.
  - 4. Top surface of bearing bars: Striated or slip resistant per Owner's recommendation.
  - 5. Cross bar spacing: 4" on center.
- B. Fabrication: Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings. Band ends and cuts in grating with bars of same size and material as bearing bars.
- C. Design Criteria:
  - 1. Loading: Grating products shall be designed and manufactured to meet the live load conditions of 100 lbs /sq ft with maximum deflection of 1/4" for the clear spans shown on the Contract Drawings. Bearing bar depth shall be as shown on the Contract Drawings or as recommended by the manufacturer to meet the loading requirements, clear span conditions and maximum deflections specified.
- D. Materials: Bearing bars and banding are Aluminum Type 6063-T6 and aluminum cross bars are type 6063-T1.
- E. Fabrication tolerances shall be in accordance with ANSI/NAAMM MBG 531-09 Metal Bar Grating Manual.
- F. Finish: Gratings shall be mill finish, A-41 clear anodized or powder coat painted, per Owner's recommendation.

### 2.03 Accessories

- A. Provide appropriate fasteners for type, grade, and class required for the approved anchorage system.

## Part 3 Execution

### 3.01 Field Verification

- A. Take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the work.

### **3.02 Installation**

- A. Prior to grating installation, contractor shall inspect supports for correct alignment and conditions for proper attachment and support of the gratings. Any inconsistencies between Contract Drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the Engineer or Owner prior to placement.
- B. Install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI/NAAMM MBG-531-09 Metal Bar Grating Manual.
- C. Protection of Aluminum from dissimilar materials:
  - 1. Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with one coat of bituminous paint or use of other approved insulating material.
  - 2. Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with one coat of bituminous paint or use of other approved insulating material.

### **3.03 Grating Attachment**

- A. Use approved attachment system and fasteners to secure grating to supporting members as shown on plans.

End of Section

## Section 05 6000 Aluminum Fabrications

### Part 1 General

#### 1.01 Summary

- A. Section Includes: The work specified in this Section consists of providing aluminum fabrications as well as the manufactured aluminum items in the Project

#### 1.02 Related Sections

- A. 01 3300 – Submittal Procedures

#### 1.03 Quality Assurance

- A. Referenced Standards:

1. The Aluminum Association (AA):
  - a. Aluminum Design Manual
  - b. 45, Designation System for Aluminum Finishes
  - c. AA-M10C22A41 and AA-M10C22A42
2. ASTM International (ASTM):
  - a. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
  - b. A320, Standard Specification for Alloy-Steel Bolting Materials for Low-Temperature Service.
  - c. B26, Specification for Alloy-Steel Bolting Materials for Low-Temperature Service.
  - d. B86, Specification for Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
  - e. B108, Standard Specification for Aluminum-alloy Sheet and Plate.
  - f. B209, Standard Specification for Aluminum and aluminum-Alloy sheet and Plates.
  - g. B211, Standard Specification for Aluminum and Aluminum or alloy Bar, Rod and Wire.
  - h. B210, Specification for Aluminum and Aluminum or Alloy Drawn Seamless Tubes.
  - i. B221, Standard Specification for Aluminum and Aluminum-alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
  - j. B241, Standard Specification for Aluminum and Aluminum-alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
  - k. B247, Standard Specification for Aluminum and Aluminum-alloy Die Forgings, Hand Forgings, and rolled Ring forgings.
  - l. B308, Standard Specification for Aluminum-alloy 6061-T6 Standard Structural Profiles.
  - m. B632, Specification for Aluminum-Alloy Rolled Tread Plate.
  - n. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
  - o. D1730, Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting.

- p. D2566, Linear Shrinkage of Cured Thermosetting Casting.
  - q. F593, standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- 3. American Welding Society (AWS):
    - a. C5.5, Recommended Practices for Gas Tungsten Arc Welding
    - b. D1.1, Structural Welding Code
    - c. D1.2, Structural Welding Code Aluminum
    - d. AWS Handbook Section 4, Chapter 69 Aluminum and Aluminum Alloys
  - 4. Federal Specifications:
    - a. Fed. Spec. FF-S-92a, Screws, Machine: Slotted, Cross Recessed or Hexagon Head.
    - b. Fed. Spec. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge expansion anchors) Class 1 (One piece steel expander with cone taper integral with stud).
    - c. Fed Spec. TT-P-645B, Primer, Paint, Zinc-Chromate, Alkyd Type.
  - 5. American Architectural Manufacturers Association:
    - a. AAMA 605.2, Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions or Panels.
  - 6. US Department of Labor, Occupational Safety and Health Administration (OSHA):
    - a. 29 CFR 1910, OSHA Safety and Health Standards for General Industry (referred to herein as OSHA standards)
  - 7. Provide rails complying with 1996 BOCA Building Code and OSHA Regulations.
- B. Qualifications:
- 1. Applicator Qualifications: Provide evidence that aluminum pipe railing installer is approved by the pipe railing system manufacturer as a qualified installer.
  - 2. Welding Qualifications: Provide evidence that welders, tackers, and welding operators have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society, to perform the type of work required.

#### 1.04 Submittals

- A. Shop Drawings: Submit Shop Drawings in accordance with Section 01 3300, demonstrating compliance with specifications.
  - 1. Aluminum fabrications shop drawings to identify the detail as indicated on the Project Drawings and be complete as to the detail of the product and location in the project, the size and weights of members, the methods of joining various components, the quantity, finish, the location and type of anchors and necessary measurements.
  - 2. Provide easy-to-read markings on Shop Drawings for assemblies requiring erection identification marks.



3. Note tolerance variations or clearance requirements.
  4. Use American Welding Society standard welding symbols.
  5. Furnish setting diagrams, templates, and installation directions.
- B. Product Data: Include manufacturer's descriptive literature and specifications covering manufactured products specified herein.
1. Include complete information necessary for fabrication and erection of the specified products.
  2. Indicate size and weight of shapes, type and location of shop and field connections; the type, size and extent of welds and welding sequence when required. Use standard welding symbols of the American Welding Society in shop drawings.
  3. Submit current Approved ICC Evaluation Reports for all expansion and adhesive anchors.

#### 1.05 Delivery, Storage and Handling

- A. Deliver, store, and handle pre-finished products in a manner that will prevent material damage and deterioration or contamination from the elements.
- B. Provide protective wrapping on pre-finished aluminum products and maintain such in place until project is ready for final inspection.

## Part 2 Products

### 2.01 Materials

- A. Aluminum Fabrications:
1. Aluminum Structural Shapes: Aluminum alloy 6061-T6 conforming to ASTM B308, rolled or extruded. Shapes and thicknesses as indicated on Drawings.
  2. Aluminum Rod and Bars: Aluminum alloy 6061-T6 conforming to ASTM B221. Dimensions as indicated on Drawings.
  3. Aluminum Sheet and Plate: Aluminum alloy 6061-T6 conforming to ASTM B209. Thickness as indicated on Drawings.
  4. Checkered Aluminum Plate: Aluminum alloy 6061-T6 conforming to ASTM B632. Thickness of plate indicated on Drawings does not include raised portion.
- B. Aluminum Grating: Removable type, fabricated to panel sizes and thickness as indicated on Drawings. Where panel sizes are not indicated, limit panel weights to a maximum of 120 pounds each. Construction details in conformance with NAAMM Metal Bar Grating Manual.
1. Bearing Bars: Aluminum alloy 6063-T6, 3/16-inch thick and conforming to ASTM B221, or equivalent I-bar style.
  2. Cross Bars and Bent Connecting Bars: Aluminum alloy 6063-T5 conforming to ASTM B221.
  3. Bar Spacing:
    - a. Bearing Bars: 1-3/16-inch center to center.
    - b. Cross Bars: Four inches center to center.
  4. Bar Connection: Mechanically lock cross bars to bearing bars.
  5. Anchor Clips: Stainless steel, two each panel, unless recommended otherwise by manufacturer.
  6. Aluminum Bearing Angle: Aluminum alloy 6061-T6 conforming to ASTM B308.
  7. Banding: Grating bar ends banded same depth as bars. Openings cutting

- two or more bearing bars require banding. Openings for pipes, ducts, conduits, and similar objects require banding.
8. Openings Through Panels: Split panels in two individual sections to facilitate removal of panels at pipes, ducts, conduits, and similar objects passing through grating panels.
  9. Anti-Slip Surfacing: Except where indicated otherwise on Drawings, provide gratings with factory-applied anti-slip surfacing of either of the following types:
    - a. Aluminum Oxide Grit/Metal Matrix: Grating walking surface to receive a uniformly dispersed aluminum oxide grit particle coating encapsulated in a metal matrix and metal bonded to the grating by an electric-arc spray process.
    - b. Aluminum Oxide Grit/Epoxy Matrix: Grating walking surface to receive a uniformly dispersed aluminum oxide grit particle coating embedded in an epoxy matrix and epoxy bonded to the grating.
  10. Acceptable Manufacturers:
    - a. Ohio Gratings, Inc.; Series 19SGF
    - b. Intertec Corp.; AL-14 Series
    - c. Seidelhuber Metal Products, Inc.
    - d. Or Approved Equal
- C. Dissimilar Surface Isolation Material: Where aluminum materials contact dissimilar surfaces, provide an isolation material product as specifically required by the aluminum material or aluminum item manufacturer, or of the following materials as the manufacturer approves:
1. Aluminum to Metal Contact: Zinc Chromate Primer; conforming to Fed. Spec. TT-P-645B.
  2. Aluminum to Concrete Contact: Mineral filled coal tar pitch; conforming to Tnemec 46-465, MAB or Sherwin Williams.

## 2.02 Anchors and Fasteners

- A. Miscellaneous Screws and Bolts:
  1. Machine Screws: AISI Type 304 stainless steel conforming to Fed. Spec. FF-S-92a.
  2. Stainless Steel Bolts, Nuts and Washers: Stainless steel conforming to ASTM A320 Grade B8, AISI Type 304, and Grade B8M, AISI Type 316 were indicated on the Drawings.
  3. U-Bolts: ASTM A320 Grade B8, AISI Type 304 stainless steel with National Coarse Threads.
  4. Eyebolts: Drop forged from 18/8 Type 304 stainless steel with National Coarse Threads.
- B. Welding Electrodes: Table 4.1.1 of AWS D1.1 as required for applicable base metals and welding process.
- C. Anchor Rods (Pre-Set): Where anchor rods are indicated or required as pre-set in cast-in-place concrete, provide anchor of headed (heavy hexnut) design. Provide nuts and washers, and leveling nuts were indicated on the Drawings, all in materials matching the rod.
  1. Stainless Steel Anchor Rods: Stainless steel conforming to ASTM A320, Grade B8, AISI Type 303 or Type 304, and Grade B8M, AISI Type 316 were indicated on the Drawings.
- D. Drilled-In Toggle Type Anchors and Fasteners: Use for applications in masonry and precast concrete hollow-core structure components.
  1. Anchors: Provide anchors designed to accept both machine bolts and/or

- threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. Expander nut fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches and bears against the shield bottom.
2. Shield Body: Consisting of four legs, the inside of each tapered toward shield bottom (or nut end). The end of one leg is elongated and turned across shield bottom. Outer surface of shield body ribbed for grip-action.
    - a. Expander Nut: Square design with sides tapered inward from bottom to top.
    - b. Material: Die cast Zamac No. 3 zinc alloy of 41,000 psi minimum tensile strength. Shield and nut made in conformance with S.A.E. 903, ASTM B86.
  3. Fasteners: Machine bolts nuts and washers conforming to AISI Type 304 stainless steel and Fed. Spec. FF-S-92a.
  4. Acceptable Manufacturers:
    - a. U.S.E. Diamond, Inc.; FORWAY System.
    - b. Or Approved Equal.
- E. Drilled-In Expansion Anchors and Fasteners: Provide anchors that meet ACI 318 Appendix D requirements for cracked concrete and have a current approved ICC Evaluation Report. Use for applications in cast-in-place concrete and solid precast concrete structure components.
1. Stainless Steel Anchor/Fastener: UL Listed one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-92a, Group II, Type 4, Class 1. Stud of AISI Type 303 or Type 304 stainless and nut and washer of AISI Type Type 316 stainless steel.
  2. Acceptable Manufacturers:
    - a. Hilti Corporation; Kwik-Bolt TZ.
    - b. Simpson Strong Tie, Strong-Bolt
- F. Adhesive Anchoring System: Provide anchors that meet ACI 318 Appendix D requirements for cracked concrete and have a current approved ICC Evaluation Report. Provide adhesive anchor setting system composed of anchors and fasteners as specified, and a self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio. Provide system designed for compatibility with hollow or solid base materials.
1. Standard Anchor Rod Assembly: Chamfered end threaded stud rod of ASTM A307 steel with nut and washer. Stud size as indicated on Drawings.
  2. Stainless Steel Anchor/Fastener: Chamfered end threaded stud rod of AISI Type 304 stainless steel, with nut and washer of AISI Type 316 stainless steel.
  3. Adhesive Cartridge: Provide a dual cartridge containing both hardener and resin and dispenses from the dual cartridge through a static mixing nozzle.
    - a. Two-component, 100 percent solid, non-sag paste, insensitive to moisture and meeting requirements of ASTM C881, Type IV, Grade 3. Class A, B, and C. Shrinkage during cure is limited to .00051 inch per inch maximum in accordance with ASTM D2566. Compressive strength of 10,300 psi minimum in accordance with ASTM D695.
    - b. Inject the pre-mixed adhesive directly into the prepared anchor hole and insert anchor/fastener in the adhesive in accordance with the adhesive manufacturer's installation instructions.
    - c. Only injection tools and static mixing nozzles as recommended by manufacturer shall be used.

4. Acceptable Manufacturers:
  - a. Hilti Corporation; HIT RE 500-SD
  - b. Simpson Strong Tie, Simpson XP
- G. Hammer drive-type and explosive charge drive-type anchors and fastener systems not acceptable. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems also not acceptable.

### 2.03 Manufactured Units

- A. Aluminum Ships Ladder: Provide OSHA approved design ship's ladder complete with handrail as required by OSHA rules and regulations.
    1. Capacity: Unit shall support a 1000 lb (454 kg) total load without failure.
    2. Degree of Incline: 60 to 75 degrees.
    3. Components: Ladder, mounting brackets and handrails on both sides.
      - a. Ladder Stringer: 5 inch by 2 inch by 3/16 inch (127 mm by 51 mm by 5 mm) extruded 6005-T5 aluminum channel.
      - b. Ladder Treads: 5-3/16 inch by 1-1/8 inch by 1/8 inch (131 mm by 29 mm by 3 mm) extruded 6005-T5 aluminum with serrated slip resistance surface standard. 1-1/4 inch by 1-1/4 by 1-1/4 inch angle welded to underside of treads. Treads shall be welded and bolted to stringer with 1/4" stainless steel bolts.
      - c. Ladder Mounting Brackets:
        - (1) Floor Brackets: 2 inch by 3 inch by 1/4 inch (51 mm by 76 mm by 6 mm) aluminum angle.
        - (2) Top Bracket: 4-3/4 inch by 5 inch by 1/4 inch (121 mm by 127 mm by 6 mm) aluminum angle.
      - d. Handrails: 1-1/4 inches (32 mm) Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.
      - e. Platform:
        - (1) Surface: Platforms 9 Sq Ft or less shall be made of standard tread material. Platforms larger than 9 Sq Ft shall have a bar grating surface.
        - (2) Toe Boards: 4 inch by 1/4" 6005 T-5 aluminum.
        - (3) Handrails: 1-1/4 inches (32 mm) Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.
      - f. Finishes:
        - (1) Standard: Mill finish on aluminum ladder components.
        - (2) Optional Finishes:
          - (a) Powder Coated
          - (b) Anodized
    4. Acceptable Manufacturer:
      - a. Precision Ladders, LLC.
      - b. Or Approved Equal.
- B. Aluminum Access Doors-WATERTIGHT: Type and size as indicated on the Drawings, and constructed of materials and components as follows:
  1. Watertight under 10 ft column of stationary water.
  2. Door shall incorporate a 90 degree return flange around the perimeter.
  3. Door Leaf: 1/4 inch aluminum diamond plate.
    - a. Designed to withstand a live load of 625 lbs per square foot.
  4. Door(s):
    - a. Auto-lock Type 316 stainless steel hold open arm with release handle.
    - b. Type 316 stainless steel hinges with tamper-proof fasteners and

- attaching hardware.
- c. Furnish with padlock lug
5. Lock:
- a. Stainless steel pressure lock (with 4 keys).
  - b. Provide keys for multiple hatches keyed alike. Coordinate Owner's keying requirements (if any) for locks.
6. Frame:
- a. Angle frame-1/4" aluminum raised curb style.
  - b. 1/4" neoprene gasket: Locate a 1-1/2 inch drainage coupling in the corner of the channel frame.
  - c. Frame Dimensions:
  - d. Number of Access Door Sets: 2
7. Furnish hatch fitted with limit switch and actuating provisions.
- a. Provide switch with double pole contacts held open when hatch is closed and closed when hatch is open. Switch contacts shall be rated at least NEMA A600.
  - b. Switch enclosures shall be watertight, NEMA 4. Switches for hatches located in hazardous areas shall also be NEMA 7, rated for use in Class I, Division 1, Group D atmospheres.
  - c. Acceptable limit switch manufacturers:
    - (1) Allen Bradley
    - (2) Square D
    - (3) Crouse-Hinds
    - (4) Or Approved Equal
8. Hardware: Type 316 Stainless Steel.
9. Acceptable manufacturers:
- a. Bilco
  - b. Haliday Products: Type F-R
  - c. Or Approved Equal.
- C. Aluminum Railings
- 1. Provide OSHA and BOCA approved design railing complete with toeboard where required. The manufacturer shall submit calculations to the Engineer for approval. Testing of base castings or base extrusions by an independent lab or manufacturer's lab (if manufacturer's lab meets the requirements of the Aluminum Association) will be an acceptable substitute for calculations. Calculations will be required for approval of all other design aspects.
  - 2. Aluminum Railing Option: Contractor shall have the option to provide mechanically connected aluminum pipe railings or welded aluminum pipe railings in the Project. However, a mixture of railing systems is not permitted, except when indicated otherwise.
  - 3. Welded Aluminum Pipe Railings: Provide shop or factory fabricated welded joint assemblies as indicated on the Drawings.
    - a. Railings: 1-1/2 inch (1.90 in. O.D.) Schedule 40 pipe fabricated from extruded aluminum alloy 6061-T6
    - b. Posts: 1-1/2 inch (1.90 in O.D.) Schedule 40 pipe fabricated from extruded aluminum alloy 6061-T6.
    - c. Fabrication: Maintain quality of workmanship by careful preparation, including accurate notching and fitting of pieces. Make bends without the use of fittings, where practical. Make railing sections as long as practical but not to exceed 20 feet. Make intersection of rails and posts by coping the pipe and continuously welding. In all cases, fabricate top rail continuous over posts, and

- posts continuous from base to top rail. Anchor posts by mechanical methods as indicated; welding of posts at base for anchoring is not acceptable.
- d. Welding: Perform welding in raised beads so that subsequent filing and polishing will remove raised weld material. Exercise care to protect manufacturers factory (anodized) finish during welding. Remove finish in the immediate area of welds for conductivity. Finish welds by filing and polishing exercising care to attain same texture of factory satin finish. Welds shall conform to AWS D1.1.
  - e. Mounting Flanges: Posts welded to mounting flanges are not acceptable.
    - (1) Heavy Duty Floor Flanges: Cast aluminum with a solid aluminum 6061-T6 reinforcing bar; such as Julius Blum 7571, or equal.
    - (2) Fascia Flanges (side mount flanges): Extruded aluminum with a solid aluminum 6061-T6 reinforcing bar.
    - (3) Flange design shall be similar to the flange details shown on the Drawings.
  - f. Acceptable Manufacturers:
    - (1) Tubular Products, Inc.; In-Line Welded Rail II.
    - (2) Tri-Tech. O.S.H.A. Rail
    - (3) Crane Veyor Corp.; C-V Pipe Rail
    - (4) Or Approved Equal.
4. Aluminum Railing Hardware and Accessories:
- a. Fasteners: AISI Type 304 stainless steel.
  - b. Guard Chain: Individually welded straight link AISI Type 316 stainless steel chain and with stainless steel hook and eye. Safety chains are not to be used unless specifically shown on the drawings.
  - c. Pipe Rail Gate: Factory fabricated to the design indicated on the Drawings, or similar, and composed of manufacturer's standard bends and straight lengths. Gates shall swing on two extruded aluminum ring hinge assemblies and shall positively latch (OSHA 1910.23) by an extruded latch ring and pin assembly.
5. Railing Finish:
- a. High Performance Organic Coating Finish: Exposed aluminum members factory finished with a high-performance organic coating conforming to the requirements of AAMA 605.2, and the following:
    - (1) Metal Preparation and Pre-Treatment: In-plant metal cleaning and pre-treatment practice shall conform to ASTM D1730, Type B, Method 5 or Method 7.
    - (2) Coating Material: Finish products containing the KYNAR 500 (polyvinylidene fluoride) fluorocarbon base, and as formulated by a recognized licensee of KYNAR 500.
    - (3) Coating Application: In-plant coating application practice shall conform to the accepted methods and recommendations of AAMA 605.2 specifications. Applied coating shall have a total dry-film thickness of 1.2 mils minimum.
    - (4) Coating Color: as per Owner.

## 2.04 Fabrication

### A. General:

1. Contractor/supplier shall verify field conditions and dimensions prior to fabrication and installation.
2. Use only materials, which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
  - a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
  - a. Ease exposed edges to a radius of approximately 1/32 IN.
  - b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
  - c. Drill or punch holes with smooth edges.
4. Form exposed connections with flush, smooth, handline joints, using stainless steel or aluminum splice locks to splice sections together or by welding. Top rail splices and expansion joints shall be located with 8 IN or post or other support.
  - a. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.
5. Provide for anchorage of type as required by field conditions.
6. Design railing and anchorage system to withstand:
  - a. 200 LB concentrated load applied at any point in any direction to top of rail system.
  - b. 50 PLF vertical and horizontal uniform load applied simultaneously to top rail of the guardrail.
  - c. Concentrated load need not be assumed to act concurrently with uniform load.
7. Custom fabricate railings to dimensions and profiles determined during field verification.
  - a. Fabricate handrail mounted to wall using minimum 1/4 IN nominal DIA schedule 40 pipe.
  - b. Fabricate all guardrail top rails using minimum 1-1/2 IN nominal DIA schedule 40 pipe.
  - c. Fabricate all guardrail vertical posts using minimum 1-1/2 IN nominal DIA schedule 40 pipe.
    - (1) Guardrail vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6063-T6.
  - d. All intermediate rails shall be fabricated using minimum 1-1/2 IN nominal DIA schedule 40 pipe.
  - e. Set horizontal rails to requirements of the Building Code or OSHA whichever requires the more restrictive design.
8. Fit exposed ends of guardrails and handrails with solid terminations.
  - a. Return ends of handrail to wall, but do not attach to wall.
  - b. Where guardrail terminates at a wall provide a vertical post located 4 IN off the wall to center of post.
9. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.

### B. Finish: 204-R1 clear anodized finish

- C. Welded Railing Fabrication
  - 1. All welding to be continuous in accordance with AWS C5.5 and D1.2.
    - a. All welded railing joints shall have full penetration welds unless noted otherwise.
  - 2. All exposed welds to be ground and buffed smooth and flush to match and blends with adjoining surfaces.
  - 3. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
  - 4. Finishing joints with filler is not acceptable.
- D. Install weeps to drain water from hollow sections of railing at exterior and high humidity conditions.
  - 1. Drill 1/4 IN weep holes in railing 1 IN above walkway surface at bottom of posts set on concrete or otherwise closed at bottom, and at any other low points where moisture can collect.
- E. Expansion Joints:
  - 1. Allow thermal expansion and contraction of railing while still meeting design-loading requirements.

### **Part 3 Execution**

#### **3.01 Installation**

- A. Provide welded type railing.
- B. Install products in accordance with manufacturer's instruction.
- C. Set work accurately in location, alignment, and elevation; plumb, level and true. Measure from established lines and items which are to be built into concrete, masonry, or similar construction.
- D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
  - 1. Space vertical posts as required by loading requirements but not more than 4 FT on center.
- E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer. Joints to be designed to allow expansion and contraction of railing and still meet design load requirements.
- F. Anchor will be either side or top mounting depending on arm being replaced and mounted with stainless steel bolts, nuts and washers
- G. Coat aluminum in contact with dissimilar metal or concrete

End of Section



## Section 06 1000 Rough Carpentry

### Part 1 General

#### 1.01 Scope of Work

- A. This Section includes all rough carpentry work including framing, nailers, blocking, wood grounds, furring and sheathing necessary for the completion of the project as indicated on the Plans. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

#### 1.02 Standard References

- A. American Forest and Paper Association (AFPA):
1. Manual for Wood Frame Construction
- B. American National Standards Institute (ANSI):
1. A208.1 Mat-Formed Manufactured Panels
- C. Engineered Wood Association American Plywood Association (APA):
1. Form E30 - Engineered Wood Design/Construction Guide: Residential and Commercial
- D. American Society of Mechanical Engineers (ASME):
1. B18.2.1 - Square and Hex Bolts and Screws - Inch Series
  2. B18.6.1 - Wood Screws (Inch Series)
- E. American Society for Testing and Materials (ASTM):
1. A153 - Specification for Zinc -Coating (Hot-Dip of Iron and Steel Hardware)
  2. A307 - Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  3. A563 - Specification for Carbon and Alloy Steel Nuts
  4. A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  5. D245 - Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber
  6. D2555 - Test Method for Establishing Clear Wood Strength Values
- F. American Wood Preservers Association (AWPA):
1. C2 - Lumber, Pressure Treatment
  2. C9 - Plywood, Pressure Treatment
  3. C20 - Structural Lumber, Fire-Retardant Pressure Treatment
  4. C27 - Plywood, Fire-Retardant Pressure Treatment

5. M4 - Standard for the Care of Preservative-Treated Wood Products

**1.03 Submittals**

- A. General: Submit the following in accordance with the conditions of Contract and Section 01 3300, Submittal Procedures.
- B. Product Data: Submit manufacturer's product data for each distinct product specified.
- C. Wood treatment data as follows, including chemical treatment manufacturer's warranty and instructions for handling, storing, installing, and finishing treated materials.
  - 1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  - 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
  - 3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.
- D. Material Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.

**1.04 Quality Assurance**

- A. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by single producer.

**1.05 Delivery, Storage, and Handling**

- A. Deliver wood products bundled or crated to provide adequate protection during transit and job storage, with required grade marks clearly identifiable. Inspect wood products for damage upon delivery. Remove and replace damaged materials.
- B. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks, and under temporary coverings.
  - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
- C. Protect sheet materials during handling to prevent breaking of corners and damage to surfaces.

**1.06 Project Conditions**

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow

attachment of other work.

## **Part 2 Products**

### **2.01 Lumber - General**

- A. Lumber Standards: Comply with PS 20-99, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review. Lumber design values are to comply with ASTM D245 and ASTM D2555.
- B. Inspection Agencies: Inspection agencies, and their grading rules include the following:
  - 1. Northeastern Lumber Manufacturers Association (NELMA):
    - a. Standard Grading Rules
  - 2. Redwood Inspection Service (RIS):
    - a. Standard Specifications for Grades of California Redwood Lumber
  - 3. Southern Pine Inspection Bureau (SPIB):
    - a. Standard Grading Rules for Southern Pine Lumber
  - 4. West Coast Lumber Inspection Bureau (WCLIB):
    - a. No. 17 Standard Grading Rules for West Coast Lumber
  - 5. Western Wood Products Association (WWPA):
    - a. Western Lumber Grading Rules.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
  - 1. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.
- D. Where nominal sizes are indicated, provide actual sizes required by PS 20-99 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 1. Provide dressed lumber, S4S, unless otherwise indicated.
  - 2. Provide lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

### **2.02 Wood-Preservative-Treated Materials**

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood).
  - 1. For exposed items indicated to receive stained finish, use chemical formulations

that do not bleed through, contain colorants, or otherwise adversely affect finishes.

- B. Pressure-treat aboveground items with waterborne preservatives to minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m.). After treatment, kiln-dry lumber and plywood to maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing members less than 18 inches (460 mm) above grade.
  - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure-treat wood members in contact with ground or freshwater with waterborne preservatives to minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m.).
- D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

### **2.03 Fire-Retardant-Treated Materials**

- A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of Underwriter Laboratory (UL), U.S. Testing, or Timber Products Inspection, Inc.
- B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation.
  - 1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested.
  - 2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
  - 3. Contact with treated wood does not promote corrosion of metal fasteners.
- C. Exterior Type: Use for exterior locations, and where indicated.
- D. Inspect each piece of treated lumber or plywood after drying, and discard damaged or defective pieces.

### **2.04 Dimension Lumber**

- A. General: If not indicated on Contract documents, provide dimension lumber of any species and grades indicated for applicable use category listed in table below. Lumber

shall comply with ALSC National Grading Rule (NGR) provisions of inspection agency applicable to species.

<b>Product (Nominal Dimension)</b>	<b>Grade</b>	<b>Use</b>
Structural Light Framing 2 to 4 inches thick 2 to 4 inches wide	Select Structural No. 1 No. 2 No. 3	Structural applications where highest design values are needed in light framing sizes.
Light Framing 2 to 4 inches thick 2 to 4 inches wide	Construction Standard Utility	Where high-strength values are not required, such as wall framing, plates, sills, cripples, and blocking.
Stud 2 to 4 inches thick 2 inches and wider	Stud	Optional all-purpose grade designed primarily for stud uses, including bearing walls.
Structural Joists and Planks 2 to 4 inches thick 5 inches and wider	Select Structural No. 1 No. 2 No. 3	Intended to fit engineering applications for lumber nominal 5 inches and wider, such as joists, rafters, headers, beams, trusses, and general framing.

- B. Species and grades must meet or exceed the following values, unless indicated otherwise on Contract documents.
1. Fb (extreme fiber stress in bending): Minimum 850 psi (5.9 MPa).
  2. E (modulus of elasticity): Minimum 1,300,000 psi (8950 MPa).
- C. Exposed Framing: Refers to dimension lumber which is not concealed by other work, and is indicated to receive stained, painted, or natural finish.
1. Provide material hand-selected from lumber of species and grade indicated for type of use, for uniformity of appearance, and freedom from characteristics that would impair finish appearance.

## 2.05 Miscellaneous Lumber

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated, and into shapes shown on Contract documents.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade and Species: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common or Standard grade per WWPA of any species.

## 2.06 Structural-Use Panels for Underlayment

- A. General: Over smooth subfloors, provide underlayment not less than 1/4 inch (6.4 mm) thick. Over board or uneven subfloors, provide underlayment not less than 11/32 inch (8.7 mm) thick.
- B. Plywood Underlayment for Resilient Flooring: For underlayment under 19/32 inch (15.1 mm) thick, provide plywood panels with fully sanded face, APA Underlayment grade, Exposure 1.
- C. Structural-Use Panel Underlayment for Resilient Flooring: For underlayment 19/32 inch (15.1 mm) thick or more, provide fully sanded, veneer-faced, APA-rated, Sturd-I-Floor panels, Exposure 1.
- D. Plywood Underlayment for Ceramic Tile: Provide APA-rated, Underlayment grade, exterior plywood, 5/8 inch (15.9 mm) thick, for ceramic tile set in epoxy mortar.
- E. Plywood Underlayment for Carpet: For underlayment under 19/32 inch (15.1 mm) thick, provide plywood panels with fully sanded face, APA Underlayment grade, Exposure 1.
- F. Structural-Use Panel Underlayment for Carpet: For underlayment 19/32 inch (15.1 mm) thick or more, provide APA-rated Sturd-I-Floor panels with touch-sanded face, Exposure 1.

## 2.07 Particleboard

- A. General: Comply with and factory mark each panel according to ANSI A208.1. Provide thickness indicated on Contract documents.
- B. Particleboard Underlayment: Grade PBU.
- C. Particleboard Subflooring: Grade M-3-Exterior Glue.
- D. Particleboard Wall Sheathing: Grade M-1-Exterior Glue.

## 2.08 Fasteners

- A. General: Provide fasteners of size and type indicated, that comply with requirements specified.
  - 1. Where rough carpentry work is exposed to weather, in ground contact, or in areas of high relative humidity, provide fasteners with hot-dip, zinc-coating per ASTM A153
- B. Nails, Wire, Brads, and Staples: ASTM F1667FS FF-N-105B.
- C. Wood Screws: ASME B18.6.1.
- D. Lag Bolts: ASME B18.2.1.
- E. Bolts: Steel bolts complying with ASTM A307, Grade A with ASTM A563 hex nuts and, where indicated, flat washers.

## 2.09 Metal Framing Anchors

- A. General: Provide galvanized steel framing anchors of structural capacity, type, and size

indicated, with allowable design loads as published by manufacturer, that meet or exceed those indicated.

- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653, G60 coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

## **Part 3 Execution**

### **3.01 Installation, General**

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work to required levels and lines, with members plumb and true and cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.
- D. Countersink nail heads on exposed carpentry work and fill holes.
- E. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

### **3.02 Wood Grounds, Nailers, Blocking and Sleepers**

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

### **3.03 Wood Furring**

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required tolerance of finished work.
- B. Firestop furred spaces on walls at each floor level and at ceiling line of top story, with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

### **3.04 Wood Framing, General**

- A. Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association (N.F.P.A).

- B. Do not splice structural members between supports.
- C. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and "National Design Specifications for Wood Construction" published by N.F.P.A.
- D. Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are by the framing system used, use closely fitted wood blocks of nominal 2" thick lumber of the same width as framing members.
- E. Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel.
  - 1. Provide single bottom plate and double top plates using members of 2-inch nominal (38 mm actual) thickness whose widths equal that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction, unless otherwise indicated.
  - 2. For exterior walls, provide 2 by 6-inch nominal (38 by 140 mm actual) size wood studs spaced 24 inches (610 mm) o.c., except where otherwise indicated or required.
  - 3. For interior partitions and walls, provide 2 by 4-inch nominal (38 by 89 mm actual) size wood studs spaced 16 inches (406 mm) o.c., except where otherwise indicated or required.
- F. Construct corners and intersections with three (3) or more studs. Provide miscellaneous blocking and framing as shown, and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide continuous horizontal blocking at mid-height of single-story partitions over 96 inches (2.4 m) high and multistory partitions, using members of 2-inch nominal (38 mm actual) thickness and of same width as wall or partitions.
- G. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal (89 mm actual) depth for openings 36 inches (914 mm) and less in width, and not less than 6-inch nominal (140 mm actual) depth for wider openings.
  - 2. For load-bearing walls, provide double-jamb studs for openings 72 inches (1.8 m) and less in width, and triple-jamb studs for wider openings. Provide headers of depth shown as indicated on Contract documents.
- H. Provide bracing in exterior walls and at interior load-bearing walls (that are not more than 25 feet (7.6 m) from other parallel braced walls) at each end and at not more than 25 feet (7.6 m) apart, to comply with IUBC Section 2308.9.326.11.3 "Bracing" and IUBC Table 2308.9.3(I).23-I-W "Braced Wall Panels" as required for Seismic Zone 2B.

### 3.05 Stud Framing

- A. General: Provide stud framing of size and spacing indicated or, if not otherwise



indicated, of the following sizes and spacings. Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using 2" thick members with widths equaling that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.

- B. Provide 1" x 4" corner let-in corner braces unless diagonal or plywood type sheathing is used.
- C. For interior partitions and walls provide 2" x 4" wood studs spaced 16" o.c.
- D. Construct corners and intersections with not less than 3 studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.
- E. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
- F. For non-bearing partitions, provide double-jamb studs and headers not less than 6" deep for openings 3' and less in width, and not less than 10" deep for wider openings.
- G. For load-bearing partitions, provide double-jamb studs for openings 4' and less in width, and triple-jamb studs with osb spacers for openings 4' to 6' in width. Provide headers of depth not less than 12" deep.

### 3.06 Floor Joist Framing

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38.1 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:
  - 1. Where supported on wood members, by toe nailing or by using metal framing anchors.
  - 2. Where framed into wood supporting members, by using wood ledgers as shown or, if not shown, by using metal joist hangers.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1.2 m).
- C. Do not notch in middle third of joists; limit notches to 1/6 depth of joist, 1/3 at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches (51 mm) from top or bottom.
- D. Provide solid blocking of 2-inch nominal (38 mm actual) thickness by depth of joist at ends of joists unless nailed to header or band.
- E. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38 mm actual) thickness by depth of joist over supports.
- F. Under jamb studs at openings, provide solid blocking between joists.
- G. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- H. Provide bridging of type indicated below, at intervals of 96 inches (2.4 m) o.c., between joists.
1. Form diagonal wood bridging from bevel cut 1 by 3-inch nominal (19 by 64 mm actual) size lumber, double-crossed and nailed both ends to joists.
  2. Install steel bridging to comply with manufacturer's written instructions.

### 3.07 Rafter and Ceiling Joist Framing

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
- B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge place directly opposite each other and nail to ridge member or use metal ridge hangers.
- C. Provide collar beams (ties) as shown or, if not shown, provide 1 by 6-inch nominal (19 by 140 mm actual) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) on center. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Rafter Ties: Tie straps shall be provided from each roof framing member to exterior studs, posts or other supporting members below the roof. Opposing rafters at ridges shall be aligned and connected with straps.

### 3.08 Stair Framing

- A. Provide stair framing members of size, space, and configuration indicated or, if not otherwise indicated, to comply with the following requirements:
1. Stringer Size: 2 by 12-inch nominal (38 by 286 mm actual) size minimum.
  2. Notching: Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches (89 mm) of effective depth.
  3. Stringer Spacing: At least three (3) stringers for each 36-inch (914 mm) clear width of stair.
- B. Provide stair framing that does not exceed the following variations between treads and risers within each flight:
1. Adjacent Treads and Risers: 3/16 inch (4.76 mm).
  2. Between Largest and Smallest Treads and Risers: 3/8 inch (9.53 mm).

### 3.09 Installation of Structural-Use Panels

- A. General: Comply with applicable recommendations contained in APA Form No. E30, for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subflooring-Underlayment: Glue subflooring and underlayment to floor joists, and screw to joists. Space panels 1/8 inch (3.18 mm) at edges and ends.
2. Subflooring: Glue subflooring to floor joists, and screw to joists. Space panels 1/8 inch (3.18 m) at edge and ends.
3. Sheathing: Nail to framing. Space panels 1/8 inch (3.18 mm) at edges and ends.
4. Underlayment: Nail to subflooring. Space panels 1/32 inch (0.8 mm) at edges and ends.
5. Plywood Backing Panels: Nail or screw to supports.

### **3.10 Particleboard Underlayment**

- A. Install to comply with the recommendations of the National Particleboard Association (NPA) for type of subfloor indicated.
  1. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
  2. Glue and nail underlayment to subflooring throughout.

End of Section

Not To Be Used For Bidding Purposes

## Section 07 5300 Elastomeric Membrane Roofing

### Part 1 General

#### 1.01 Scope of Work

- A. This section includes the installation of fully adhered elastomeric roofing membrane, insulation, and flashing.

#### 1.02 Related Work Specified Elsewhere

- A. Section 06 1000: Rough Carpentry
- B. Section 07 6000: Flashing and Sheet Metal
- C. Section 07 9200: Joint Sealants

#### 1.03 Reference Standards

- A. ASTM C 1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2001.
- B. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Tension; 1998a.
- C. ASTM D 448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 1998.
- D. ASTM D 624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000.
- E. ASTM D 746 – Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 1998.
- F. ASTM D 4637 – Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 1996.
- G. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials; 2000.
- H. NRCA ML104 – The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition.
- I. UL (RMSD) – Roofing Materials and Systems Directory; Underwriters Laboratories Inc.; current edition.

#### 1.04 Submittals

- A. Submit the following in accordance with Section 01 3300, Submittal Procedures:
  - 1. Product Data: For each major component, including membrane, rigid board insulation, membrane flashings and adhesives. Highlight critical criteria for proper installation.

2. Shop Drawings: Include plans, sections, details in accordance with performance requirements, and for attachment to other portions of the Work.
3. Test Reports:
  - a. Product Test Reports shall be submitted based on the evaluation of comprehensive tests conducted by an independent testing agency of the specified roofing Products.
  - b. Manufacturer Field Inspection Reports shall be submitted based on manufacturer's written acceptance of roofing installation.

#### **1.05 Quality Assurance**

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
  1. Submit manufacturer certificates signed by roofing manufacturer verifying that installer is approved, authorized or licensed by manufacturer to install specified Products.
- C. Applicator Qualifications: Company specializing in performing the work of this section 10 years experience and approved by manufacturer and approved by manufacturer.
  1. Submit installer certificates signed by installer verifying that they have the specified qualifications herein.

#### **1.06 Delivery, Storage, And Protection**

- A. Deliver and store Products undamaged in original containers with manufacturer's labels and seals intact.
- B. Store Products in designated areas elevated off the ground and protected from ultra-violet radiation, inclement weather and construction activities.
- C. Store solvent-based liquids away from excessive heat and open flame.
- D. Store adhesives and sealants at temperature above 5 degrees Celsius.
- E. Store membrane rolls on end, dry, and protected from moisture and damage. Cover rolls, insulation and other moisture-sensitive Products with tarpaulins.
- F. Store products on roof deck in a manner to prevent overloading the structure and properly secured to prevent movement due to wind or other forces. Prevent permanent deformation of deck.

#### **1.07 Environmental Requirements**

- A. Do not apply any roofing materials during inclement weather.
- B. Comply with manufacturer's recommendations for minimum and maximum

temperatures and humidity during application.

- C. Do not install Products when temperatures are below -10 degrees Celsius. Consider effects of wind chill on adhesives, and ensure they will not prematurely set before proper adhesion takes place.
- D. Keep water-based Products from freezing. Do not apply water-based Products if temperatures are below 5 degrees Celsius.

#### **1.08 Warranty**

- A. Submit warranties in accordance with the General Conditions of the Contract.
- B. Installer's Warranty: Provide standard 2 year warranty, commencing from the date of Substantial Performance of the Work.
- C. Manufacturer's Warranty: Provide a written guarantee that the manufacturer will replace, at no cost to OWNER, any portion of the roofing membrane which experiences actual leaks resulting from defects in the manufacture of the membrane for a period of 10 years, commencing from the date of Substantial Performance of the Work.

### **Part 2 Products**

#### **2.01 Acceptable Manufacturers**

- A. EPDM Membrane Materials:
  - 1. Carlisle SynTec Incorporated;
  - 2. Firestone Building Products Co.;
  - 3. GenFlex Roofing Systems;
  - 4. Versico, Inc. or
  - 5. ENGINEER-approved equal.
- B. Insulation:
  - 1. Apache Products Co.;
  - 2. GAF Materials Corporation;
  - 3. Dow Chemical Co.;
  - 4. Owens Corning Corp.; or
  - 5. ENGINEER-approved equal.

#### **2.02 Roofing – Fully Adhered Applications**

- A. Elastomeric Membrane Roofing: One ply membrane fully adhered over insulation that is mechanically or adhesively attached to substrate with membrane continuously anchored at the perimeter with mechanical anchors.
- B. Roofing Assembly Requirements:
  - 1. Roof Covering External Fire-resistance Classification: UL Class A.
- C. Acceptable Insulation Types - Under Membrane - Constant Thickness Application:

Any of the types specified.

1. Minimum 2 inch thickness layers of polyisocyanurate board.

D. Acceptable Insulation Types:

1. Tapered polyisocyanurate board.

### 2.03 Roofing Membrane And Associated Materials

A. Membrane: Ethylene-propylene-diene-monomer (EPDM); non-reinforced; complying with minimum properties of ASTM D 4637, Type I.

1. Thickness ..... (60 mils) 0.060 inch
2. Unbacked Sheet ..... Grade 1 or 2 and Class (unreinforced)
3. Sheet Width (minimum): ..... 144 inch
4. Color: ..... Black
5. Tensile Strength (ASTM D412): ..... 1305 psi
6. Ultimate Elongation (ASTM D412): ..... 300 percent
7. Tear Resistance (ASTM D624): ..... 150 lbf/in
8. Water Vapor Permeability (ASTM E96): ..... 2.0 perm inch
9. Brittleness Temperature (ASTM D746): ..... -49 degrees Fahrenheit

B. Seaming Materials: As recommended by membrane manufacturer, including only liquids that meet VOC requirements of authorities having jurisdiction.

C. Flexible Flashing Material: Same material as membrane; conforming to the following:

1. Thickness: ..... 60 mil
2. Tensile Strength ..... 1,200 psi
3. Color: ..... Black
4. Product: ..... Formflash manufactured by Firestone, or equal

### 2.04 Insulation

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289, and with the following characteristics:

1. Facing: ..... Asphalt felt or mat both faces
2. Board Size: ..... 48 x 96 inch
3. Board Thickness: ..... (minimum) 2 inch
4. Thermal Resistance: ..... Conditioned R-value of 10
5. Board Edges: ..... Square
6. Tapered Units to achieve roof drainage profile: ..... As Required

B. Acceptable Manufacturers:

1. Apache Products Co.;
2. Dow Chemical Co.;
3. GAF Materials Corporation;
4. Celotex Corporation; or
5. ENGINEER-approved equal.

## **2.05 Accessories**

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Membrane Adhesive: As recommended by membrane manufacturer.
- C. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch (25 mm) wide, roll formed and pre-punched.
- D. Pourable Sealers: For pitch pockets.
- E. Pre-formed: Inside and outside corner sheet flashings, cone flashings, reglets and other accessories recommended by roofing manufacturer for intended use.

## **Part 3 Execution**

### **3.01 Examination**

- A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
- B. Verify that roof openings and penetrations are in place and set and braced and that roof scuppers are properly roughed into position.
- C. Verify that wood nailers are in place and secured and match thickness of insulation required.
- D. Do not proceed with installation until after the minimum concrete curing period recommended by roofing system manufacturer.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.02 Preparation**

- A. Clean substrate of dust, debris and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging scuppers and conductors and from spilling or migrating onto surfaces of other construction.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecasted. Remove and discard temporary seals before beginning work on adjoining roofing.

### **3.03 Insulation Installation**

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.



- B. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated and as confirmed by shop drawings.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where insulation thickness is 2 inches (50 mm) or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Carefully trim and adjust insulation at scuppers so completed drain path does not restrict drainage flow.
- F. Install insulation with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ½ inch (6 mm) with insulation.
- G. Attached insulation: Use only roofing system and insulation manufacturer's approved attachment methods, coordinating with any restrictions placed by substrate manufacturer. Manufacturer's approved mechanical or adhesive attachment methods are acceptable if approved for the warranty and loading criteria for the system installed.
- H. Install cover boards only if required by roof manufacturer for warranty specified.

#### **3.04 Adhered Sheet Installation**

- A. Install EPDM sheet over area to receive roofing according to roofing system manufacturer's written instructions. Unroll sheet and allow to relax for a minimum of 30 minutes before final positioning.
- B. Start installation of sheet in presence of roofing system manufacturer's technical personnel.
- C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Apply bonding adhesive to substrate and underside of sheet at rate required by manufacturer for a strong bond.
- E. Mechanically fasten sheet securely at terminations and perimeter of roof.
- F. Shingle side laps with slope as possible.
- G. Carefully place scupper components and seals to ensure complete leak free drainage.

#### **3.05 Seam Installation**

- A. Clean and prime both surfaces of splice areas, apply splice tape and firmly roll end laps according to manufacturer's written instructions. Apply lap sealant and seal exposed edges of sheet terminations.
- B. Revisit all laps, joints and repairs to ensure proper placement of seaming materials.

### **3.06 Flashing Installation**

- A. Install sheet flashings and pre-formed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### **3.07 Coping Installation**

- A. Install pre-formed copings to conceal roof membrane terminations at parapets according to roofing system manufacturer's written instructions.

### **3.08 Field Quality Control**

- A. Manufacturer's Field Service: Arrange for manufacturer's technical representative to regularly inspect the roofing application (minimum twice per week) and confirm that the roofing system installation is in strict accordance with manufacturer's recommendations.

### **3.09 Cleaning**

- A. Clean drains and downspouts of debris, ensuring free drainage.
- B. Clean adjacent roof surfaces, levels and ground level areas of debris and excess Products.

### **3.10 Protection of Finished Work**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

End of Section

## Section 07 6000 Flashing and Sheet Metal

### Part 1 General

#### 1.01 Scope of Work

- A. This section includes furnishing and installing fascia, soffits, drip edge, and miscellaneous sheet metal accessories.

#### 1.02 Reference Standards

- A. American National Standards Institute (ANSI):
1. ANSI/SPRI RD-1 - Standard for Retrofit Roof Drains
- B. American Welding Society (AWS):
1. AWS D1.2/D1.2M - Structural Welding Code - Aluminum
- C. ASTM International (ASTM):
1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  2. ASTM A038 - Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot Dip Process
  3. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  4. ASTM B101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction
  5. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  6. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  7. ASTM B32 - Standard Specification for Solder Metal
  8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction
  9. ASTM B69 - Standard Specification for Rolled Zinc
  10. ASTM D1784 - Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
  11. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

12. ASTM D41 - Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
13. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free

### **1.03 Submittals**

- A. Product Data:
  1. Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- B. Samples of the following flashing, sheet metal, and accessory items:
  1. 8-inch square samples of specified sheet materials to be exposed as finished surfaces.
  2. 12-inch long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
- C. Shop Drawings:
  1. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counter-flashings, trim/fascia units, and expansion joint systems. Provide layouts at 1/4 inch scale and details at 3-inch scale.

### **1.04 Delivery, Handling, and Storage**

- A. Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

### **1.05 Warranty**

- A. Products shall be warranted to be free of defects in material and workmanship for a period of five (5) years from date of shipment.
- B. Product liability is limited to the repair or replacement of furnished materials, provided printed installation instructions have been followed. Manufacturer shall provide, at no additional charge to OWNER, a 20-year finish warranty against peeling, chalking, fading, checking and crazing, commencing upon the date of substantial completion. No other warranties either expressed or implied are acceptable unless so stated in writing.

### **1.06 Project Conditions**

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

## Part 2 Products

### 2.01 Materials

#### A. Sheet Metal Flashing and Trim Materials

1. Stainless Steel: Any necessary flashing shall be AISI Type 302/304, complying with ASTM C167, 2D annealed finished, soft, except where harder temper required for forming or performance; 0.0156 inch thick (28 gage) except as otherwise indicated.
2. Extruded Aluminum: Fascia and soffit shall be manufacturer's standard extrusions of sizes and profiles indicated, 60064-T52, AA-C22A41 mill finish; with baked on enamel finish, 0.080 inch minimum thickness for primary legs of extrusions.

#### B. Miscellaneous Materials and Accessories:

1. Solder: For use with stainless steel, provide 60-40 tin/lead solder (ASTM B 32), with acid-chloride type flux, except use rosin flux over tinned surfaces.
2. Fasteners: Same metal as flashing/sheet metal or, other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
3. Bituminous Coating: SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
4. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
5. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 9200, Joint Sealants.
6. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

#### C. Fabricated Units:

1. General Metal Fabrication: Shop fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices.
2. Fabricate for water proof and weather resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates.
3. Comply with material manufacturer instructions and recommendations for forming material.
4. Form exposed sheet metal work without excessive oil-canning, buckling and

tool marks, true to line and levels indicated, with exposed edges folded back for form hems.

5. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
6. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).
7. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
8. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers, for installation behind main members where possible. Fabricate mitered and welded corner units.

## **Part 3 Execution**

### **3.01 Installation**

- A. Installation Standards: Install flashing and sheet metalwork as indicated and in accordance with the approved Shop Drawings and SMACNA Architectural Sheet Metal Manual.
- B. Flashing and Metal Trim: Provide flashing, counterflashing, cap flashing, metal trim, and any other fabricated items and miscellaneous sheet metalwork indicated or required to provide a complete and watertight installation.
- C. Gutters and Downspouts: Install gutters and downspouts as indicated and in accordance with the approved Shop Drawings and pertinent provisions of SMACNA Architectural Sheet Metal Manual.
- D. Work Quality:
  1. Sheet metalwork shall be finished straight and true, with miters and joints accurately fitted. Exposed work shall be free of dents and other defects. Corners shall be reinforced and seams made waterproof. Edges of sheet metal shall be hemmed.
  2. Provide for expansion and contraction in sheet metal assembly by means of expansion joints or other appropriate methods of SMACNA Architectural Sheet Metal Manual. Provide reinforcement as required.
  3. Isolate and protect dissimilar metals from contact with each other by applying specified isolation material to contact surfaces. Protect surfaces of sheet metal in contact with concrete, treated wood, or aluminum with a heavy coating of bituminous paint.
  4. Provide waterproof neoprene washers wherever required fasteners penetrate

sheet metal. Exposed fasteners will not be permitted for any portion of this work.

E. Caulking and Sealing:

1. Caulk or seal joints and laps of sheet metalwork as indicated or required for a waterproof installation. Beads of sealant which will be concealed in the finished work shall be continuous with no voids of material. Interface and coordinate the caulking and sealing work of this Section with the work specified in Section 07 9200, Joint Sealants.

F. Flashing for Roof Penetrations:

1. Flashing of roof penetrations shall be 4 pound lead. Flashing shall be accurately formed to conform with roofing contours and configurations and as required to assure a watertight installation. Flashing shall be built in as the roofing work progresses. Flash and burn lead against any penetrations through its surface.
2. Except as indicated otherwise, plumbing and mechanical vent flashing shall be of 4 pound lead tubing. Flanges shall be minimum 18 inches square, and tubing shall be long enough to permit turning lead into the end of vent pipe.

**3.02 Cleaning and Protection**

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.
- B. Protect flashing and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering at time of substantial completion.

End of Section

## Section 07 9200 Joint Sealants

### Part 1 General

#### 1.01 Related Documents

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

#### 1.02 Summary

- A. Section Includes:
  - 1. Urethane joint sealants.

#### 1.03 Preconstruction Testing

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
- B. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- C. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to and compatibility with, joint substrates and other materials matching those submitted.

#### 1.04 Action Submittals

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

#### 1.05 Informational Submittals

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.



- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

#### **1.06 Quality Assurance**

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

#### **1.07 Project Conditions**

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

### **Part 2 Products**

#### **2.01 Materials, General**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Suitability for Immersion in Liquids: Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Colors of Exposed Joint Sealants: As selected by Owner's Representative from manufacturer's full range.

## 2.02 Urethane Joint Sealants

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
    - b. Tremco Incorporated; Dymonic FC.
- B. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Polymeric Systems, Inc.; PSI-270.
    - b. Tremco Incorporated; Dymeric 240 FC.
- C. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Sonolastic NP 2.
    - b. LymTal International, Inc.; Iso-Flex 885 SG.
    - c. May National Associates, Inc.; Bondaflex PUR 2 NS.
    - d. Pecora Corporation; Dynatred.
    - e. Tremco Incorporated; Vulkem 227.
- D. Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. LymTal International, Inc.; Iso-Flex 880 GB.
    - b. May National Associates, Inc.; Bondaflex PUR 2 SL.
    - c. Tremco Incorporated; Vulkem 245.

## 2.03 Joint Sealant Backing

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin); Type O (open-cell material); Type B (bicellular material with a surface skin); or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

#### **2.04 Miscellaneous Materials**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

### **Part 3 Execution**

#### **3.01 Examination**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 Preparation**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of

interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

- a. Metal.
- b. Glass.

- B. Joint Priming: Prime joint substrates were recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint sealant.

### 3.03 Installation of Joint Sealants

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
  - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### 3.04 Cleaning

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.05 Protection

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.06 Joint Sealant Schedule

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces, Multicomponent, Nonsag, Traffic-Grade Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
  1. Joint Locations:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Joints between plant-precast architectural concrete units.
    - c. Other joints as indicated.
  2. Joint-Sealant Color: As selected by Owner's Representative from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion, Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I; or Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.
  1. Joint Locations:
    - a. Joints in equipment base slabs.
    - b. Other joints as indicated.
  2. Joint-Sealant Color: As selected by Owner's Representative from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces, Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
  1. Joint Locations:
    - a. Joints between plant-precast architectural concrete units.
    - b. Control and expansion joints in unit masonry.

- c. Joints between metal panels.
  - d. Joints between different materials listed above.
  - e. Perimeter joints between materials listed above and frames of doors, HVAC equipment and louvers.
  - f. Control and expansion joints in ceilings.
  - g. Other joints as indicated.
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces, Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
- 1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
  - 2. Joint-Sealant Color: As selected by Owner's Representative from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces, Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
- 1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
    - d. Joints on underside of plant-precast structural concrete planks.
    - e. Perimeter joints between interior wall surfaces and frames of interior doors.
    - f. Other joints as indicated.
  - 2. Joint-Sealant Color: As selected by Owner's Representative from manufacturer's full range of colors.
- F. Joint-Sealant Application: Immersed interior joints in vertical surfaces and horizontal traffic surfaces, Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I; or Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I (for immersed horizontal surfaces only).
- 1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of tank walls.
    - b. Control and expansion joints on exposed interior surfaces of tank floors.
    - c. Other joints as indicated.
  - 2. Joint-Sealant Color: As selected by Owner's Representative from manufacturer's full range of colors.

End of Section

## Section 08 1300 FRP Faced Aluminum Doors and Aluminum Frames

### Part 1 General

#### 1.01 Scope of Work

- A. All work of this Section shall be performed by the General Contractor.

#### 1.02 Related Documents

- A. Drawings and General provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work specified in this section.

#### 1.03 Description of Work

- A. The extent of each type of Door and Frame is shown on the drawings and in schedules. Note that the door to be installed shall match the existing doors installed in the pump station.
- B. The following types of Doors and Frames are required:
  - 1. Aluminum Frames
  - 2. Fiberglass Reinforced Polymer Faced Aluminum Doors
- C. Door types, sizes, and locations are as follows:
  - 1. See Door Schedule located in Section 08 7000 – Door Hardware, 3.07.

#### 1.04 Related Work Specified Elsewhere

- A. Section 07 9200 – Joint Sealants
- B. Section 08 7000 – Door Hardware

#### 1.05 System Performance

- A. Provide Door assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below, as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.
- B. Thermal Transmission (Exterior Doors): U-value of not more than 0.09 (BTU/Hr. x sf x degrees F.) per AAMA 1503.01.

#### 1.06 Quality Assurance

- A. Standards: Comply with the requirements and recommendations in applicable specifications and standards by NAAMM, AAMA, and AA, including the terminology definitions and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated.

- B. For Fiberglass Reinforced Polymer Faced Aluminum Doors, comply with fire resistance and flammability regulations as interpreted by governing authorities, and as follows:
1. Face sheets tested in accordance with ASTM E84 shall have the following ratings:
    - a. Smoke Developed: Not greater than 340.
    - b. Flame Spread: Not greater than 70.
- C. Manufacturer shall have produced Fiberglass Reinforced Polymer Faced Aluminum (F.R.P.) Doors and Aluminum Frames for at least 12 years and shall have completed projects similar to this building in type and size.
1. In addition, the manufacturer, and/or his representative, shall visit this project and instruct the installers in the proper installation of the Door and Frame assemblies.
- D. Field Measurements: Take field measurements prior to fabrication of doors and frames to insure proper fitting of assemblies. Successful bidders are expected to field verify all dimensions, sizes, quantities and the material required to complete this project. Failure to do so will not relieve the successful Contractor from the necessity of furnishing any and all materials that may be required, without any additional costs to the Owner.

#### **1.07 Submittals**

- A. Product Data: Submit door manufacturer's product data, specifications and instructions for each type of door and frame.
1. Include details of core, stile and rail construction, including trim for lites and similar components.
  2. Include details of Finish Hardware mounting.
  3. Include three samples of each Aluminum finish are required, of the alloys to be used on this project. Where normal color and texture variations are expected, include two or more units in each sample as required to show the range of such variations.
    - a. Architect/engineer reserves the right to require samples of typical fabricated section, showing joints, exposed fastenings (if any), quality of workmanship, hardware and accessory items, before fabrication of the work proceeds.
- B. Submit six sets of shop drawings for the fabrication and installation of the Doors and Frames and associated components of the work. Include wall elevations at 1/2" scale and half-sized detail sections of every typical composite member. Show anchors, joint system, expansion provisions and other components not included in the manufacturer's standard data. Include glazing details.

#### **1.08 Product Delivery, Storage and Handling**

- A. All materials supplied shall be delivered to the jobsite in their original, unopened packages with labels intact. Materials shall be inspected for damage, and the manufacturer shall be advised at once of any discrepancies. Unsatisfactory materials are not to be used.



- C. All materials supplied shall be packaged in individual corrugated cartons. Doors shall be “floated” within cartons, with no portion of the door having contact with the outer shell of the container.

### **1.09 Special Project Warranty**

- A. Provide a written warranty signed by the manufacturer, installer and Contractor agreeing to replace, at no cost to the Owner, any doors, frames or hardware that fail in materials or workmanship, within the time period of acceptance, as indicated below. Failure of materials or workmanship includes excessive deflection, faulty operation of entrances, deterioration of finish, or construction, in excess of normal weathering and defects in hardware, weather stripping and other components of the work.
  - 1. Minimum Time Period of Warranty: Five Years from substantial completion.

## **Part 2 Products**

### **2.01 Acceptable Manufacturers**

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Special-Lite, Inc. - Decatur, Michigan
  - 2. Amarlite - Atlanta, Georgia

### **2.02 Materials and Accessories**

- A. Aluminum Members: Provide alloy and temper as recommended by manufacturer for strength, corrosion resistance and application of required finish and control of color; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate, with a minimum wall thickness of 0.125”.
- B. Fasteners: Provide aluminum, non-metallic, stainless steel or other non-corrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened. For exposed fasteners (if any), provide Phillips head flat head screws with finish matching the item to be fastened.
  - 1. Do not use exposed fasteners, except where unavoidable for the assembly of units or unavoidable for the fastening of hardware. Provide only concealed screws in glazing stops.
- C. Reinforcement and Brackets: Manufacturer’s standard formed or fabricated steel units, of shapes, plates or bars, with 2.0 ounce hot-dip zinc coating, complying with ASTM A 123, applied after fabrication.
- D. Anchor Devices: Lead shield or toothed steel, drill-in, expansion bolt anchors or Tapcon style anchors shall be used.
- E. Bituminous Coating: Cold applied asphalt mastic complying with SSPC-PS 12, compounded for 30-mil thickness per coat.

- F. Sealants and Gaskets: Provide sealants and gaskets in the fabrication, assembly and installation of the work, which are recommended by the manufacturer to remain permanently elastic, non-shrinking, non-migrating and weatherproof.

### 2.03 Fabrication

- A. Sizes and Profiles: The required sizes for door and frame units and profile requirements are shown on the drawings.
  - 1. The installation shown is based upon standard details by one or more manufacturers. It is intended that details by other manufacturers will be accepted, provided they comply with size requirements and with minimum/maximum profile requirements as shown.
- B. Coordination of Fabrication: Check the actual frame or door openings in the construction work by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress, as directed by Contractor, and avoid delays of the work.
- C. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to the cleaning, finishing, treatment and application of coatings. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".
- D. No Welding of joints will be accepted.
- E. Conceal fasteners, whenever possible, except as otherwise noted.
- F. Maintain continuity of line and accurate relation of planes and angles. Provide secure attachments and support at mechanical joints, with hairline fit at contacting members.
- G. Reinforce the work as necessary for performance requirements and for support to the structure. Separate dissimilar metals with bituminous paint or preformed separators, which will prevent corrosion. Separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.

### 2.04 Fiberglass Reinforced Polymer (F.R.P.) Faced Aluminum Doors

- A. Materials and Construction
  - 1. Doors shall be 1-3/4" thickness and constructed of 6063-T5 aluminum alloy rails and stiles 2-5/16" depth. Joinery shall be 3/8" diameter full width steel tie rods through integral splines in horizontal rails with 3/16" corner angle blocks as standard. Rails and stiles shall be concealed 2-5/16" minimum thickness and shall be tubular shaped to accept hardware as specified. No welds or other type of mechanical fastening for joinery shall be accepted. Face sheet capture shall be by use of an internal reglet on all stiles and rails. No rail caps shall be accepted.
  - 2. Top and bottom rails shall be extruded with legs for interlocking continuous rail rigidity weather bar. The face sheet material shall be locked on with

- extruded interlocking edges to be flush with aluminum rails and stiles. No rivets, welds, glued-on or snap-on fastening of face sheets shall be accepted.
3. Door face sheets shall be 0.120" minimum thickness fiberglass reinforced polymer (F.R.P.) with pebble-like embossed finish. The finish shall be white, alumilite gray, blue, green, beige, dark gray, bronze, black as selected. The color shall be throughout the face sheet. No painting is required of door assembly. Plastic laminate or wood veneer face sheet materials may be used only on interior surfaces of F.R.P. flush doors.
  4. Door core material shall be a foamed-in-place closed-cell polyurethane foam with a minimum of five pounds per cubic foot density. The door assembly shall have a minimum "R" value of 11. No Kraft paper honeycomb or other door core material is acceptable.
  5. Meeting stiles on pairs of doors and top and bottom rigidity weather bars shall have Schlegel type pile weather stripping. The meeting stile weather stripping shall be placed in an adjustable astragal. No additional weather stripping is required. No vinyl, plastic or other type weather stripping is acceptable.
  6. All doors shall be manufactured with cutouts for louvers or glass or panels as required. All cutouts shall have the louver, glass or panel installed at the factory prior to shipping. Glazing materials shall be as specified elsewhere in this specification. All cutouts shall be fastener applied on the interior of the door assembly.
  7. All F.R.P. Faced Aluminum doors shall be pre-machined in accordance with templates from the specified hardware manufacturers and approved hardware schedule. All surface applied hardware shall utilize the Riv-Nut or similar blind fastener for attachment. All Fiberglass Reinforced Polymer Faced Aluminum Doors (F.R.P.) doors shall be reinforced for specified hardware in accordance with the manufacturer's standards. All hardware, excepting the door closer, threshold or other field applied hardware, as noted shall be installed on the door assembly at the factory and shipped applied to the door assembly to the jobsite.
  8. All doors shall be packaged individually and shipped in individual cartons. All doors shall be floated within the cartons, with no portion of the door or hardware to be in contact with the corrugated outer shell.

## 2.05 Aluminum Framing Systems

### A. Tubular Framing

1. Aluminum framing systems shall be of the size and type shown and shall not be less than 0.125" in wall thickness. Type 6063-T5 aluminum alloy shall be used. Framing shall have ½" high applied stops with screws. No clips or snap-on or integral stops are permitted. Schlegel type pile weather stripping shall be used in all principal frame member stops.
2. All framing systems shall utilize a clip system arrangement for joints of horizontal and vertical sections. The joinery shall be a fit joint, which projects into one member of the frame and is screwed securely into place. No welds or glues are acceptable.
3. All framing shall have applied stops for side, transom and borrowed lites and panels with fasteners exposed on interior portion only. All framing members in contact with the door shall be reinforced and pre-machined for hardware

per manufacturer's standards, the approved hardware schedule and this specification.

4. Anchors and frame reinforcements of a suitable type shall be used to fasten framing system to wall materials. A minimum of five anchors shall be used on all jamb and perimeter frame members up to 7'4". Additional anchors are required for over 7'4". Please check this specification for conditions, which call for other anchoring conditions.
5. Framing systems shall come from the manufacturer in a knock-down condition and be assembled at the jobsite. Joinery clips shall be factory attached to one member of a particular joint, and all frame pieces shall be marked according to location.

## **2.06 Aluminum Finishes**

- A. Preparation: Prior to fabrication of doors and frames, prepare the aluminum surfaces for finishing in accordance with the aluminum producer's recommendations and the standards of the finisher or processor. Process all components of each assembly simultaneously to attain complete uniformity of color.
- B. High Performance Organic Coating: Provide NAAMM AA-C12C42R1x coating (cleaned with inhibited chemicals, conversion coated with acid-chromate-fluoride-phosphate treatment, and painted with organic coating specified below). Prepare, pre-treat and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' instructions.
  1. Fluorocarbon Coating: Provide manufacturer's standard multicoat thermocured system, composed of specially formulated primer and fluorocarbon topcoats, complying with AAMA 605.2.
  2. Color: Provide color as selected by Architect from standard choices available from the coating manufacturer.

## **Part 3 Execution**

### **3.01 Installation**

- A. Comply with manufacturer's recommendations and specifications for the installation of doors and frames in both new and existing openings requiring wraparound frames and existing openings requiring inset frames if applicable.
- B. Set units plumb, level and true to line without warp or rack of doors or frames. Anchor securely in place. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials with bituminous coatings or other means as approved by Architect/engineer.
- C. Set thresholds in a bed of compound and back-seal with appropriate sealant. Install thresholds to cover frame faces of fixed mullions.
- D. Clean surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coatings (if any). Remove excess glazing and sealant compounds, dirt and other substances.

- E. Provide protective treatment and other precautions required through the remainder of the construction period to ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.
- F. Provide Owner with all adjustment tools and instruction sheets. Arrange an in-service session to Owner at Owner's convenience. Provide a minimum two-year written warranty on all labor related to this section. Any workmanship, which is defective or deficient, shall be corrected to the Owner's satisfaction and at no additional cost to the Owner.

End of Section

Not To Be Used For Bidding Purposes

## Section 08 7000 Door Hardware

### Part 1 General

#### 1.01 Related Documents

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

#### 1.02 Summary

- A. Section Includes:
  - 1. Hardware for Fiberglass Reinforced Plastic Clad Aluminum doors with Aluminum Frames
  - 2. Spare hardware sets for OWNER storage
  - 3. Thresholds
  - 4. Weatherstripping, seals, astragals and door gaskets
- B. Related Sections:
  - 1. Section 08 1300: FRP Faced Aluminum Doors and Aluminum Frames
- C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
  - 1. Thresholds and weather stripping to be installed under other Sections.
  - 2. Padlocks to be turned over to OWNER for installation by OWNER.

#### 1.03 Action Submittals

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
  - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
    - b. Format: Comply with scheduling sequence and vertical format in Door Hardware Institute's (DHI) "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

- d. Content: Include the following information:
  - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
  - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
  - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
  - 4) Fastenings and other pertinent information.
  - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
  - 6) Mounting locations for door hardware.
  - 7) List of related door devices specified in other Sections for each door and frame.
- 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing OWNER's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

#### **1.04 Submittals**

- A. Qualification Data: For Architectural Hardware Consultant.
- B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Warranty: Special warranty specified in this Section.

#### **1.05 Closeout Submittals**

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

#### **1.06 Quality Assurance**

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with CONTRACTOR and OWNER about door hardware and keying.
  - 1. Warehousing Facilities: In Project's vicinity.
  - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
  - 1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

### **1.07 Delivery, Storage, and Handling**

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to OWNER.

### **1.08 Coordination**

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

### **1.09 Warranty**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of doors and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: Five years from date of Substantial Completion, unless otherwise indicated.
    - a. Exit Devices: Five years from date of Substantial Completion.
    - b. Manual Closers: Ten years from date of Substantial Completion.

### **1.10 Maintenance Service**

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

## **Part 2 Products**

### **2.01 Scheduled Door Hardware**

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article and as designated on Drawings to comply with requirements in this Section.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:



1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

## 2.02 Hinges

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Baldwin Hardware Corporation.
    - b. Bommer Industries, Inc.
    - c. Cal-Royal Products, Inc.
    - d. Hager Companies.
    - e. IVES Hardware; an Ingersoll-Rand company.
    - f. Lawrence Hardware Inc.
    - g. McKinney Products Company; an ASSA ABLOY Group company.
    - h. PBB, Inc.
    - i. Stanley Commercial Hardware Div. of The Stanley Works.

## 2.03 Continuous Hinges

- A. Continuous Hinges: BHMA A156.26, minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bommer Industries, Inc.
    - b. Cal-Royal Products, Inc.
    - c. Hager Companies.
    - d. IVES Hardware; an Ingersoll-Rand company.
    - e. McKinney Products Company; an ASSA ABLOY Group company.
    - f. Select Products Limited.
    - g. Stanley Commercial Hardware; Div. of The Stanley Works.
    - h. Zero International.

## 2.04 Mechanical Locks and Latches

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  1. Mortise Locks: Minimum 3/4-inch latchbolt throw.

2. Deadbolts: Minimum 1-inch bolt throw.
- C. Lock Backset: 2-3/4 inches, unless otherwise indicated.
- D. Lock Trim:
  1. Description: Sargent 8200 Series.
  2. Levers: Forged.
    - a. Model B.
  3. Escutcheons (Roses): Wrought – Model LN.
  4. Dummy Trim: Match lever lock trim and escutcheons.
  5. Operating Device: Lever with escutcheons (roses).
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
  1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Accurate Lock & Hardware Co.
    - b. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - c. Arrow USA; an ASSA ABLOY Group company.
    - d. Best Access Systems; Div. of Stanley Security Solutions, Inc.
    - e. Cal-Royal Products, Inc.
    - f. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - g. Falcon Lock; an Ingersoll-Rand company.
    - h. Marks USA.
    - i. PDO Manufacturing.
    - j. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - k. Schlage Commercial Lock Division; an Ingersoll-Rand company.
    - l. Yale Security Inc.; an ASSA ABLOY Group company.

## 2.05 Auxiliary Locks

- A. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Accurate Lock & Hardware Co.
    - b. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - c. Arrow USA; an ASSA ABLOY Group company.
    - d. Best Access Systems; Div. of Stanley Security Solutions, Inc.
    - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - f. Schlage Commercial Lock Division; an Ingersoll-Rand company.
    - g. Yale Security Inc.; an ASSA ABLOY Group company.

## 2.06 Surface Bolts

- A. Surface Bolts: BHMA A156.16.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Burns Manufacturing Incorporated.
    - b. Don-Jo Mfg., Inc.
    - c. Door Controls International, Inc.
    - d. Glynn-Johnson
    - e. IVES Hardware; an Ingersoll-Rand company.
    - f. Trimco.

## 2.07 Spring Return Chain Bolts

- A. Spring Barrel Chain Bolts: Class 81-2550
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Stanley Commercial Hardware; Div. of The Stanley Works

## 2.08 Manual Flush Bolts

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - b. Burns Manufacturing Incorporated.
    - c. Don-Jo Mfg., Inc.
    - d. Door Controls International, Inc.
    - e. Hiawatha, Inc.
    - f. IVES Hardware; an Ingersoll-Rand company.
    - g. Trimco.

## 2.09 Exit Devices and Auxiliary Items

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - b. Arrow USA; an ASSA ABLOY Group company.
    - c. Cal-Royal Products, Inc.
    - d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - e. Detex Corporation.
    - f. Door Controls International, Inc.
    - g. DORMA Architectural Hardware; Member of The DORMA Group North America.
    - h. Dor-O-Matic; an Ingersoll-Rand company.

- i. K2 Commercial Hardware; a Black & Decker Corp. company.
- j. Monarch Exit Devices & Panic Hardware; an Ingersoll-Rand company.
- k. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc.
- l. Rutherford Controls Int'l. Corp.
- m. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
- n. Von Duprin; an Ingersoll-Rand company.
- o. Yale Security Inc.; an ASSA ABLOY Group company.

## 2.10 Lock Cylinders

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
  - 1. Manufacturer: Same manufacturer as for locking devices.
  - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Arrow USA; an ASSA ABLOY Group company.
    - b. ASSA, Inc.; An ASSA ABLOY Group Company.
    - c. Best Access Systems; Div. of Stanley Security Solutions, Inc.
    - d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - e. Falcon Lock; an Ingersoll-Rand company.
    - f. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
    - g. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - h. Schlage Commercial Lock Division; an Ingersoll-Rand company.
    - i. Yale Security Inc.; an ASSA ABLOY Group company.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
- C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

## 2.11 Keying

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
  - 1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
  - 2. Existing System:
    - a. Master key or grand master key locks to OWNER's existing system.
- B. Keys: Nickel silver.
  - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
    - a. Notation: Information to be furnished by OWNER.
  - 2. Quantity: In addition to one extra key blank for each lock, provide the following:
    - a. Cylinder Change Keys: Three.
    - b. Master Keys: Five.
    - c. Grand Master Keys: Five.

## 2.12 Key Control System

- A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Key Boxes and Cabinets.
    - b. GE Security, Inc.
    - c. HPC, Inc.
    - d. Lund Equipment Co., Inc.
    - e. MMF Industries.
    - f. Tri Palm International.
  - 2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

## 2.13 Operating Trim

- A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Burns Manufacturing Incorporated.
    - b. Don-Jo Mfg., Inc.
    - c. Forms + Surfaces.
    - d. Hager Companies.
    - e. Hiawatha, Inc.
    - f. IVES Hardware; an Ingersoll-Rand company.
    - g. Rockwood Manufacturing Company.
    - h. Trimco.

## 2.16 Surface Closers

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Arrow USA; an ASSA ABLOY Group company.
    - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - c. DORMA Architectural Hardware; Member of The DORMA Group North America.
    - d. Dor-O-Matic; an Ingersoll-Rand company.
    - e. K2 Commercial Hardware; a Black & Decker Corp. company.
    - f. LCN Closers; an Ingersoll-Rand company.
    - g. Norton Door Controls; an ASSA ABLOY Group company.
    - h. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

- i. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
- j. Yale Security Inc.; an ASSA ABLOY Group company.

## 2.17 Mechanical Stops and Holders

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; stainless steel base metal.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Architectural Builders Hardware Mfg., Inc. (ABH)
    - b. Baldwin Hardware Corporation.
    - c. Burns Manufacturing Incorporated.
    - d. Cal-Royal Products, Inc.
    - e. Don-Jo Mfg., Inc.
    - f. Door Controls International, Inc.
    - g. Hager Companies.
    - h. Hiawatha, Inc.
    - i. IVES Hardware; an Ingersoll-Rand company.
    - j. Rockwood Manufacturing Company.
    - k. Stanley Commercial Hardware; Div. of The Stanley Works.
    - l. Trimco.

## 2.18 Overhead Stops and Holders

- A. Overhead Stops and Holders: BHMA A156.8.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Architectural Builders Hardware Mfg., Inc.
    - b. Glynn-Johnson; an Ingersoll-Rand company.
    - c. Rockwood Manufacturing Company.
    - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

## 2.19 Door Gasketing

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
  - 1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hager Companies.
    - b. M-D Building Products, Inc.
    - c. National Guard Products.
    - d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
    - e. Reese Enterprises, Inc.
    - f. Sealeze; a unit of Jason Incorporated.
    - g. Zero International.

## 2.20 Thresholds

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hager Companies.
    - b. M-D Building Products, Inc.
    - c. National Guard Products.
    - d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
    - e. Reese Enterprises, Inc.
    - f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    - g. Sealeze; a unit of Jason Incorporated.
    - h. Zero International.

## 2.21 Metal Protective Trim Units

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Baldwin Hardware Corporation.
    - b. Burns Manufacturing Incorporated.
    - c. Don-Jo Mfg., Inc.
    - d. Hiawatha, Inc.
    - e. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
    - f. IVES Hardware, an Ingersoll-Rand company.
    - g. Pawling Corporation.
    - h. Rockwood Manufacturing Company.
    - i. Trimco.

## 2.22 Fabrication

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by ENGINEER.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use

through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Spacers or Hex Bolts: For through bolting of hollow-metal doors.
3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## **2.23 Finishes**

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **Part 3 Execution**

### **3.01 Examination**

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 Preparation**

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. FRP Clad Aluminum Doors: For surface applied door hardware, thru-bolt doors & reinforce frames for either thru-bolt or drill and tap installation.

### **3.03 Installation**

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of



surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as directed by OWNER.
- E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 9200, Joint Sealants.
- G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### **3.04 Field Quality Control**

- A. Independent Architectural Hardware Consultant: OWNER will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### **3.05 Adjusting**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.

2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.06 Cleaning and Protection

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### 3.07 Door Hardware Schedule

Hardware Set Monessen Pump Station Addition Exterior Door.

Quantity	Item	Manufacturer	Model Number	Finish
1 each	Continuous Gear Hinge	Select Products Limited	SL 11HD	Clear Anodized Aluminum
1 each	Exit Device	Sargent	12-8813 ETB (rim)	US32D
1 each	Saddle Threshold	Pemko	172 A	Mill Finish Aluminum
1 each	Overhead hold open/stop	Glynn-Johnson	904 H US32D J	US32D
1 set	Weatherstrip/Gasketing	Pemko	290APK/2891APK/303AS	Mill Finish Aluminum/Silicone Bulb/Blade

Hardware Set Donner Pump Station Addition Exterior Door.

Quantity	Item	Manufacturer	Model Number	Finish
1 each	Continuous Gear Hinge	Select Products Limited	SL 11HD	Clear Anodized Aluminum
1 each	Exit Device	Sargent	12-8813 ETB (rim)	US32D
1 each	Saddle Threshold	Pemko	172 A	Mill Finish Aluminum
1 each	Overhead hold open/stop	Glynn-Johnson	904 H US32D J	US32D
1 set	Weatherstrip/Gasketing	Pemko	290APK/2891APK/303AS	Mill Finish Aluminum/Silicone Bulb/Blade

End of Section

## **Section 09 9100 Painting and Coating**

### **Part 1 General**

#### **1.01 Scope of Work**

- A. This Section includes painting/coatings Work complete with surface preparation and coating of exterior and interior surfaces. This Section includes coating operations to be performed by a fabricator in the shop, a manufacturer of equipment and applicator coatings applied in the field. This Section does not include damp proofing.
- B. Painting includes field painting of walls and ceilings, support systems, exposed bare and covered pipes and valves, exposed steel and iron supports, coating of the interior of the digester, and surfaces of mechanical and electrical equipment that do not have a factory finish applied.
- C. A more detailed scope of work of the items/areas to be painted is defined as follows:
  - 1. Donner and Monessen Pump Stations Building Additions
    - a. Paint all walls, ceilings, piping and valves. Concrete floors and concrete equipment pads are to be coated with a sealer and hardener.
  - 2. As detailed on the plans.

#### **1.02 Definitions**

- A. The term "paint" or "coating" shall include emulsions, enamels, varnishes, sealers, stains and other coatings whether used as prime, intermediate or finish coats.
- B. The term "DFT" means Dry Film Thickness

#### **1.03 Reference Standards**

- A. NACE - National Association of Corrosion Engineers
- B. SSPC - The Society for Protective Coatings

#### **1.04 Quality Assurance**

- A. Quality of Materials:
  - 1. Upon request from other trades, furnish information on characteristics of finish materials proposed for use to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the ENGINEER in writing of any anticipated problems using specified coating systems with substrates primed by others.
- B. Sample Areas:
  - 1. Paint sample areas to establish standards of quality and workmanship as directed by the ENGINEER and to establish a basis for acceptability of the painting Work and coloring.

### 1.05 Submittals

#### A. Color Samples:

1. Submit paint system manufacturer's standard color range and sheens for each paint system specified. Samples shall be not less than 12 square inches in size.
2. After receipt of color samples and before commencement of the Work, the ENGINEER will furnish a color schedule, showing the location of the various colors.

#### B. Manufacturer's Data:

1. For information only, submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use. Transmit a copy of each manufacturer's instructions to the paint applicator.

### 1.06 Product Delivery, Storage, and Handling

#### A. Delivery:

1. Deliver specified products to job in manufacturer's unopened, sealed containers bearing manufacturer's name, brand name, type of paint, analysis showing all important constituents of the paint, color of paint, and instructions for thinning.

#### B. Storage:

1. Store products in the space designated for the storage and mixing of paint. Whenever it may be necessary to change the location of storage space, promptly move products to the newly designated space. Protect latex paints from freezing. Take the necessary precautions to prevent fire.

### 1.07 Job Conditions

#### A. Environmental Requirements:

1. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 90 degrees F, unless otherwise permitted by the paint manufacturer's printed instructions.
2. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 95 degrees F, unless otherwise permitted by the paint manufacturer's printed instructions.
3. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions. Do not apply coatings over condensation or when surface temperature is within 5° F of the dew point.
4. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

- B. Protection:
  - 1. Adjacent Work:
    - a. Protect Work of other Sections, whether to be painted or not, against damage by painting and finishing Work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to the ENGINEER.
  - 2. Fresh Paint:
    - a. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

## **Part 2 Products**

### **2.01 Acceptable Manufacturers**

- A. The manufacturers of paint products mentioned in this Specification are set up as standards of quality. This listing or description shall not be construed so as to eliminate from competition other equal or better products which are similar in design or function.
- B. Acceptable manufacturers include Euclid Company, Themec Company, Carboline Company, Sherwin-Williams, ICI Paint Company, Ameron Protective Coatings or ENGINEER approved equal.

## **Part 3 Execution**

### **3.01 Contractor's Verification**

- A. Examine construction in place on which the Work of this Section is dependent. Defects which may influence satisfactory completion and performance of the Work of this Section shall be corrected in accordance with the requirements of the applicable section of the Specifications prior to commencement of the Work. Commencement will be construed as construction in place being acceptable for satisfying the requirements of this Section.
- B. Surface Preparation - General:
  - 1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
  - 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
  - 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.
  - 4. Mix and prepare painting materials in accordance with manufacturer's directions.

5. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
6. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

C. Cementitious Surfaces:

1. Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted in accordance with SSPC-SP-13. Surface shall be free of contaminants, laitance, loosely adhering concrete, and dust, and shall be dry, sound, and uniform.
2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted in the manufacturer's printed directions.
3. Power wash using a biodegradable solution to remove curing oils, form oils, laitance, soluble salts, and waxes. Acid etch with a 20% to 30% solution of muriatic acid or whip blast concrete surfaces to create a profile on the surfaces similar to medium to fine sandpaper. Allow concrete to cure a minimum to 28 days prior to application of coating materials.
4. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner, flush floor with clean water to neutralize acid, and allow to dry before painting. Test for moisture per ASTM F1869 Moisture Test by use of Calcium Chloride or ASTM D4263 Plastic Sheet Method.

D. Ferrous Metal Surface:

1. Ferrous metal that is not galvanized or shop coated shall have rust, dust, and scale, as well as other foreign substances, removed by sandblasting in accordance with the current edition of SSPC-SP10. Cleaned metal shall be primed or pretreated immediately after cleaning. Ferrous metals not shop primed which have to be sandblasted shall be sandblasted in the field prior to the application of the primer, pretreatment, or paint in accordance with the latest edition of SSPC-SP10.
2. Ferrous metal that has been shop primed but that requires touch up cleaning in the field shall have rust, dust and scale, as well as other foreign substances removed by power tool cleaning in accordance with the current requirements of SSPC-SP1. Power cleaning procedures and degree of cleaning required shall be in accordance with the current requirements of SSPC-SP3 Power Tool Cleaning.
3. Touch up shop-applied prime coats wherever damaged or bare, where required by other sections of these Specifications. Clean and touch up with the same type shop primer.
4. Prepare welds by grinding smooth. Remove sharp edges, spatter, undercuts, recesses and pinholes.

E. Galvanized Metal Surface:

1. Clean free of oil and surface contaminants with a non-petroleum base solvent in accordance with SSPC-SP1 and ASTM D2092.

F. Wood Surfaces:

1. Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, and paneling.

### 3.02 Application

A. General:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
3. Apply additional coats when evidence of suction spots, burn through or other coating defects until the paint film is of uniform finish, color and appearance. Insure all surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Ensure that all edges of paint adjoining other materials or colors are sharp and clean without overlapping. Sand lightly between each succeeding enamel or varnish coat.
5. CONTRACTOR shall arrange to meet with site engineer and selected coatings manufacturer's representative prior to application of coating materials to assure the scope and intent of this Section is fully understood.
6. Color selections for all coatings shall be as identified by the Owner's Representative from actual paint chips and/or coupons of the specified material in a range of colors provided by the Contractor that includes all the paint manufacturer's standard color and finish offerings.

B. Minimum Coating Thickness:

1. Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by manufacturer for the service intended.

C. Primer Coats:

1. Apply the first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Apply primer coat on items that are to be painted or finished and that have not been shop primed by others or require touch up in the field.

D. Methods of Application:

1. General:

- a. Application on cementitious and similar surfaces shall be done by brush or roller unless otherwise directed by ENGINEER. Combination spray and back-roll method may be used on the surfaces as approved by the ENGINEER.
- b. On other surfaces, exterior first coats shall be applied by brush, and interior first coats, except on shop primed surfaces, shall be applied by brush or roller. Succeeding coats over field primed surfaces and all coats over shop primed surfaces may be applied by brush, roller or sprayer.
- c. Spray equipment shall be as recommended by the manufacturer of the paint used.

2. Surface Finish:

a. Enamel:

- 1) Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections. Rollers for application shall have a short nap.

b. Pigmented:

- 1) Completely cover to provide an opaque, smooth surface of uniform finish, color appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
- 2) Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3. Drying Time:

- a. Drying time shall be construed to mean "under normal conditions" and where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times will be necessary. Additional coats of paint shall not be applied, nor will units be put into service until paints are thoroughly dry.

4. Inspection:

- a. Work will be inspected as to proper surface preparation, pretreatment, priming, dry film thickness, curing, color and workmanship.
- b. CONTRACTOR shall supply the following testing equipment and standard. This equipment shall be on the job site and available to the site inspector.
  - 1) SSPC-VIS-1-89 Photographic Blast Cleaning Standards
  - 2) Magnetic Dry Film Thickness Gauge, 0-45 mils
  - 3) Tinker & Rasor M-1 Holiday Detector or Equal
  - 4) Mark 5 Tooke Gauge or Equal

**3.03 Items Not to be Painted/Coated**

A. Finished Metal Surfaces:

1. Metal surfaces of anodized aluminum, stainless steel, galvanized steel, chromium plate, copper, bronze and similar metals will not require finish painting, unless otherwise specified elsewhere.



B. Operating Parts and Labels:

1. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise specified elsewhere.
2. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

C. Pre-finished Items:

1. Factory-finished or installer-finished materials, equipment and construction including the following:
  - a. Metal toilet enclosures, unless otherwise specified
  - b. Acoustic materials
  - c. Architectural woodwork and casework
  - d. Finished mechanical and electrical equipment
  - e. Switchgear
  - f. Distribution cabinets
  - g. Metal roofing
  - h. Galvanized components of prefabricated metal buildings
  - i. Factory painted mechanical equipment with approved finishes.

D. Equipment and Construction:

1. Factory finished surfaces such as:
  - a. Anodized aluminum
  - b. Stainless steel
  - c. Galvanized steel
  - d. Chromium plate
  - e. Glass
  - f. Bronze and brass
  - g. Fiberglass items and construction.

E. Electrical items include (but are not limited to):

1. Exposed conduit and fittings
2. Exposed cabinets, enclosures, junction boxes, and pull boxes
3. Exposed hangers

**3.04 Items to be Painted/Coated**

A. General:

1. Paint exposed surfaces whether or not colors are designated herein, except where surface or material is specifically indicated not to be painted or to remain natural.
2. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.
3. If color or finish is not designated, the ENGINEER/OWNER will select from standard colors or finishes available. It is preferred that exterior equipment be factory finished with a color that blends with the building colors. Provide available color samples with equipment submittals.

- B. Mechanical items to be painted include, but are not limited to:
  - 1. Exposed process piping, pipe supports, equipment and equipment supports shall be painted and color coded per Part 3 of this Section.
  - 2. Exposed HVAC piping, ductwork and hangers and supports in occupied areas shall be painted as specified.
  - 3. Exterior piping, uninsulated ductwork, and equipment shall be painted to match the building exterior.
- C. Interior walls & ceilings of occupied rooms & equipment rooms:
  - 1. Exposed surfaces of rooms as indicated in Room Finish Schedule
- D. Miscellaneous Surfaces:
  - 1. Surfaces behind movable equipment and furniture the same as similar exposed surfaces.
  - 2. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

**3.05 Paint/Coating Systems: Listed by surface material, service & exposure.**

- A. Ferrous Metal – Submerged - Nonpotable Water – Interior & Exterior:
  - 1. Amine Epoxy Coating, total dry film thickness of 12 to 15 mils
    - a. Surface Preparation: Near-White Blasting SSPC-SP10.
    - b. Field Prime Coat: Amine Epoxy
      - 1) Ameron: Amercoat 90HS
      - 2) Carboline: Bitumastic 187 HFP
      - 3) Sherwin-Williams: Shelcote II
    - c. First and Second Coats: Amine Epoxy
      - 1) Ameron: Amercoat 90HS
      - 2) Carboline: Bitumastic 187 HFP
      - 3) Sherwin-Williams: Shelcote II
- B. Concrete – Submerged - Nonpotable Water - Interior & Exterior:
  - 1. Amine Epoxy Coating, total dry film thickness of 12 to 15 mils
    - a. Surface Preparation: Near-White Blasting SSPC-SP10.
    - b. Field Prime Coat: Amine Epoxy
      - 1) Ameron: Amercoat 90HS
      - 2) Carboline: Phenoline 187VOC
      - 3) Sherwin-Williams: Shelcote II
    - c. First and Second Coats: Amine Epoxy
      - 1) Ameron: Amercoat 90HS
      - 2) Carboline: Phenoline 187VOC
      - 3) Sherwin-Williams: Shelcote II
- C. Concrete – Pump & Equipment Rooms – Interior Walls & Ceilings:
  - 1. Surface Preparation: Clean and dry
  - 2. Epoxy-Polyamide Coating with total dry film thickness of 6.0 to 10.0 mils.
    - Carboline: Carboguard 60 @ 4.0 – 6.0 mils DFT per coat.

D. Piping Systems, Steel, Ductile, or Cast Iron - Interior:

1. Epoxy-Polyamide Coating with total dry film thickness of 6.0 to 10.0 mils
  - a. Surface Preparation (if not shop primed with compatible primer): Near-White Blasting SSPC-SP10 for Carbon Steel; for Ductile prepare in accordance with NAPF 500-03 Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
  - b. First and Second Coats: Polyamide Epoxy
    - 1) Tnemec: Series 66 Hi-Build Epoxoline
    - 2) Carboline: Carboguard 60
    - 3) Sherwin-Williams: Epolon II Multi-Mil Epoxy

E. Concrete Masonry – Occupied Rooms – Interior Walls:

1. Interior Polyamide Epoxy in Semi-Gloss Finish: Three coats with total dry film thickness not less than 10.0 mils.
  - a. Filler:
    - 1) Solvent-thinned block filler (FS TT-F-1098). Apply filler coat at a rate to ensure complete coverage with pores filled.
      - i. Tnemec: 54-660 Masonry Filler
      - ii. Carboline: Sanitile 500
      - iii. Sherwin-Williams: Epo-Plex Cementitious Water Based Epoxy Block Filler
  - b. First and Second Coats: Polyamide Epoxy.
    - 1) Tnemec: Series 66 Hi-Build Epoxoline
    - 2) Carboline: Carboguard 60
    - 3) Devco: Tru-Glaze 4508
    - 4) Sherwin-Williams: Tile-Clad High Solids B62Z Series/B60VZ75

F. Concrete Masonry – Exposed Exterior Walls:

1. Lusterless (Flat) Acrylic Finish: Two coats over filler coat with total dry film thickness not less than 2.5 excluding filler coat.
  - a. Filler Coat:
    - 1) High-performance latex block filler; heavy-duty latex block filler.
      - i. Tnemec: Series 130
  - b. First and Second Finish Coats:
    - 1) Acrylic Emulsion (FS TT-P-19):
      - i. Tnemec: Series 6
      - ii. Sherwin-Williams A-100 Exterior Flat Latex A6 Series

G. Ferrous Metal – Inaccessible Structural & Miscellaneous Metal – Interior – Dry; or Accessible Structural & Miscellaneous Metal – Interior - Wet or Corrosive

1. Epoxy-Polyamide Coating with total dry film thickness of 12.0 mils minimum
  - a. Surface Preparation: Power wash at minimum 3,000 psi, with TSP cleaning solution. Power tool clean all areas. Heavily rusted areas shall be grinded then power wire brushed to remove rust from pits in steel. Heavily pitted steel shall be filled with Sherwin Williams steel seam filler or Carboline Carboguard 510, then spot primed with re-coatable epoxy primer or Carboline Carboguard 60

- b. First and Second Coats: Polyamide Epoxy
  - 1) Sherwin-Williams: Macropoxy 646
  - 2) Carboline: Carboguard 60

**3.06 Schedules**

A. General:

- 1. Unless otherwise specified herein, colors shall be in accordance with color schedule furnished by the ENGINEER after award of contract and approval of manufacturer.

B. Pipe Labeling and Color Schedule:

- 1. Exposed piping, fittings, valves, associated supports, and hangers, and appurtenances shall be painted with color code as specified below.
- 2. Pipes shall be labeled by white letters no larger than four inches high but no smaller than the diameter of the pipe less 1/2-inch.
- 3. Lines shall be identified at intervals no greater than 20 feet. Directional arrows or other data may be as required by the ENGINEER.

Type	Base Color	Bands*
<b>WATER LINES</b>		
Finished or Potable	Dark Blue	
Service or Non-Potable	Light Blue	Black
Circulating - Hot and Return	Dark Blue	Red
<b>CHEMICAL LINES</b>		
Sodium Bicarbonate	Orange	
Polymer Solution	Purple	
Chlorine (Gas or Solution)	Yellow	
Sulfur Dioxide	Yellow	Red
<b>WASTE LINES</b>		
Raw Sludge	Brown	Black
Sludge Draw Off Line	Brown	Orange
Sludge Recirculation Discharge Line	Brown	
Sludge Gas Line	Red	
Sewer (Sanitary, Discharge, or Other)	Dark Gray	
Final Effluent	Light Gray	
Supernatant	Light Green	Dark Green
Scum	Light Gold	
Drainage and Vent	**Black	
<b>MISCELLANEOUS ITEMS</b>		
Natural Gas	Safety Red	Black
Sample Piping	To match piping sampled	
Electrical Conduit	**Light Gray	
Pumps, Valves, and Compressors	To match piping color of line it serves	

\* Banding shall be 6 inches wide at 30-inch c/c.

\*\* When exposed to the building interiors above the basement areas, the color shall match the adjacent finish.

End of Section

## Section 11 1000 Mechanically Cleaned Bar Screen - Donner

### Part 1      General

#### 1.01      Summary

- A.      This section includes the furnishing of a front-cleaning, front-return link driven mechanically cleaned bar screen assembly and any auxiliary equipment or accessories to be installed in the location as indicated on the drawings and as specified herein.
  - 1.      Number of units: 1 EA Donner Pump Station
  - 2.      Equipment designation: Duperon® FlexRake® IQ™
  - 3.      Equipment location: Indoor Installation
- B.      All equipment supplied under this section shall be furnished by or through a single screening system supplier who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the screening components. The screening system supplier shall have the sole responsibility for the coordination and performance of all components of the screenings system with the performance and design criteria specified herein.
- C.      The Contractor shall be responsible to coordinate all details of the screening equipment with other related parts of the work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the work required to accommodate the equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

#### 1.02      Related Sections

- A.      The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied (for complete list of sections, see specification index).
  - 1.      All sections of Division 1 including but not limited to Submittal Procedures, Shop Drawings, Product Data and Samples, Operating and Maintenance information, Protection of Materials and Equipment, Installation, Testing, and Commissioning, Instruction of Operations and Maintenance Personnel, and Spare Parts Maintenance Manuals.
  - 2.      Section 09 9100 – Painting and Coating
  - 3.      Section 11 2000 – Washer Compactor
  - 4.      Section 11 3000 – Additional Equipment
  - 5.      Section 26 0500 – Electrical General Requirements
  - 6.      Section 40 0500 – Process Equipment General Requirements

#### 1.03      Reference Standards

- A.      American National Standards Institute (ANSI)

- B. American Society for Testing and Materials (ASTM)
- C. American Welding Society (AWS)
- D. American Institute of Steel Construction (AISC)
- E. American Bearing Manufacturers Association (ABMA)
- F. American Gear Manufacturers Association (AGMA)
- G. National Electrical Manufacturers Association (NEMA)
- H. Underwriters Laboratory (UL)

#### **1.04 Submittals**

- A. The equipment manufacturer shall submit the following items:
  - 1. Six (6) Sets of General Arrangement Drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation including anchorage locations. Other related data including descriptive literature, electrical control drawings, catalog cut sheets for individual components and drive motor data.
  - 2. A list of recommended spare parts including any special tools required for routine maintenance of the equipment is provided in Section 2.5.
  - 3. Six (6) Sets of Operation & Maintenance manuals including As-Built Drawings of the mechanically cleaned bar screen arrangement, controls, and accessories shall be provided in digital format after equipment ship for inclusion in the close-out submittal process.
  - 4. For sites that have (3) feet or greater head differential, equipment manufacturer shall provide structural certification from licensed civil engineer.

#### **1.05 Quality Assurance**

- A. The mechanically cleaned bar screens shall be fully assembled, and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of four (4) hours of run time. The Contractor, the Engineer, the Owner, or the owner's designated representative reserves the right to witness the shop test. Travel expenses are the responsibility of the traveler. A minimum three (3) week notice shall be provided prior to the test to allow for travel coordination.
- B. To assure quality and performance: All equipment furnished under this section and related sections shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer. The screen manufacturer shall have at least 50 installations of link driven mechanically cleaned bar screen equipment that has been in successful operation, at similar installations, for at least ten (10) years. Upon request, the manufacturer shall provide a reference of such installation sites along with the relevant contact information.
- C. The equipment furnished shall be fabricated, assembled, installed, and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.
- D. No screen manufacturer will be considered by the Engineer as an "or equal" by simply meeting the functional intent of the specifications.

- E. The screenings system shall have operations, origin of manufactured, after sales service & support in the United States of America

### 1.06 Warranty

- A. Manufacturer shall provide a written two (2) year standard warranty from the date of use of the mechanically cleaned bar screen equipment to guarantee that there shall be no defects in material or workmanship in any item supplied.
- B. Manufacturer shall warrant for the period of five (5) years all rotating parts of the mechanically cleaned bar screen including the gear motor, bearing, drive head, and the link system including the links, castings, pins and retaining rings. Manufacturer warrants that these components shall be replaced if damaged or defective in the normal use of the equipment.

## Part 2 Products

### 2.01 Manufacturers

- A. The basis of design for the Screening System shall be as manufactured by Duperon Corporation, 1200 Leon Scott Court, Saginaw, Michigan, toll-free 800.383.8479. The screens shall be the FlexRake® Model, Full Penetration Fine Screens FR IQ™ or FR IQ<sup>2</sup>™ no equal.

### 2.02 Basis of Design

- A. The mechanically cleaned bar screen shall have a head sprocket only, with no sprockets, bearings, idlers, or similar drive components under water to trap the chain. Equipment featuring reciprocating rake arms or lower bearings/sprockets/tracks below the water is not acceptable.
- B. The mechanically cleaned bar screen shall clean the entire bar screen a minimum of every 7.1 seconds at high speed.
- C. The flow ability of the screen area, specifically, shall be defined as follows: A composite number representing the specific flow- ability of a screen area composed of the bars' hydraulic head loss
- D. Coefficient Shape Factor, the bar width and the clear opening of the screen field per formula below  
$$\text{(Coefficient Shape Factor)} \times \left( \frac{\text{Bar Width}}{\text{Clear Opening}} \right) = \left( \frac{0.190}{\text{Clear Opening}} \right)$$
- E. The mechanically cleaned bar screen shall be designed to run continuously (24/7), without operator.
- F. The equipment shall have multiple scrapers on the bar screen at one time cleaning continuously from bottom to top, the entire width of the bar screen. The drive output shaft rotation shall be constant and in one direction in order to reduce maintenance and increase product life. Units which have single raking arms or that require cycle times shall not be allowed. Cleaning mechanisms that utilize shock absorbers, springs or other dampening or hydraulic actuations are unacceptable.
- G. The link system shall have jam evasion capability by flexing around and collecting large objects such as a 2 X 4, bowling ball, grease balls and surges of solids at peak loading times without overloading and shutting down the unit. The link system shall be such that it bends in one direction only, which allows it to become its own lower sprocket and frame and shall have a 1,000-pound lifting capacity.

- H. Designs employing the use of endless moving media or cables and hydraulic cylinders to remove debris from the channel and units utilizing proximity or limit switches for reverse cycles are not acceptable.
- I. Equipment utilizing a motor greater than 1 HP motor to complete a screen cleaning cycle is not acceptable.
- J. The design shall be such to ensure that all maintenance can be accomplished at the operating floor level or above. No part of the drive system including sprockets shall be located below the water surface at maximum design flow.
- K. Design Conditions:

<b>Site Installation Information:</b>	
Channel Width:	3ft
Channel Height:	30.57ft
(upstream clearance) Channel Depth:	See contract drawings
Bar Opening Size:	5/8 inches
Angle of Installation:	0°
Average Flow:	1 MGD
Average Downstream Water Level:	1ft
Maximum Flow:	3.5 MGD
Maximum Downstream Water Level:	3 ft
Maximum Head Differential:	Standard 1ft
Equipment Location:	Indoors
<b>Indoor Installation:</b>	
Ceiling Clearance Height:	8.0 ft
Site Access Constraints:	Two 90° bends at entrance (see site plans)
Roof Opening Available:	No
Door Opening Size:	Exterior: 6 ft x 7 ft Interior: 3 ft x 7 ft
Installation Area Classification:	Unclassified
<b>Collection and Conveyance:</b>	
Containment Height:	See contract drawings
Debris Bin:	See contract drawings
Conveyor:	No
Washer/Compactor:	Yes, Dual Auger Design

## 2.03 Components

- A. Bar screen assembly: Bar screen assembly shall be of stainless steel and designed to withstand 1-foot head differential unless noted otherwise in Section 2.2 J Design Conditions. Unless noted otherwise materials of construction shall be 316 stainless steel. A stainless steel channel bottom plate shall be an integral part of the bar screen assembly to fully engage scrapers in the bar screen at the base of the unit and assure that the raking mechanism reaches the bottom of the screen to prevent debris accumulation. The bar screen assembly shall be shipped in one piece.



1. Screen Bars: Bars shall be 304 stainless steel and be rectangular shaped, with the minimum dimensions of 0.25 inch x 1.00 inch. Bars shall be individually replaceable without welding. Screen bars shall have a 24 inch diameter curve at the base of the screen to allow for increased flowable area.
  2. Side Fabrication: The screen framework shall be 316 stainless steel bent plate with minimum of 3/16 inch cross section. Horizontal members shall be of stainless steel bent plate or stainless steel pipe. Support members and frame shall adequately support the bar screen based on site-specific requirements.
  3. Dead Plate: Dead plate shall be 0.25 inch thick 316 stainless steel. The dead plate shall be flat and true; span the entire width of the unit; and transition from bar screen to discharge point.
  4. Discharge Chute: The discharge chute shall be 0.25 inch 316 stainless steel. The discharge chute shall be designed to allow debris to be transferred from discharge point into the debris containment.
  5. Link Slides: Link slide assembly shall be provided per manufacturer standard design and shall be constructed of UV Stable UHMW PE and 316 stainless steel supports and components.
  6. Flexor: Flexor assembly shall be provided per manufacturer standard design and shall be constructed of UV Stable UHMW PE rollers and stainless steel rails and components. Flexor shall act to provide positive engagement force for the scrapers into the screen while also allowing the scrapers to flex away up to 12 inches from the screen for large debris. Device shall only use gravity and the weight of the components to create the necessary force and flexibility. The device shall not use springs, shocks, nor actuators of any kind to create the force and flexibility.
- B. Return Guide/Closeouts: Return guide/Closeouts shall be 316 stainless steel and shall assure proper alignment of scrapers as they enter the bar screen and assure that there is no space wider than the clear opening between bars to prevent passage of larger solids than allowed through the screen.
- C. Debris Blade: A 316 stainless steel and UV Stable UHMW-PE debris blade assembly, which does not require a separate drive, shall be installed to assist in removing debris from the scraper on the mechanically cleaned bar screen unit as recommended by the manufacturer. Hydraulic, shock, or spring controlled debris blade mechanisms are not acceptable.
- D. Screen Enclosure: A 14 gauge #4-brushed satin finish 316 stainless steel enclosure shall be installed to cover the screen above the operating deck level. Front enclosure shall have removable panels for access to equipment. Removable panels shall be 16 gauge 316 stainless steel and shall be provided with a lift off option for "no tool required" access. The top of the front enclosure shall include a knock out for a customer site option to install a 6-inch diameter pipe stub (the option of connecting to the site's exhaust system, to provide a positive air exchange from interior of enclosure, by others).
- E. For multi-deck applications, 14 gauge #4 brushed satin finish 316 stainless steel side shields will also be provided.
- F. Link System: The link system shall be passivated stainless steel castings and have a minimum ultimate strength of 60,000 lbs. with a minimum cross section of 1.5 inches and weighing a minimum of 5 pounds each. Parts must meet ASTM A380 specification for surface finish. Link bearing shall be SAE 841 Bronze type for unlimited life. All wear shall happen between the pin and bearing surface.
1. 316 stainless steel link system includes 316 stainless steel retaining rings and 316 stainless steel pins.

- G. Scrapers: Scrapers shall be spaced 24 inches apart. To provide long product life the scraper shall move at no greater than 34 inches per minute at normal operating speed of .71 rpm allowing for approximately 1.41 debris discharges per minute Thru-Bar™ Scrapers: Thru-Bar™ Scrapers shall be 1.00 inch thick, UV Stable UHMW-PE and shall fully penetrate the bar screen, cleaning all three sides of the bars as well as through to the cross members in openings of 0.625 through 4 inches. UHMW-PE scraper support bracket shall be of 2205 super duplex stainless steel.
- H. Drive Head: The drive head shall be located at the top of the mechanically cleaned bar screen.
1. Drive Unit: Each mechanically cleaned bar screen unit shall operate independently and shall have its own drive unit and driven components.
    - a. 316 stainless steel drive sprockets & 316 stainless steel drive shaft
    - b. The gearbox shall be shaft-mounted, right angle type and include spiral bevel gearing. The output shaft speed shall be controlled by a vector type inverter or per rake manufacturer's recommendation. It shall have at least a 1.39 or greater service factor based on machine torque requirements. The gearbox shall not be vented to the outside atmosphere. The gearbox shall be grease filled. Oil filled gearboxes are not allowed.
    - c. The motor shall be AC induction type, inverter duty, mounted to the gear reducer. The motor shall be 1 HP, and rated for Class I, Groups C & D, Class II Groups F & G environments, NEMA design B. Service factor shall be 1.0 or greater, Class F insulation. The motor must be UL listed and designed for continuous operation.
    - d. The motor shall have built in, normally closed, thermostat to protect from overheating that is to be field wired to corresponding terminal in control panel for redundant (ambient) overload protection.
    - e. All drive head components shall be of components available in the United States.
  2. Bearing: Bearing shall be self-lubricating engineered Thordon® or Vesconite® bearing and shall have a 24/7/365 L10 life of 20 years when in compliance with stated operation & maintenance recommendations. Non-sealed bearings are not acceptable.
  3. Speed Reducer: Speed reducer shall be a double-reduction, cycloidal style and shall comply with all applicable AGMA standards. The speed reducer shall be capable of a 5/1 speed range with variable output speeds between 0.69 to 4.13 output RPMs (in high flow conditions). The speed reducer shall produce an output torque of 11,000 in.lb. and have a gear ratio of 424:1.
- I. Standard Coating: All non-stainless bar screen components shall be coated in strict accordance with the paint manufacturer's specification. Surface preparation shall be done in accordance with SSPC-SP-10 near-white. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tneme Zinc at 2.5-3.5 mils DFT, Intermediate Coat Series 27 F.C. Typoxy at 3.0-5.0 mils DFT, and Top Coat Series 1095 Endura-Shield at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements.
- J. Alternatives: Any alternate products must provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test method, system, and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.
- K. Downstream Underflow Weir: 316 Stainless steel underflow / overflow weir plate shall be provided by the screen manufacturer and installed downstream of the mechanically cleaned

bar screen to maintain a minimum of 1 foot downstream water level during average and minimum flows. The weir plate shall be anchored to both channel walls with 3/8 inch anchors, by others. Contractor to field verify the channel dimensions prior to the design and manufacturing of the weir plate.

- L. Modular Construction: The bar screen will be shipped from the factory fully assembled with the exception of the operating deck enclosures and side shields. The overall bar screen unit will be constructed in sections to be disassembled on site. Prior to fabrication, the Contractor shall coordinate with the manufacturer the dimensions of the modular sections to allow entrance into the building and channel.

## 2.04 2.4 Electrical, Controls, Instrumentation

- A. General: Controls for each rake shall be in enclosures provided by the bar screen manufacturer. The bar screen manufacturer shall be responsible for proper sizing and function of the controls at 480V, unless specified otherwise.

1. Main control panels require shading from the sun and shall be operated within a temperature range between 35°F and 104°F. Sunshields, visors or other structures needed to provide shade are by others (if the controls will experience temperatures outside this range, then special climate provisions are available).
2. Controls shall be designed to accept incoming power supply per plans/specs and shall include a step-down transformer as needed to achieve 120V.
3. Control panel(s) shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified control panel build facility and will be supported by the appropriate UL labeling.
4. Controls shall be tested prior to shipment to owner. The rake manufacturer shall verify all overload settings in the rake controller to insure proper overload and speed settings required for the application are properly programmed.
5. Control panel(s) shall be wired complete with a minimum of #16 MTW wire in the appropriate colors for the circuits being supplied. 120VAC control shall be red, grounded AC neutral shall be white, DC control shall be blue, DC neutral shall be white with blue tracer, equipment ground shall be green and all incoming and outgoing external power source wires shall be a yellow configuration. All AC power wiring shall be a minimum of #12 Black. All wires shall be labeled at both ends with heat-shrink wire markers. Internal panel wiring shall be contained in non-flammable, covered wire way.
6. All panel(s) and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Tags shall be white with black core, engraved as required.
7. All field wiring and power cables between the bar screen's Main Control Panel and the Local Control Push Button Station shall be provided by others under the Electrical Section. VFD rated motor cable (Belden #29502 or equal) is recommended for all motors. Motor cables shall be less than 80 feet unless otherwise specified.

- B. Components:

1. Main Control Panel
  - a. Enclosure(s) shall be NEMA 12 painted for indoor installations.
  - b. Enclosure shall not be located in an explosive environment.

- c. Main Control Panel shall be designed with a SCCR rating of 18KA at 480VAC minimum and labeled as such, unless otherwise specified.
- d. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
- e. The Main Control Panel shall include at a minimum the following
- Main fusible disconnect with lockable operator, unless otherwise specified.
  - Physical or virtual Hand/Off/Auto (HOA) Selector and Push/pull E-Stop button.
  - Elapsed run-time meter
  - Indication for "Power On", "Forward" and necessary faults.
- f. PLC Based Controls shall include the following:
- (1) Programmable Logic Controller (PLC)
  - (2) Variable Frequency Drive (VFD)
  - (3) HMI programmable functions as required
  - (4) SCADA Interlocking via Hard Contact and/or Ethernet Communications Protocols as required.
2. Local Control Push Button Station
- a. Enclosure shall be NEMA 7 rated for Classified area installation. Local push button station must be local to the equipment to maintain requirements of local safety codes as determined by the Engineer.
  - b. Local station shall be mounted within 10 feet or as close to the equipment as safely possible and be field wired by the electrical subcontractor to the corresponding terminal inputs in the main control panel.
  - c. The remote pushbutton station shall include Forward Jog Reverse and E-Stop buttons.
3. Instrumentation: Each raking assembly shall have a separate level system.
- a. Single Level/Speed Control: When the level switch trips, the rake runs. When the level switch returns to the normal position, an off-delay timer is initiated to prevent intermittent equipment starting/stopping. Cycle timing logic shall also be included that shall function in parallel with the level control for optimal rake run time.
    - (1) Mechanical Float Switch including 50 feet long cabling to be used as a backup to the differential level control.
  - b. Differential Level Control: Shall use a PLC and a HMI. Program shall include differential set points used to automatically start/stop the rake based on the head loss across the screen. The logic shall also include a "Rake Off" set point which shall be lower than the initial run set point. This set point is required to help avoid intermittent starting/stopping caused by the differential level equalizing with minimal rake run time. Cycle timing logic shall also be included in the program that shall function in parallel with the differential level control logic for optimal rake run time. Level sensing instrumentation shall be installed upstream and downstream from the rake and shall be one of the following types:

- (1) KPSI® 700 series Submersible Pressure Transducers, or equal, with 50 foot long cabling. Transducers shall be submerged by at least 1 foot of water at all times. Customer to provide stilling wells.

C. Controls Design Conditions:

Incoming Power: (Voltage/Phase)	Provide
Enclosures:	Same for Multiple
Installation location:	Indoors
Approx. distance between main panel and equipment motor	25 feet
Climate controlled location:	No
Transducer/Float cable length:	50 feet (standard)

**2.05 Specialty Tools, Spare Parts, And Lubrication**

A. Manufacturer shall provide any specialty tools and recommend spare parts required for maintaining the equipment as follows:

1. Snap/Retaining Rings (10)
2. Link Clevis Pins (2)
3. Button Head Cap Screw (4)
4. 3/8"-16 Nylock Nut (4)
5. Snap Ring Tool (1)
6. Anti- Seize paste 1 oz. tube (1)

**Part 3 – Execution**

**3.01 Shipment**

A. Shipment of all equipment shall be coordinated to allow the screen shipment as one complete integrated assembly unless otherwise specified by the Contractor, Engineer, Owner or Owner's Representative.

**3.02 Installation**

A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions, as submitted with shop drawings, operation and maintenance manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks as required by the engineer or manufacturer, such as unloading, touch-up painting, etc. and any other installation tasks and materials such as wiring, conduit, controls stands as determined by the customer and/or specified by the manufacturer.

B. Anchors: Anchors and nuts shall be 316 stainless steel and furnished for each item of equipment by the CONTRACTOR.

1. Anchors template drawings shall be included in the submittal to permit verification of the location structural elements, new or existing in the concrete.
2. Anchors sizes, quantity, and requirements will be indicated on the submittal drawings. Quantity is site specific but typically each bar screen assembly requires (8) to (12) 1/2" dia. x 4 1/2" Lg. embed HILTI KWIK bolt TZ for mechanical screen anchorage and typically (8) to (12) 3/8" dia. x 3 3/8" Lg. embed HILTI KWIK bolt TZ anchors for the return guide/closeouts anchorage.

### **3.03 Testing**

- A. After completion of installation, CONTRACTOR shall provide for testing performed in strict conformance with the manufacturer's start up instructions. Testing of the bar screen shall demonstrate that the equipment is fully operational by picking up and depositing materials into specified containment.
- B. Field certification shall include inspection of the following:
  1. Verify equipment is properly aligned and anchored per the installation instructions and drawings. Assure the bar screen unit is square, flat, and unobstructed with required clearances maintained.
  2. Assure controls and instrumentation work in all modes.
  3. Check equipment for proper operation of debris blade, scrapers, etc. as well as completion of the start-up requirements in the installation guide.

### **3.04 Onsite Technical Assistance**

- A. Manufacturer shall provide services to include installation certification, and shall include (1) day for Start-Up and (1) day for Training. Manufacturer shall be given minimum 14 days notification prior to the need for such services. To assure the best outcome for the Owner and Contractor, the Contractor shall provide certification for completion of the PRE-COMMISSIONING CHECKLIST.

End of section

# Section 11 1000

## Mechanically Cleaned Bar Screen - Monessen

### Part 1 General

#### 1.01 Summary

- A. This section includes the furnishing of a front-cleaning, front-return link driven mechanically cleaned bar screen assembly and any auxiliary equipment or accessories to be installed in the location as indicated on the drawings and as specified herein.
1. Number of units: 1 EA Monessen Pump Station
  2. Equipment designation: Duperon® FlexRake® IQ™
  3. Equipment location: Indoor Installation
- B. All equipment supplied under this section shall be furnished by or through a single screening system supplier who shall coordinate with the Contractor the design, fabrication, delivery, installation and testing of the screening components. The screening system supplier shall have the sole responsibility for the coordination and performance of all components of the screenings system with the performance and design criteria specified herein.
- C. The Contractor shall be responsible to coordinate all details of the screening equipment with other related parts of the work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the work required to accommodate the equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

#### 1.02 Related Sections

- A. The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied (for complete list of sections, see specification index).
1. All sections of Division 1 including but not limited to Submittal Procedures, Shop Drawings, Product Data and Samples, Operating and Maintenance information, Protection of Materials and Equipment, Installation, Testing, and Commissioning, Instruction of Operations and Maintenance Personnel, and Spare Parts Maintenance Manuals.
  2. Section 09 9100 - Painting and Coating
  3. Section 11 2000 - Washer Compactor
  4. Section 11 3000 - Additional Equipment
  5. Section 26 0500 - Electrical General Requirements
  6. Section 40 0500 - Process Equipment General Requirements

#### 1.03 Reference Standards

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. American Welding Society (AWS)
- D. American Institute of Steel Construction (AISC)
- E. American Bearing Manufacturers Association (ABMA)
- F. American Gear Manufacturers Association (AGMA)
- G. National Electrical Manufacturers Association (NEMA)
- H. Underwriters Laboratory (UL)

#### **1.04 Submittals**

- A. The equipment manufacturer shall submit the following items:
  - 1. Six (6) Sets of General Arrangement Drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation including anchorage locations. Other related data including descriptive literature, electrical control drawings, catalog cut sheets for individual components and drive motor data.
  - 2. A list of recommended spare parts including any special tools required for routine maintenance of the equipment is provided in Section 2.5.
  - 3. Six (6) Sets of Operation & Maintenance manuals including As-Built Drawings of the mechanically cleaned bar screen arrangement, controls, and accessories shall be provided in digital format after equipment ship for inclusion in the close-out submittal process.
  - 4. For sites that have (3) feet or greater head differential, equipment manufacturer shall provide structural certification from licensed civil engineer.

#### **1.05 Quality Assurance**

- A. The mechanically cleaned bar screens shall be fully assembled, and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of four (4) hours of run time. The Contractor, the Engineer, the Owner, or the owner's designated representative reserves the right to witness the shop test. Travel expenses are the responsibility of the traveler. A minimum three (3) week notice shall be provided prior to the test to allow for travel coordination.
- B. To assure quality and performance: All equipment furnished under this section and related sections shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer. The screen manufacturer shall have at least 50 installations of link driven mechanically cleaned bar screen equipment that has been in successful operation, at similar installations, for at least ten (10) years. Upon request, the manufacturer shall provide a reference of such installation sites along with the relevant contact information.
- C. The equipment furnished shall be fabricated, assembled, installed, and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.
- D. No screen manufacturer will be considered by the Engineer as an "or equal" by simply meeting the functional intent of the specifications.



- E. The screenings system shall have operations, origin of manufactured, after sales service & support in the United States of America

### 1.06 Warranty

- A. Manufacturer shall provide a written two (2) year standard warranty from the date of use of the mechanically cleaned bar screen equipment to guarantee that there shall be no defects in material or workmanship in any item supplied.
- B. Manufacturer shall warrant for the period of five (5) years all rotating parts of the mechanically cleaned bar screen including the gear motor, bearing, drive head, and the link system including the links, castings, pins and retaining rings. Manufacturer warrants that these components shall be replaced if damaged or defective in the normal use of the equipment.

## Part 2 Products

### 2.01 Manufacturers

- A. The basis of design for the Screening System shall be as manufactured by Duperon Corporation, 1200 Leon Scott Court, Saginaw, Michigan, toll-free 800.383.8479. The screens shall be the FlexRake® Model, Full Penetration Fine Screens FR IQ™ or FR IQ<sup>2</sup>™ no equal.

### 2.02 Basis of Design

- A. The mechanically cleaned bar screen shall have a head sprocket only, with no sprockets, bearings, idlers, or similar drive components under water to trap the chain. Equipment featuring reciprocating rake arms or lower bearings/sprockets/tracks below the water is not acceptable.
- B. The mechanically cleaned bar screen shall clean the entire bar screen a minimum of every 7.1 seconds at high speed.
- C. The flow ability of the screen area, specifically, shall be defined as follows: A composite number representing the specific flow- ability of a screen area composed of the bars' hydraulic head loss
- D. Coefficient Shape Factor, the bar width and the clear opening of the screen field per formula below.

$$\text{(Coefficient Shape Factor)} \times \left( \frac{\text{Bar Width}}{\text{Clear Opening}} \right) = \left( \frac{0.190}{\text{Clear Opening}} \right)$$

- E. The mechanically cleaned bar screen shall be designed to run continuously (24/7), without operator.
- F. The equipment shall have multiple scrapers on the bar screen at one time cleaning continuously from bottom to top, the entire width of the bar screen. The drive output shaft rotation shall be constant and in one direction in order to reduce maintenance and increase product life. Units which have single raking arms or that require cycle times shall not be allowed. Cleaning mechanisms that utilize shock absorbers, springs or other dampening or hydraulic actuations are unacceptable.
- G. The link system shall have jam evasion capability by flexing around and collecting large objects such as a 2 X 4, bowling ball, grease balls and surges of solids at peak loading times without overloading and shutting down the unit. The link system shall be such that it bends

in one direction only, which allows it to become its own lower sprocket and frame and shall have a 1,000-pound lifting capacity.

- H. Designs employing the use of endless moving media or cables and hydraulic cylinders to remove debris from the channel and units utilizing proximity or limit switches for reverse cycles are not acceptable.
- I. Equipment utilizing a motor greater than 1 HP motor to complete a screen cleaning cycle is not acceptable.
- J. The design shall be such to ensure that all maintenance can be accomplished at the operating floor level or above. No part of the drive system including sprockets shall be located below the water surface at maximum design flow.
- K. Design Conditions:

<b>Site Installation Information:</b>	
Channel Width:	3ft
Channel Height:	28.17ft
(upstream clearance) Channel Depth:	See contract drawings
Bar Opening Size:	5/8 inches
Angle of Installation:	0°
Average Flow:	2 MGD
Average Downstream Water Level:	1ft
Maximum Flow:	9.4 MGD
Maximum Downstream Water Level:	3 ft
Maximum Head Differential:	Standard 1ft
Equipment Location:	Indoors
<b>Indoor Installation:</b>	
Ceiling Clearance Height:	8.0 ft
Site Access Constraints:	Two 90° bends at entrance (see site plans)
Roof Opening Available:	No
Door Opening Size:	Exterior: 6 ft x 7 ft Interior: 3 ft x 7 ft
Installation Area Classification:	Unclassified
<b>Collection and Conveyance:</b>	
Containment Height:	See contract drawings
Debris Bin:	See contract drawings
Conveyor:	No
Washer/Compactor:	Yes, Dual Auger Design

## 2.03 Components

- A. Bar screen assembly: Bar screen assembly shall be of stainless steel and designed to withstand 1-foot head differential unless noted otherwise in Section 2.2 J Design Conditions. Unless noted otherwise materials of construction shall be 316 stainless steel. A stainless steel channel bottom plate shall be an integral part of the bar screen assembly to fully engage scrapers in the bar screen at the base of the unit and assure that the raking mechanism reaches the

bottom of the screen to prevent debris accumulation. The bar screen assembly shall be shipped in one piece.

1. Screen Bars: Bars shall be 304 stainless steel and be rectangular shaped, with the minimum dimensions of 0.25 inch x 1.00 inch. Bars shall be individually replaceable without welding. Screen bars shall have a 24 inch diameter curve at the base of the screen to allow for increased flowable area.
  2. Side Fabrication: The screen framework shall be 316 stainless steel bent plate with minimum of 3/16 inch cross section. Horizontal members shall be of stainless steel bent plate or stainless steel pipe. Support members and frame shall adequately support the bar screen based on site-specific requirements.
  3. Dead Plate: Dead plate shall be 0.25 inch thick 316 stainless steel. The dead plate shall be flat and true; span the entire width of the unit; and transition from bar screen to discharge point.
  4. Discharge Chute: The discharge chute shall be 0.25 inch 316 stainless steel. The discharge chute shall be designed to allow debris to be transferred from discharge point into the debris containment.
  5. Link Slides: Link slide assembly shall be provided per manufacturer standard design and shall be constructed of UV Stable UHMW PE and 316 stainless steel supports and components.
  6. Flexor: Flexor assembly shall be provided per manufacturer standard design and shall be constructed of UV Stable UHMW PE rollers and stainless steel rails and components. Flexor shall act to provide positive engagement force for the scrapers into the screen while also allowing the scrapers to flex away up to 12 inches from the screen for large debris. Device shall only use gravity and the weight of the components to create the necessary force and flexibility. The device shall not use springs, shocks, nor actuators of any kind to create the force and flexibility.
- B. Return Guide/Closeouts: Return guide/Closeouts shall be 316 stainless steel and shall assure proper alignment of scrapers as they enter the bar screen and assure that there is no space wider than the clear opening between bars to prevent passage of larger solids than allowed through the screen.
- C. Debris Blade: A 316 stainless steel and UV Stable UHMW-PE debris blade assembly, which does not require a separate drive, shall be installed to assist in removing debris from the scraper on the mechanically cleaned bar screen unit as recommended by the manufacturer. Hydraulic shock, or spring controlled debris blade mechanisms are not acceptable.
- D. Screen Enclosure: A 14 gauge #4-brushed satin finish 316 stainless steel enclosure shall be installed to cover the screen above the operating deck level. Front enclosure shall have removable panels for access to equipment. Removable panels shall be 16 gauge 316 stainless steel and shall be provided with a lift off option for "no tool required" access. The top of the front enclosure shall include a knock out for a customer site option to install a 6-inch diameter pipe stub (the option of connecting to the site's exhaust system, to provide a positive air exchange from interior of enclosure, by others).
- E. For multi-deck applications, 14 gauge #4 brushed satin finish 316 stainless steel side shields will also be provided.
- F. Link System: The link system shall be passivated stainless steel castings and have a minimum ultimate strength of 60,000 lbs. with a minimum cross section of 1.5 inches and weighing a minimum of 5 pounds each. Parts must meet ASTM A380 specification for surface finish. Link bearing shall be SAE 841 Bronze type for unlimited life. All wear shall happen between the pin and bearing surface.

1. 316 stainless steel link system includes 316 stainless steel retaining rings and 316 stainless steel pins.
- G. Scrapers: Scrapers shall be spaced 24 inches apart. To provide long product life the scraper shall move at no greater than 34 inches per minute at normal operating speed of .71 rpm allowing for approximately 1.41 debris discharges per minute Thru-Bar™ Scrapers: Thru-Bar™ Scrapers shall be 1.00 inch thick, UV Stable UHMW-PE and shall fully penetrate the bar screen, cleaning all three sides of the bars as well as through to the cross members in openings of 0.625 through 4 inches. UHMW-PE scraper support bracket shall be of 2205 super duplex stainless steel.
- H. Drive Head: The drive head shall be located at the top of the mechanically cleaned bar screen.
  1. Drive Unit: Each mechanically cleaned bar screen unit shall operate independently and shall have its own drive unit and driven components.
    - a. 316 stainless steel drive sprockets & 316 stainless steel drive shaft
    - b. The gearbox shall be shaft-mounted, right angle type and include spiral bevel gearing. The output shaft speed shall be controlled by a vector type inverter or per rake manufacturer's recommendation. It shall have at least a 1.39 or greater service factor based on machine torque requirements. The gearbox shall not be vented to the outside atmosphere. The gearbox shall be grease filled. Oil filled gearboxes are not allowed.
    - c. The motor shall be AC induction type, inverter duty, mounted to the gear reducer. The motor shall be 1 HP, and rated for Class I, Groups C & D, Class II Groups F & G environments, NEMA design B. Service factor shall be 1.0 or greater, Class F insulation. The motor must be UL listed and designed for continuous operation.
    - d. The motor shall have built in, normally closed, thermostat to protect from overheating that is to be field wired to corresponding terminal in control panel for redundant (ambient) overload protection.
    - e. All drive head components shall be of components available in the United States.
  2. Bearing: Bearing shall be self-lubricating engineered Thordon® or Vesconite® bearing and shall have a 24/7/365 L10 life of 20 years when in compliance with stated operation & maintenance recommendations. Non-sealed bearings are not acceptable.
  3. Speed Reducer: Speed reducer shall be a double-reduction, cycloidal style and shall comply with all applicable AGMA standards. The speed reducer shall be capable of a 6/1 speed range with variable output speeds between 0.69 to 4.13 output RPMs (in high flow conditions). The speed reducer shall produce an output torque of 11,000 in.lb. and have a gear ratio of 424:1.

Standard Coating: All non-stainless bar screen components shall be coated in strict accordance with the paint manufacturer's specification. Surface preparation shall be done in accordance with SSPC-SP-10 near-white. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tneme Zinc at 2.5-3.5 mils DFT, Intermediate Coat Series 27 F.C. Typoxy at 3.0-5.0 mils DFT, and Top Coat Series 1095 Endura-Shield at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements.

- J. Alternatives: Any alternate products must provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test method, system, and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.

- K. Downstream Underflow Weir: 316 Stainless steel underflow / overflow weir plate shall be provided by the screen manufacturer and installed downstream of the mechanically cleaned bar screen to maintain a minimum of 1 foot downstream water level during average and minimum flows. The weir plate shall be anchored to both channel walls with 3/8 inch anchors, by others. Contractor to field verify the channel dimensions prior to the design and manufacturing of the weir plate.
- L. Modular Construction: The bar screen will be shipped from the factory fully assembled with the exception of the operating deck enclosures and side shields. The overall bar screen unit will be constructed in sections to be disassembled on site. Prior to fabrication, the Contractor shall coordinate with the manufacturer the dimensions of the modular sections to allow entrance into the building and channel.

## 2.04 Electrical, Controls, Instrumentation

- A. General: Controls for each rake shall be in enclosures provided by the bar screen manufacturer. The bar screen manufacturer shall be responsible for proper sizing and function of the controls at 480V, unless specified otherwise.
  - 1. Main control panels require shading from the sun and shall be operated within a temperature range between 35°F and 104°F. Sunshields, visors or other structures needed to provide shade are by others (if the controls will experience temperatures outside this range, then special climate provisions are available).
  - 2. Controls shall be designed to accept incoming power supply per plans/specs and shall include a step-down transformer as needed to achieve 120V.
  - 3. Control panel(s) shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified control panel build facility and will be supported by the appropriate UL labeling.
  - 4. Controls shall be tested prior to shipment to owner. The rake manufacturer shall verify all overload settings in the rake controller to insure proper overload and speed settings required for the application are properly programmed.
  - 5. Control panel(s) shall be wired complete with a minimum of #16 MTW wire in the appropriate colors for the circuits being supplied. 120VAC control shall be red, grounded AC neutral shall be white, DC control shall be blue, DC neutral shall be white with blue tracer, equipment ground shall be green and all incoming and outgoing external power source wires shall be a yellow configuration. All AC power wiring shall be a minimum of #12 Black. All wires shall be labeled at both ends with heat-shrink wire markers. Internal panel wiring shall be contained in non-flammable, covered wire way.
  - 6. All panel(s) and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Tags shall be white with black core, engraved as required.
  - 7. All field wiring and power cables between the bar screen's Main Control Panel and the Local Control Push Button Station shall be provided by others under the Electrical Section. VFD rated motor cable (Belden #29502 or equal) is recommended for all motors. Motor cables shall be less than 80 feet unless otherwise specified.
- B. Components:
  - 1. Main Control Panel
    - a. Enclosure(s) shall be NEMA 12 painted for indoor installations.
    - b. Enclosure shall not be located in an explosive environment.

- c. Main Control Panel shall be designed with a SCCR rating of 18KA at 480VAC minimum and labeled as such, unless otherwise specified.
  - d. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
  - e. The Main Control Panel shall include at a minimum the following
    - (1) Main fusible disconnect with lockable operator, unless otherwise specified.
    - (2) Physical or virtual Hand/Off/Auto (HOA) Selector and Push/pull E-Stop button.
    - (3) Elapsed run-time meter
    - (4) Indication for "Power On", "Forward" and necessary faults.
  - f. PLC Based Controls shall include the following:
    - (1) Programmable Logic Controller (PLC)
    - (2) Variable Frequency Drive (VFD)
    - (3) HMI programmable functions as required
    - (4) SCADA Interlocking via Hard Contact and/or Ethernet Communications Protocols as required.
2. Local Control Push Button Station
- a. Enclosure shall be NEMA 7 rated for Classified area installation. Local push button station must be local to the equipment to maintain requirements of local safety codes as determined by the Engineer.
  - b. Local station shall be mounted within 10 feet or as close to the equipment as safely possible and be field wired by the electrical subcontractor to the corresponding terminal inputs in the main control panel.
  - c. The remote pushbutton station shall include Forward Jog Reverse and E-Stop buttons.
3. Instrumentation: Each raking assembly shall have a separate level system that shall be installed, and field wired by others per the manufacturer's instructions. Note that the HydroRanger® can be installed in the control panel or remotely and wired to the control panel.
- a. Single Level/Speed Control: When the level switch trips, the rake runs. When the level switch returns to the normal position, an off-delay timer is initiated to prevent intermittent equipment starting/stopping. Cycle timing logic shall also be included that shall function in parallel with the level control for optimal rake run time.
    - (1) Mechanical Float Switch including 50 feet long cabling to be used as a backup to the differential level control.
  - b. Differential Level Control: Shall use a PLC and a HMI. Program shall include differential set points used to automatically start/stop the rake based on the head loss across the screen. The logic shall also include a "Rake Off" set point which shall be lower than the initial run set point. This set point is required to help avoid intermittent starting/stopping caused by the differential level

equalizing with minimal rake run time. Cycle timing logic shall also be included in the program that shall function in parallel with the differential level control logic for optimal rake run time. Level sensing instrumentation shall be installed upstream and downstream from the rake and shall be one of the following types:

- (1) KPSI® 700 series Submersible Pressure Transducers, or equal, with 50 foot long cabling. Transducers shall be submerged by at least 1 foot of water at all times.

C. Controls Design Conditions:

Incoming Power: (Voltage/Phase)	Provide
Enclosures:	Same for Multiple
Installation location:	Indoors
Approx. distance between main panel and equipment motor	10 feet
Climate controlled location:	No
Transducer/Float cable length:	50 feet (standard)

**2.05 Specialty Tools, Spare Parts, And Lubrication**

A. Manufacturer shall provide any specialty tools and recommend spare parts required for maintaining the equipment as follows:

- 1. Snap/Retaining Rings (10)
- 2. Link Clevis Pins (2)
- 3. Button Head Cap Screw (4)
- 4. 3/8"-16 Nylock Nut (4)
- 5. Snap Ring Tool (1)
- 6. Anti-Seize paste, 1 oz. tube (1)

**Part 3 – Execution**

**3.01 Shipment**

A. Shipment of all equipment shall be coordinated to allow the screen shipment as one complete integrated assembly unless otherwise specified by the Contractor, Engineer, Owner or Owner’s Representative.

**3.02 Installation**

A. Equipment shall be installed in strict conformance with the manufacturer’s installation instructions, as submitted with shop drawings, operation and maintenance manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks as required by the engineer or manufacturer, such as unloading, touch-up

painting, etc. and any other installation tasks and materials such as wiring, conduit, controls stands as determined by the customer and/or specified by the manufacturer.

- B. Anchors: Anchors and nuts shall be 316 stainless steel and furnished for each item of equipment by the CONTRACTOR.
  - 1. Anchors template drawings shall be included in the submittal to permit verification of the location structural elements, new or existing in the concrete.
  - 2. Anchors sizes, quantity, and requirements will be indicated on the submittal drawings. Quantity is site specific but typically each bar screen assembly requires (8) to (12) 1/2" dia. x 4 1/2" Lg. embed HILTI KWIK bolt TZ for mechanical screen anchorage and typically (8) to (12) 3/8" dia. x 3 3/8" Lg. embed HILTI KWIK bolt TZ anchors for the return guide/closeouts anchorage.

### 3.03 Testing

- A. After completion of installation, CONTRACTOR shall provide for testing performed in strict conformance with the manufacturer's start up instructions. Testing of the bar screen shall demonstrate that the equipment is fully operational by picking up and depositing materials into specified containment.
- B. Field certification shall include inspection of the following:
  - 1. Verify equipment is properly aligned and anchored per the installation instructions and drawings. Assure the bar screen unit is square, flat, and unobstructed with required clearances maintained.
  - 2. Assure controls and instrumentation work in all modes.
  - 3. Check equipment for proper operation of debris blade, scrapers, etc. as well as completion of the start up requirements in the installation guide.

### 3.04 Onsite Technical Assistance

- A. Manufacturer shall provide services to include installation certification, and shall include (1) day for Start-Up and (1) day for Training. Manufacturer shall be given minimum 14 days notification prior to the need for such services. To assure the best outcome for the Owner and Contractor, the Contractor shall provide certification for completion of the PRE-COMMISSIONING CHECKLIST.

End of section



## **Section 11 2000 Washer Compactor**

### **Part 1 General**

#### **1.01 Summary**

A. Scope of work

Duperon Corporation shall furnish an interleaving, dual auger washer compactor assembly as shown on the drawings and as specified herein. A single unit shall provide washing and compacting action on wastewater screenings. The equipment shall be manufactured by Duperon Corporation, 1200 Leon Scott Court, Saginaw, Michigan, 48601, (800) 383-8479, in accordance with this section.

B. Related work

1. Bar Screen
2. Conveyor
3. Receptacle

C. Quality assurance

1. All equipment supplied under this section shall be of a single manufacturer and demonstrate, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein.
2. The equipment furnished shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

#### **1.02 Related Sections**

A. The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied. (For complete list of sections see specification index.)

1. All sections of Division 1 including but not limited to Submittal Procedures, Shop Drawings, Product Data and Samples, Operating and maintenance information, Protection of Materials and Equipment, Installation, Testing, and Commissioning, Instruction of Operations and Maintenance Personnel, and Spare Parts Maintenance Manuals.
2. Section 09 9100 - Painting and Coating
3. Section 11 1000 - Mechanically Cleaned Bar Screen
4. Section 26 0500 - Electrical General Requirements
5. Section 40 0500 - Process Equipment General Requirements

#### **1.03 Reference Standards**

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. American Welding Society (AWS)
- D. American Institute of Steel Construction (AISC)

- E. American Bearing Manufacturers Association (ABMA)
- F. American Gear Manufacturers Association (AGMA)
- G. National Electrical Manufacturers Association (NEMA)
- H. Underwriters Laboratory (UL)

#### **1.04 Submittals**

- A. The equipment manufacturer shall submit the following items:
  - 1. Sets of Shop Drawings, including Main Layout Drawings, List of Equipment Specifications, and Recommendations furnished by the Equipment Manufacturer.
  - 2. Sets As-Built Drawings of Washer Compactor Structure, Controls, and Accessories (as applicable).
  - 3. List of Spare Parts and Special Tools (as applicable).
  - 4. Sets O&M Manuals (including As-Built Drawings) to be provided after equipment ships for inclusion in the close-out Submittal process.

#### **1.1 QUALITY ASSURANCE**

##### **1.05 Quality Assurance**

- A. The Washer Compactor shall be fully assembled, and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of 4 hours of run time.
- B. To assure quality and performance: All equipment furnished under this Section and related sections shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein. And the Washer Compactor manufacturer shall have at least 25 installations of the specified model of Washer Compactor equipment that has been in successful operation, at similar installations, for at least five (5) years. Upon request, the manufacturer shall provide a reference of such installation sites along with the relevant contact information.
- C. Possible consideration may be given to manufacturers with less installation experience but only upon submission and approval of dimensional and installation drawings and O & M Manuals. Additionally, a complete product development plan with dates indicating all applicable alpha and beta testing shall be provided for review and acceptance.
- D. Approval of any manufacturer that does not meet the installation experienced defined herein shall be contingent upon submission and approval of the previously defined information. Additionally, such manufacturers shall be required to provide a performance bond issued in favor of the owner, covering the full amount of the manufacturer's offering and for the entire warranty period of the project.
- E. The equipment furnished shall be fabricated, assembled, installed and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

##### **1.06 Warranty**

- A. Manufacturer shall provide a written two-year standard warranty from the date of use of the Washer Compactor equipment to guarantee that there shall be no defects in material or workmanship in any item supplied.

## Part 2 Products

### 2.01 Manufacturers

- A. Washer Compactor[s] shall be as manufactured by Duperon Corporation, 1200 Leon Scott Court, Saginaw, Michigan, TF 800.383.8479.
- B. Or pre-approved equal. Washer Compactor manufacturer seeking pre-approval must submit application a minimum of three (3) weeks prior to bid day. Charges for additional engineering to alter site drawings to meet the intention of the specification shall be at the cost of the manufacturer requesting such change. The necessary submission to be considered a pre-approved equal shall include the following information:
  - 1. Product data sheet
  - 2. Site Specific Proposal Drawing
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  - 5. An employee list of in-house design engineers along with their respective locations and resumes.
  - 6. An employee list of in-house controls engineers along with their respective locations and resumes.
  - 7. An employee list of in-house application engineers along with their respective locations and resumes.
  - 8. An employee list of in-house project managers along with their respective locations and resumes.
  - 9. An employee list of in-house field service technicians along with their respective locations and resumes.

### 2.02 Basis Of Design

- A. Compacting Action: The Washer Compactor shall have dual augers to provide positive displacement action. Augers shall be oriented on top of each other and rotate in opposing directions. Augers shall be intermeshed, with one left-hand and one right-hand lead. Augers shall be designed with a limited float on top of a strainer to allow for the accommodation of irregular debris.
- B. Washing Action: The Washer Compactor shall have a wash water manifold integrated into the main housing. Two ports inside the unit shall emit a medium pressure stream. Wash water shall run continuously when the Washer Compactor is in motion. Continuous operation (non-batching) equipment is required; filling- and batching-type equipment shall not be accepted.
- C. Operation: The Washer Compactor shall be continuous run, not requiring an operator. The Washer Compactor shall be equipped with a self-regulating, active pressure zone designed to accept non-standard wastewater debris in its original form, including but not limited to rocks; broken concrete; and metal (such as bolts or short pipe) up to 4 inches long. The Washer Compactor shall have the ability to process multiple pieces of clothing, variable volumes of debris, and unprocessed septage or grease. The Washer Compactor shall move at a normal operating speed of 0.5 to 2.2 RPM and shall have the ability to run intermittently to sync with upstream equipment.

D. Materials:

1. Fabrications: All welded fabrications shall be made from stainless steel. All welded connections and welding procedures shall comply with AWS "Structural Welding Code – Sheet Steel" D1.3/D1.6.
2. Select Parts: Select power transmission parts to be made from cast iron; however, shall conform to standard coating as follows.
3. Standard Coating:
  - a. Motor gearbox shall be coated in strict accordance with the paint manufacturer's specification. Surface preparation shall be done in accordance with SSPC-SP-10 near White. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tnemec Zinc at 2.5-3.5 mils DFT; Intermediate Coat Series F.C.Tyoxo at 3.0-5.0 mils DFT; and Top Coat Series 1095 Endura-Shield at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all State and Federal VOC and other regulatory requirements.
  - b. Alternatives: Any alternate product must provide certified test reports when submitting products other than those specified herein. Test reports shall indicate the test method, system, and requirements for those products being submitted and shall meet or exceed the test criteria and performance values of the coatings specified herein.
4. Non-Metal: Parts not covered in the specifications above shall be manufactured from UHMW polyethylene.

Not To Be Used For Bidding Purposes

Washer Compactor WC3.D2.6 Data Sheet	
Peak Capacity:	30 cu.ft./hr (approx. 15 minutes)
Average Capacity (Continuous):	6.5 cu.ft./hr
Wastewater Application (¼" bar screen):	Up to 15 MGD
Water: Typical	Utilizes filtered effluent or municipal water Consumes 3-10 GPM Requires 40-60 PSI ½ inch NPT supply (female threads) 3 inch NPT drain (male threads)
Materials of Construction:	316 SSTL 17-4 Spur Gears Delrin (or equivalent) thrust and plane bearings UHMW Auger Supports
Strainer:	Perforated Screen
Hopper Height (Deck to Hopper):	38"
Hopper Length (WC3.D2.6 Unit):	43"
Below Freezing Temperatures: Heat tracing on body, transition and discharge chutes (installation and power by others)	No
Performance Data (Typical Wastewater Debris)	
Dry Solids:	30%-60%
Mass/Weight Reduction:	60%-70%
Volume Reduction:	70%-80%
Odor/Fecal:	Significantly decreases odor/fecal
Motor/Drive	
Motor Size:	1 HP
Motor Paint:	Duperon® Standard Tnemec Coating
Motor Service Factor (Minimum):	1.0
Output Speed:	2.2 RPM
Speed Reducer Ratio/Output:	809:1
Speed Reducer Paint:	Duperon® Standard Tnemec Coating
Site Power	
Phase/Voltage:	240/480 volt
Controls	
	NEMA 4X SSTL enclosure Main Disconnect Emergency Stop HOA (Auto is discreet "Run" input)

	Fwd/Jog Reverse/E-Stop Push Button Station "Run" and "In Auto" discrete outputs Explosion-Proof station (local standard)
Mounting:	Wall Pedestal (by others)
<b>Project Management</b>	
Submittal Quantity:	2 - 4
O&M Manual Quantity:	2 - 4
Warranty Period:	1 year
<b>Shipping</b>	
	Main unit Chute(s)

### 2.03 Components

- A. Main Housing: The main housing of the Washer Compactor shall be constructed of stainless steel (material options contained in table) with a minimum thickness of 11 gauge. Support and flange connections shall be 3/8 inch.
- B. Hopper: The hopper of the Washer Compactor shall be constructed of stainless steel (material options contained in table) with a minimum thickness of 11 gauge.
- C. Augers: The augers shall be of stainless steel (material options contained in table) with 8-inch diameter flights, 3/8 inch thick, with 4-inch flight pitch. The augers shall be coupled to a transmission at the drive end and be supported at the compaction end with UHMW plane bearings. This arrangement shall allow for the accommodation of irregular debris. The auger shaft shall be 2-inch stainless steel schedule 40 pipe with 2-inch solid stainless steel stub shaft.
- D. Compaction Housing: The compaction housing of the Washer Compactor shall be 1/4 inch stainless steel (material options contained in table) and shall house a spring and gate assembly to provide the resistance for compaction. The compaction housing shall contain the auger supports.
- E. Discharge Chute: The discharge chute of the Washer Compactor shall be constructed of stainless steel (material options contained in table) with a minimum thickness of 14 gauge. Support and flange connections shall be 1/4 inch. The discharge chute shall be tapered outward toward the discharge end.
- F. Water Supply: The water supply shall connect at a single point with a 1/2 inch NPT female connector. A NEMA 7/9 Explosion proof solenoid valve is provided to limit the wash water flow to only when the washer compactor is running. Ball valves shall be provided to distribute flow to the washing and trough sprayer connections.
- G. Strainer: A strainer shall be located beneath the lower auger to filter the washed solids. The strainer shall be removable via drain trough and pressed against the lower auger with spring pressure. The strainer shall be self-cleaning through continuous, even contact with the lower auger. Strainers requiring auger-mounted brushes will not be accepted.
- H. Drain Trough: A removable pan shall be provided beneath the main housing to collect wash water. Wash water shall be drained through a 3-inch NPT male drain port. The pan shall be a minimum of 11-gauge stainless steel (material options contained in table).
- I. Drive Assembly:

1. Each Washer Compactor unit shall operate independently, with its own drive unit and driven components. The gearbox shall not be vented to the outside atmosphere.
  2. The gearbox shall be grease lubricated and designed for 5 years (or 20,000 hours of operation) between recommended clean and re-grease services. The gearbox shall be right angle type and shall incorporate cycloidal and spiral bevel gearing with a total ratio of 809:1. The gear reducer output shaft speed shall be 0.5 RPM minimum to 2.2 RPM maximum and controlled by a vector-type inverter (or greater service factor) based on unit torque requirements. It shall be shaft-mounted utilizing the keyless Taper-Grip® bushing.
  3. The motor shall be mounted to the gear reducer by utilizing a quill, C-Face mounting style. The motor shall be AC induction type, 1 HP, 3/60/230/460-volt, explosion-proof, inverter-duty model.
  4. The drive assembly shall incorporate the Duperon® standard coating system.
- J. Auger Transmission:
- K. The Drive Assembly shall be coupled to a dual gear transmission, which drives the augers in a counter-rotation.
- L. The spur gears are contained in a stainless-steel housing and supported by Delrin (or equivalent) plane bearing.
- M. Grease fittings shall be located outside of the transmission housing to provide lubrication to the gears.
- N. Speed Reducer: The Speed Reducer shall have a maximum output of 2.2 RPM, 809:1 reduction ratio with 18,900 in-lb. of output torque.
- O. Thrust Bearings: Thrust Bearings shall be Delrin (or equivalent), self-lubricating, and be capable of withstanding a minimum of 2000 lb. of thrust load (each auger) at 2.2 RPM for life of machine.
- P. Screw Supports: Screw supports shall be UHWM plane type, self-lubricating, and fastened into place using stainless steel fasteners.

#### **2.04 Electrical, Controls, Instrumentation**

- A. General: Controls the washer compactor shall be in enclosures provided by the washer compactor manufacturer. The washer compactor manufacturer shall be responsible for proper sizing and function of the controls at 480V, unless specified otherwise. Note that the washer compactor controls can be integrated into the main control panel of the bar screen if provided by the same manufacturer.
1. Main control panels require shading from the sun and shall be operated within a temperature range between 35°F and 104°F. Sunshields, visors or other structures needed to provide shade are by others. (If the controls will experience temperatures outside this range, then special climate provisions are available.)
  2. Controls shall be designed to accept incoming power supply per plans/specs and shall include a step-down transformer as needed to achieve 120V.
  3. Control Panel(s) shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified control panel build facility and will be supported by the appropriate UL labeling.
  4. Controls shall be tested prior to shipment to owner. The washer compactor manufacturer shall verify all overload settings in the motor controller to ensure

proper overload and speed settings required for the application are properly programmed.

5. Control panel(s) shall be wired complete with a minimum of #16 MTW wire in the appropriate colors for the circuits being supplied. 120VAC control shall be red, grounded AC neutral shall be white, DC control shall be blue, DC neutral shall be blue with a white tracer, equipment ground shall be green and all incoming and outgoing external power source wires shall be a yellow configuration. All AC power wiring shall be a minimum of #12 Black. All wires shall be labeled at both ends with heat-shrink wire markers. Internal panel wiring shall be contained in non-flammable, covered wire way.
6. All panel(s) and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Tags shall be white with black core, engraved as required.
7. All field wiring and power cables between the washer compactor Main Control Panel and the Local Push Button Station shall be provided by others under the Electrical Section. VFD rated motor cable (Belden #29502 or equal) is recommended for all motors. Motor cables shall be less than 80 ft unless otherwise specified.

B. Components:

1. Main Control Panel
  - a. Enclosure(s) can be NEMA 12 painted for indoor installations.
  - b. Enclosure shall not be located in a Classified area.
  - c. Main Control Panel shall be designed with a SCCR rating of 18KA at 480VAC minimum and labeled as such, unless otherwise specified.
  - d. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
  - e. The Main Control Panel shall include at a minimum the following
    - (1) Main fusible disconnect with lockable operator, unless otherwise specified.
    - (2) Physical or virtual Hand/Off/Auto (HOA) Selector and Push/pull E-Stop button.
    - (3) Elapsed run-time meter
    - (4) Indication for "Power On", "Forward" and necessary faults
    - (5) Fused connection for the wash water solenoid.
  - f. PLC Based Controls shall include the following:
    - (1) Programmable Logic Controller (PLC)
    - (2) Variable Frequency Drive (VFD)
    - (3) HMI programmable functions as required
    - (4) SCADA Interlocking via Hard Contact and/or Ethernet Communications Protocols as required.
2. Local Control Push Button Station



- a. Enclosure shall be NEMA 7 rated for Classified area installation. Local push button station must be local to the equipment to maintain requirements of local safety codes as determined by the Engineer.
- b. Local station shall be mounted within 10 feet or as close to the equipment as safely possible and be field wired by the electrical subcontractor to the corresponding terminal inputs in the main control panel.
- c. The remote pushbutton station shall include Forward, Jog, Reverse, and E-Stop buttons.
3. Sequence of Operations:
- a. The Washer Compactor controls shall enable the push button station installed near the Washer Compactor when in "Hand" mode and utilize an input signal from a remote source when in "Auto" mode. Upon receiving a disruption of "remote source" signal in "Auto" mode, the Washer Compactor shall utilize an off-delay timer to allow debris to finish depositing. The wash water solenoid is energized any time that the washer compactor is running.
- b. The Duperon® Speed Controller fault shall be cleared by turning off the Washer Compactor, then waiting approximately three minutes (or time designated per current UL standards) and then turning the HOA back to the desired setting. A motor overtemp fault shall clear automatically when the motor cools to a temperature within the normal operating range.
4. Miscellaneous:
- a. The following shall be provided by the electrical contractor and are not part of the Washer Compactor manufacturer scope of supply:
- (1) Mounting stands
  - (2) Mounting hardware
  - (3) Field wiring and conduit
    - (a) VFD-rated motor cable (Belden #29502 or equal) recommended for all motors.
    - (b) Motor cables shall be less than 80 ft. long unless specified otherwise.
  - (4) Junction boxes
  - (5) Installation
- b. Field wiring shall include (but not be limited to) the following connections as applicable:
- (1) All incoming power supply to the main control panel.
  - (2) All required grounding of the motor and controls.
  - (3) Motor to the main control panel.
  - (4) VFD-rated motor cable (Belden #29502 or equal) recommended for all motors.
  - (5) Motor cables shall be 80 ft. long unless specified otherwise.
  - (6) Motor thermostat to the terminal inputs in the control panel.

- (7) Wash water solenoid wiring
- (8) Input and output signal wiring for remote start/stop as required by plans/specs.
- c. Remote station contacts to the corresponding terminal inputs in the main control panel.

**2.05 Specialty Tools, Spare Parts and Lubrication**

- A. Duperon does not typically recommend the purchase of additional spare parts, though some customers prefer to have them on hand.
- B. Plane Bearing Kit includes:
  - 1. Side Auger Supports (2)
  - 2. Upper/Lower Auger Supports (2)
  - 3. FHSCS: 1/4-20 x 1.00 LG (24)
  - 4. Washer: 1/4 Flat SAE (24)
  - 5. Nut: 1/4-20 Nylock (24)
  - 6. Grease Tube (14oz.) (1)
  - 7. Anti-Seize Lubricant (1oz.) (1)
- C. Bagger (optional): A continuous bag system shall be provided for containing washed/compacted screenings as they are discharged from the end of the chute. The bagger shall include quick-release latches, and a bag dispenser/holder for storing the unused bags shall be easily removed for refilling. The bag dispenser shall hold (1) continuous bag pack, with (1) bag pack provided at delivery of equipment. Bag refills shall be Longofill/Paxxo 90-meter long refills.
- D. OR
- E. Drop Sleeve (optional): A flexible canvas sleeve shall be connected to the end of the Washer Compactor steel chute. The sleeve shall provide a guidance for dropping screenings. The sleeve shall help contain the debris as it falls and prevent debris from being scattered by the wind or otherwise impact the immediate environment. The sleeve shall be constructed of heavy-duty urethane canvas and be tethered to the surroundings as required (by others).

**Part 3 Execution**

**3.01 Shipment**

- A. Shipment of all equipment shall be coordinated to allow the Washer Compactor shipment as one complete integrated assembly unless otherwise specified by the customer, contractor, or engineer.

**3.02 Installation**

- A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions, as submitted with Shop Drawings, Operation and Maintenance Manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks as required by the engineer or manufacturer, such as unloading, touch-up painting, etc. and any other installation tasks and materials such as wiring, conduit, controls stands as determined by the customer and/or specified by the manufacturer. All plumbing

shall be completed on site by a qualified individual in accordance with all local and national plumbing regulations.

- B. Anchors: Anchors and nuts shall be 316 stainless steel and furnished for each item of equipment by the CONTRACTOR.
  - 1. Anchors template drawings shall be included in the submittal to permit verification of the location structural elements, new or existing in the concrete.
  - 2. Anchors sizes, quantity and requirements will be indicated on the submittal drawings. Quantity is site specific but typically each Washer Compactor assembly requires (4) 1/2" dia. x 4 1/2" Lg. embed HILTI HAS RODS w/ RE-500v3 Adhesive system anchors.

### **3.03 Testing**

- A. After completion of installation, CONTRACTOR shall provide for testing and shall be performed in strict conformance with the manufacturer's start up instructions. Testing of the Washer Compactor shall demonstrate that the equipment is fully operational and that the equipment will wash, compact, and deposit materials not to exceed 4 inches.
- B. Field certification shall include inspection of the following:
  - 1. Verify Washer Compactor is properly leveled and anchored per the installation instructions and site drawings.
  - 2. Assure controls and instrumentation work in all modes.
  - 3. Assure proper auger rotation.
  - 4. Check to assure all Start-Up requirements are completed per the Installation Guide.

### **3.04 Onsite Technical Assistance**

- A. Manufacturer shall provide services to include Installation Certification, and shall include (1) day for Start-Up and (1) day for Training. Manufacturer shall be given minimum 14 days notification prior to the need for such services. To assure the best outcome for the Owner and Contractor, the Contractor shall provide certification for completion of the PRE-COMMISSIONING CHECKLIST. Duperon reserves the right to combine the start-up and training time for the Duperon® Washer Compactor with that of other Duperon® equipment, such as the Duperon® FlexRake®.

End of section

# Section 11 2000 Washer Compactor

## Part 1 General

### 1.01 Summary

A. Scope of work

Duperon Corporation shall furnish an interleaving, dual auger washer compactor assembly as shown on the drawings and as specified herein. A single unit shall provide washing and compacting action on wastewater screenings. The equipment shall be manufactured by Duperon Corporation, 1200 Leon Scott Court, Saginaw, Michigan, 48601, (800) 363-8479, in accordance with this section.

B. Related work

1. Bar Screen
2. Conveyor
3. Receptacle

C. Quality assurance

1. All equipment supplied under this section shall be of a single manufacturer and demonstrate, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein.
2. The equipment furnished shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

### 1.02 Related Sections

A. The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied. (For complete list of sections see specification index.)

1. All sections of Division 1 including but not limited to Submittal Procedures, Shop Drawings, Product Data and Samples, Operating and maintenance information, Protection of Materials and Equipment, Installation, Testing, and Commissioning, Instruction of Operations and Maintenance Personnel, and Spare Parts Maintenance Manuals.
2. Section 09 9100 – Painting and Coating
3. Section 11 1000 – Mechanically Cleaned Bar Screen
4. Section 26 0500 – Electrical General Requirements
5. Section 40 0500 – Process Equipment General Requirements

### 1.03 Reference Standards

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. American Welding Society (AWS)
- D. American Institute of Steel Construction (AISC)

- E. American Bearing Manufacturers Association (ABMA)
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#### **1.05 Quality Assurance**

- A. The Washer Compactor shall be fully assembled, and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of 4 hours of run time.
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- C. Operation: The Washer Compactor shall be continuous run, not requiring an operator. The Washer Compactor shall be equipped with a self-regulating, active pressure zone designed to accept non-standard wastewater debris in its original form, including but not limited to rocks; broken concrete; and metal (such as bolts or short pipe) up to 4 inches long. The Washer Compactor shall have the ability to process multiple pieces of clothing, variable volumes of debris, and unprocessed septage or grease. The Washer Compactor shall move at a normal operating speed of 0.5 to 2.2 RPM and shall have the ability to run intermittently to sync with upstream equipment.
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  - 1. Fabrications: All welded fabrications shall be made from stainless steel. All welded connections and welding procedures shall comply with AWS "Structural Welding Code – Sheet Steel" D1.3/D1.6.

2. Select Parts: Select power transmission parts to be made from cast iron; however, shall conform to standard coating as follows.
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E. Design Conditions:

<b>Washer Compactor WC3.D2.6 Data Sheet</b>	
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Average Capacity (Continuous):	6.5 cu.ft./hr
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Materials of Construction:	316 SSSL 17-4 Spur Gears Delrin (or equivalent) thrust and plane bearings UHMW Auger Supports
Strainer:	Perforated Screen
Hopper Height (Deck to Hopper):	38"
Hopper Length (WC3.D2.6 Unit):	43"
Below Freezing Temperatures: Heat tracing on body, transition and discharge chutes (installation and power by others)	No
<b>Performance Data (Typical Wastewater Debris)</b>	
Dry Solids:	30%-60%
Mass/Weight Reduction:	60%-70%
Volume Reduction:	70%-80%
Odor/Fecal:	Significantly decreases odor/fecal
<b>Motor/Drive</b>	
Motor Size:	1 HP
Motor Paint:	Duperon® Standard Tnemec Coating
Motor Service Factor (Minimum):	1.0
Output Speed:	2.2 RPM
Speed Reducer Ratio/Output:	809:1
Speed Reducer Paint:	Duperon® Standard Tnemec Coating
<b>Site Power</b>	
Phase/Voltage:	240/480 volt
<b>Controls</b>	
	NEMA 4X SSSL enclosure Main Disconnect Emergency Stop



	HOA (Auto is discreet "Run" input) Fwd/Jog Reverse/E-Stop Push Button Station "Run" and "In Auto" discrete outputs Explosion-Proof station (local standard)
Mounting:	Wall Pedestal (by others)
<b>Project Management</b>	
Submittal Quantity:	2 - 4
O&M Manual Quantity:	2 - 4
Warranty Period:	1 year
<b>Shipping</b>	
	Main unit Chute(s)

### 2.03 Components

- A. Main Housing: The main housing of the Washer Compactor shall be constructed of stainless steel (material options contained in table) with a minimum thickness of 11 gauge. Support and flange connections shall be 3/8 inch.
- B. Hopper: The hopper of the Washer Compactor shall be constructed of stainless steel (material options contained in table) with a minimum thickness of 11 gauge.
- C. Augers: The augers shall be of stainless steel (material options contained in table) with 8-inch diameter flights, 3/8 inch thick, with 4-inch flight pitch. The augers shall be coupled to a transmission at the drive end and be supported at the compaction end with UHMW plane bearings. This arrangement shall allow for the accommodation of irregular debris. The auger shaft shall be 2-inch stainless steel schedule 40 pipe with 2-inch solid stainless steel stub shaft.
- D. Compaction Housing: The compaction housing of the Washer Compactor shall be 1/4 inch stainless steel (material options contained in table) and shall house a spring and gate assembly to provide the resistance for compaction. The compaction housing shall contain the auger supports.
- E. Discharge Chute: The discharge chute of the Washer Compactor shall be constructed of stainless steel (material options contained in table) with a minimum thickness of 14 gauge. Support and flange connections shall be 1/4 inch. The discharge chute shall be tapered outward toward the discharge end.
- F. Water Supply: The water supply shall connect at a single point with a 1/2 inch NPT female connector. A NEMA 7/9 Explosion proof solenoid valve is provided to limit the wash water flow to only when the washer compactor is running. Ball valves shall be provided to distribute flow to the washing and trough sprayer connections.
- G. Strainer: A strainer shall be located beneath the lower auger to filter the washed solids. The strainer shall be removable via drain trough and pressed against the lower auger with spring pressure. The strainer shall be self-cleaning through continuous, even contact with the lower auger. Strainers requiring auger-mounted brushes will not be accepted.
- H. Drain Trough: A removable pan shall be provided beneath the main housing to collect wash water. Wash water shall be drained through a 3-inch NPT male drain port. The pan shall be a minimum of 11-gauge stainless steel (material options contained in table).

- I. Drive Assembly:
1. Each Washer Compactor unit shall operate independently, with its own drive unit and driven components. The gearbox shall not be vented to the outside atmosphere.
  2. The gearbox shall be grease lubricated and designed for 5 years (or 20,000 hours of operation) between recommended clean and re-grease services. The gearbox shall be right angle type and shall incorporate cycloidal and spiral bevel gearing with a total ratio of 809:1. The gear reducer output shaft speed shall be 0.5 RPM minimum to 2.2 RPM maximum and controlled by a vector-type inverter (or greater service factor) based on unit torque requirements. It shall be shaft-mounted utilizing the keyless Taper-Grip® bushing.
  3. The motor shall be mounted to the gear reducer by utilizing a quill, C-Face mounting style. The motor shall be AC induction type, 1 HP, 3/60/230/460-volt, explosion-proof, inverter-duty model.
  4. The drive assembly shall incorporate the Duperon® standard coating system.
- J. Auger Transmission:
- K. The Drive Assembly shall be coupled to a dual gear transmission, which drives the augers in a counter-rotation.
- L. The spur gears are contained in a stainless-steel housing and supported by Delrin (or equivalent) plane bearing.
- M. Grease fittings shall be located outside of the transmission housing to provide lubrication to the gears.
- N. Speed Reducer: The Speed Reducer shall have a maximum output of 2.2 RPM, 809:1 reduction ratio with 18,900 in-lb. of output torque.
- O. Thrust Bearings: Thrust Bearings shall be Delrin (or equivalent), self-lubricating, and be capable of withstanding a minimum of 2000 lb. of thrust load (each auger) at 2.2 RPM for life of machine.
- P. Screw Supports: Screw supports shall be UHWM plane type, self-lubricating, and fastened into place using stainless steel fasteners.

## 2.04 Electrical, Controls, Instrumentation

- A. General: Controls the washer compactor shall be in enclosures provided by the washer compactor manufacturer. The washer compactor manufacturer shall be responsible for proper sizing and function of the controls at 480V, unless specified otherwise. Note that the washer compactor controls can be integrated into the main control panel of the bar screen if provided by the same manufacturer.
1. Main control panels require shading from the sun and shall be operated within a temperature range between 35°F and 104°F. Sunshields, visors or other structures needed to provide shade are by others. (If the controls will experience temperatures outside this range, then special climate provisions are available.)
  2. Controls shall be designed to accept incoming power supply per plans/specs and shall include a step-down transformer as needed to achieve 120V.
  3. Control Panel(s) shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified control panel build facility and will be supported by the appropriate UL labeling.

4. Controls shall be tested prior to shipment to owner. The washer compactor manufacturer shall verify all overload settings in the motor controller to ensure proper overload and speed settings required for the application are properly programmed.
5. Control panel(s) shall be wired complete with a minimum of #16 MTW wire in the appropriate colors for the circuits being supplied. 120VAC control shall be red, grounded AC neutral shall be white, DC control shall be blue, DC neutral shall be blue with a white tracer, equipment ground shall be green and all incoming and outgoing external power source wires shall be a yellow configuration. All AC power wiring shall be a minimum of #12 Black. All wires shall be labeled at both ends with heat-shrink wire markers. Internal panel wiring shall be contained in non-flammable, covered wire way.
6. All panel(s) and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Tags shall be white with black core, engraved as required.
7. All field wiring and power cables between the washer compactor Main Control Panel and the Local Push Button Station shall be provided by others under the Electrical Section. VFD rated motor cable (Belden #29502 or equal) is recommended for all motors. Motor cables shall be less than 80 ft unless otherwise specified.

B. Components:

1. Main Control Panel
  - a. Enclosure(s) can be NEMA 12 painted for indoor installations.
  - b. Enclosure shall not be located in a Classified area.
  - c. Main Control Panel shall be designed with a SCCR rating of 18KA at 480VAC minimum and labeled as such, unless otherwise specified.
  - d. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
  - e. The Main Control Panel shall include at a minimum the following
    - (1) Main fusible disconnect with lockable operator, unless otherwise specified.
    - (2) Physical or virtual Hand/Off/Auto (HOA) Selector and Push/pull E-Stop button.
    - (3) Elapsed run-time meter
    - (4) Indication for "Power On", "Forward" and necessary faults
    - (5) Fused connection for the wash water solenoid.
  - f. PLC Based Controls shall include the following:
    - (1) Programmable Logic Controller (PLC)
    - (2) Variable Frequency Drive (VFD)
    - (3) HMI programmable functions as required
    - (4) SCADA Interlocking via Hard Contact and/or Ethernet Communications Protocols as required.
2. Local Control Push Button Station

- a. Enclosure shall be NEMA 7 rated for Classified area installation. Local push button station must be local to the equipment to maintain requirements of local safety codes as determined by the Engineer.
- b. Local station shall be mounted within 10 feet or as close to the equipment as safely possible and be field wired by the electrical subcontractor to the corresponding terminal inputs in the main control panel.
- c. The remote pushbutton station shall include Forward, Jog, Reverse, and E-Stop buttons.
3. Sequence of Operations:
- a. The Washer Compactor controls shall enable the push button station installed near the Washer Compactor when in "Hand" mode and utilize an input signal from a remote source when in "Auto" mode. Upon receiving a disruption of "remote source" signal in "Auto" mode, the Washer Compactor shall utilize an off-delay timer to allow debris to finish depositing. The wash water solenoid is energized any time that the washer compactor is running.
- b. The Duperon® Speed Controller fault shall be cleared by turning off the Washer Compactor, then waiting approximately three minutes (or time designated per current UL standards) and then turning the HOA back to the desired setting. A motor overtemp fault shall clear automatically when the motor cools to a temperature within the normal operating range.
4. Miscellaneous:
- a. The following shall be provided by the electrical contractor and are not part of the Washer Compactor manufacturer scope of supply:
- (1) Mounting stands
  - (2) Mounting hardware
  - (3) Field wiring and conduit
    - (a) VFD-rated motor cable (Belden #29502 or equal) recommended for all motors.
    - (b) Motor cables shall be less than 80 ft. long unless specified otherwise.
  - (4) Junction boxes
  - (5) Installation
- b. Field wiring shall include (but not be limited to) the following connections as applicable:
- (1) All incoming power supply to the main control panel.
  - (2) All required grounding of the motor and controls.
  - (3) Motor to the main control panel.
  - (4) VFD-rated motor cable (Belden #29502 or equal) recommended for all motors.
  - (5) Motor cables shall be 80 ft. long unless specified otherwise.
  - (6) Motor thermostat to the terminal inputs in the control panel.

- (7) Wash water solenoid wiring
- (8) Input and output signal wiring for remote start/stop as required by plans/specs.
- c. Remote station contacts to the corresponding terminal inputs in the main control panel.

**2.05 Specialty Tools, Spare Parts and Lubrication**

- A. Duperon does not typically recommend the purchase of additional spare parts, though some customers prefer to have them on hand.
- B. Plane Bearing Kit includes:
  - 1. Side Auger Supports (2)
  - 2. Upper/Lower Auger Supports (2)
  - 3. FHSCS: 1/4-20 x 1.00 LG (24)
  - 4. Washer: 1/4 Flat SAE (24)
  - 5. Nut: 1/4-20 Nylock (24)
  - 6. Grease Tube (14oz.) (1)
  - 7. Anti-Seize Lubricant (1oz.) (1)
- C. Bagger (optional): A continuous bag system shall be provided for containing washed/compacted screenings as they are discharged from the end of the chute. The bagger shall include quick-release latches, and a bag dispenser/holder for storing the unused bags shall be easily removed for refilling. The bag dispenser shall hold (1) continuous bag pack, with (1) bag pack provided at delivery of equipment. Bag refills shall be Longofill/Paxxo 90-meter long refills.
- D. OR
- E. Drop Sleeve (optional): A flexible canvas sleeve shall be connected to the end of the Washer Compactor steel chute. The sleeve shall provide a guidance for dropping screenings. The sleeve shall help contain the debris as it falls and prevent debris from being scattered by the wind or otherwise impact the immediate environment. The sleeve shall be constructed of heavy-duty urethane canvas and be tethered to the surroundings as required (by others).

**Part 3 Execution**

**3.01 Shipment**

- A. Shipment of all equipment shall be coordinated to allow the Washer Compactor shipment as one complete integrated assembly unless otherwise specified by the customer, contractor, or engineer.

**3.02 Installation**

- A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions, as submitted with Shop Drawings, Operation and Maintenance Manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks as required by the engineer or manufacturer, such as unloading, touch-up painting, etc. and any other installation tasks and materials such as wiring, conduit, controls stands as determined by the customer and/or specified by the manufacturer. All plumbing

shall be completed on site by a qualified individual in accordance with all local and national plumbing regulations.

- B. Anchors: Anchors and nuts shall be 316 stainless steel and furnished for each item of equipment by the CONTRACTOR.
  - 1. Anchors template drawings shall be included in the submittal to permit verification of the location structural elements, new or existing in the concrete.
  - 2. Anchors sizes, quantity and requirements will be indicated on the submittal drawings. Quantity is site specific but typically each Washer Compactor assembly requires (4) 1/2" dia. x 4 1/2" Lg. embed HILTI HAS RODS w/ RE-500v3 Adhesive system anchors.

### **3.03 Testing**

- A. After completion of installation, CONTRACTOR shall provide for testing and shall be performed in strict conformance with the manufacturer's start up instructions. Testing of the Washer Compactor shall demonstrate that the equipment is fully operational and that the equipment will wash, compact, and deposit materials not to exceed 4 inches.
- B. Field certification shall include inspection of the following:
  - 1. Verify Washer Compactor is properly leveled and anchored per the installation instructions and site drawings.
  - 2. Assure controls and instrumentation work in all modes.
  - 3. Assure proper auger rotation.
  - 4. Check to assure all Start-Up requirements are completed per the Installation Guide.

### **3.04 Onsite Technical Assistance**

- A. Manufacturer shall provide services to include Installation Certification, and shall include (1) day for Start-Up and (1) day for Training. Manufacturer shall be given minimum 14 days notification prior to the need for such services. To assure the best outcome for the Owner and Contractor, the Contractor shall provide certification for completion of the PRE-COMMISSIONING CHECKLIST. Duperon reserves the right to combine the start-up and training time for the Duperon® Washer Compactor with that of other Duperon® equipment, such as the Duperon® FlexRake®.

End of section

## **Section 11 3000 Additional Equipment**

### **Part 1 General**

#### **1.01 Scope of Work**

- A. This section includes the furnishing additional equipment associated with the Monessen and Donner Pump Stations Screenings Improvements Project, including:
  - 1. Screenings Waste Receptacle for collection of screenings produced by the mechanical bar screen.
  - 2. Underflow Weir installed downstream of the Mechanical Bar Screen in the Influent Channel.
  - 3. Manual Bar Screen installed in the channel that formerly contained the comminutor. This channel is to be converted into a bypass channel containing a Manual Bar Screen.
- B. All equipment supplied under this section shall be furnished by or through a single supplier who shall coordinate delivery and installation of the waste receptacle with the Contractor.
- C. The Contractor shall be responsible to coordinate all details of the waste receptacle with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate the equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

#### **1.02 Related Sections**

- A. The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied. (For complete list of sections see specification index.)
  - 1. All sections of Division 1 including but not limited to Submittal Procedures, Shop Drawings, Product Data and Samples, Operating and maintenance information, Protection of Materials and Equipment, Installation, Testing, and Commissioning, Instruction of Operations and Maintenance Personnel, and Spare Parts Maintenance Manuals.
  - 2. Section 11 1000 – Mechanically Cleaned Bar Screen
  - 3. Section 11 2000 – Washer Compactor
  - 4. Section 40 0500 – Process Equipment General Requirements

#### **1.03 Reference Standards**

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)

- C. American Welding Society (AWS)
- D. American Institute of Steel Construction (AISC)
- E. American Bearing Manufacturers Association (ABMA)
- F. American Gear Manufacturers Association (AGMA)
- G. National Electrical Manufacturers Association (NEMA)
- H. Underwriters Laboratory (UL)

#### **1.04 Submittals**

- A. The equipment manufacturer shall submit the following items:
  - 1. (6) Sets of General Arrangement drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation.
  - 2. Other related data including descriptive literature and catalog cut sheets.

#### **1.05 Quality Assurance**

- A. To assure quality and performance: All equipment furnished under this Section and related sections shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein. Upon request, the manufacturer shall provide a reference of such installation sites along with the relevant contact information.
- B. The equipment furnished shall be fabricated, assembled, installed and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

#### **1.06 Warranty**

- A. Manufacturer shall provide a written one-year standard warranty from the date of use of the waste receptacle to guarantee that there shall be no defects in material or workmanship in any item supplied.

### **Part 2 Products**

#### **2.01 Acceptable Manufacturers**

- A. Screenings Waste Receptacle
  - 1. McMaster-Carr
  - 2. Or approved equal.



- B. Weir
  - 1. To be fabricated on site.
- C. Manual Bar Screen
  - 1. To be fabricated on site.

**2.02 Basis of Design**

A. Screenings Waste Receptacle

- 1. The Screenings Waste Receptacle shall be designed such that one plant operator shall be capable of moving the receptacle out of the pump station and depositing its contents into a dumpster or other waste collection vessel. Equipment that requires multiple individuals to move and/or transfer waste is not acceptable.
- 2. Design Conditions:

<b>Equipment Information:</b>	
McMaster-Carr Item No.:	2880T13
Body Material:	Polypropylene Plastic, ¼" thick
Frame Material:	Powder Coated Steel
Capacity:	20 cu. ft.
Caster Type:	Two Rigid and Two Swivel Casters
Wheel:	5 in. diameter, polypropylene plastic
<b>Exterior Dimensions:</b>	
Length:	42 in.
Width:	30 in.
Height:	37 in.

B. Underflow Weir

- 1. The Underflow Weir plate is to be installed across the width of the influent channel approx. 12-18" downstream of mechanical screen. Its design is to provide a minimum upstream water depth of 1 ft with an opening notch, 1-2" across the bottom of plate to allow sediments and water to pass through to flush the channel invert.
- 2. Design Conditions:

<b>Equipment Information:</b>	
Material:	316 SS
Width:	Full Influent Channel Width (To Be Field Verified by Contractor)
Bent Plate Thickness:	0.5 in.
Bent Plate Dimensions:	1 ft x 0.5 ft
Connection Hardware:	Epoxy Anchors

C. Manual Bar Screen

1. Design Conditions:

<b>Equipment Information:</b>	
Material:	316 SS
Bar Shape:	Tear Shaped
Bar Opening Size:	3/4"
Minimum Bar Dimensions:	0.25" x 0.75" x 0.13"
Angle:	45°
Monessen Pump Station Bar Screen Dimensions:	
Width:	3'-6"
Length:	4'-6"
Donner Pump Station Bar Screen Dimensions:	
Width:	2'-6"
Length:	4'-6"

**Part 3 Execution**

**3.01 Contractor's Verification**

- A. CONTRACTOR shall field measure dimensions and check possible interferences.

**3.02 Installation**

- A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions, as submitted with Shop Drawings, Operation and Maintenance Manuals and/or any pre-installation checklists.

End of Section

## Section 23 0590 Testing, Adjusting, and Balancing

### Part 1 General

#### 1.01 Summary

- A. Section Includes: Requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include:
1. Measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications.
  2. Recording and reporting the results.
- B. Test, adjust, and balance the following mechanical systems:
1. Supply air systems.
  2. Return air systems.
  3. Exhaust air systems.
  4. Hydronic systems.
  5. Verify temperature control system operation.
- C. This Section does not include:
1. Testing boilers and pressure vessels for compliance with safety codes.
  2. Specifications for materials for patching mechanical systems.
  3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
  4. Requirements and procedures for piping and ductwork systems leakage tests.
- D. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to Work of this Section.

#### 1.02 Definitions

- A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
1. The balance of air and water distribution.
  2. Adjustment of total system to provide design quantities.
  3. Electrical measurement.
  4. Verification of performance of all equipment and automatic controls.
- B. Test: To determine quantitative performance of equipment.

- C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).
- D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
- E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
- F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
- G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- H. Main: Duct or pipe containing the system's major or entire fluid flow.
- I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
- J. Branch main: Duct or pipe serving two or more terminals.
- K. Branch: Duct or pipe serving a single terminal.

### 1.03 Submittals

- A. Shop Drawings: Submit in accordance with Section 01 3300, Submittal Procedures, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Agency Data: Proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified in Quality Assurance Article.
  - 2. Engineer and Technicians Data: Proof that the Test and Balance Engineer assigned to supervise the procedures and the technicians proposed to perform the procedures meet the qualifications specified below.
  - 3. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this Project.
- B. Certified Reports:
  - 1. Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards, are an accurate representation of how the systems have been installed, are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures, and are an accurate record of all final quantities measured to establish normal operating values of the systems. Follow the procedures and format specified below:
    - a. Reports: Upon completion of testing, adjusting, and balancing procedures, prepare a testing and balancing report. Reports must be complete, factual, accurate, and legible. Organize and format reports as specified below. Submit four complete sets of reports to ENGINEER for evaluation and approval.

- b. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
- 1) General Information and Summary.
  - 2) Air Systems.
  - 3) Hydronic Systems.
  - 4) Temperature Control Systems (if applicable).
- c. Report Contents: Provide the following minimum information forms, and data:
- 1) General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, CONTRACTOR, OWNER, ENGINEER, and Project. Include addresses and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
  - 2) The remainder of the report shall contain the appropriate forms containing, as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form. Diagrams are not required for air systems containing one or two terminals.
- C. Calibration Reports:
1. Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of 6 months prior to starting Project.

#### 1.04 Quality Assurance

- A. Agency Qualifications:
1. Employ the services of an independent testing, adjusting, and balancing agency to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and recording and reporting the results.
  2. An independent testing, adjusting, and balancing agency certified by Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB), in those testing and balancing disciplines required for this Project and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC or NEBB as a Test and Balance Engineer.
- B. Codes and Standards:
1. AABC: "National Standards for Total System Balance."

2. ASHRAE: ASHRAE Handbook, Current Edition, Testing, Adjusting, and Balancing.
- C. Pre-balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

### **1.05 Project Conditions**

- A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

### **1.06 Sequencing and Scheduling**

- A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.

## **Part 2 Products (Not Used)**

## **Part 3 Execution**

### **3.01 Preliminary Procedures for Air System Balancing**

- A. Before operating the system, perform these steps:
  1. Obtain design Drawings and Specifications and become thoroughly acquainted with the design intent.
  2. Obtain copies of approved Shop Drawings of all air handling equipment, outlets (supply, return and exhaust), and temperature control diagrams.
  3. Compare design to installed equipment and field installations.
  4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
  5. Check filters for cleanliness.
  6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
  7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
  8. Determine best locations in main and branch ductwork for most accurate duct traverses.
  9. Place outlet dampers in the full open position.
  10. Prepare schematic diagrams of system ductwork and piping layouts conforming to construction records to facilitate reporting.
  11. Lubricate all motors and bearings.
  12. Check fan belt tension.
  13. Check fan rotation.

### **3.02 Preliminary Procedures for Hydronic System Balancing**

- A. Before operating the system perform these steps:
  - 1. Open valves to full open position.
  - 2. Remove and clean all strainers.
  - 3. Examine hydronic systems and determine if water has been treated and cleaned.
  - 4. Check pump rotation.
  - 5. Clean and set automatic fill valves for required system pressure.
  - 6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
  - 7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
  - 8. Set temperature controls so all coils are calling for full flow.
  - 9. Check operation of automatic bypass valves (where applicable).
  - 10. Lubricate all motors and bearings.

### **3.03 Measurements**

- A. Provide all required instrumentation to obtain proper measurements calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
- B. Provide instruments meeting the specifications of the referenced standards.
- C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- D. Apply instrument as recommended by the manufacturer.
- E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.
- F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until two consecutive identical values are obtained.
- G. Take all reading with the eye at the level of the indicated value to prevent parallax.
- H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
- I. Take measurements in the system where best suited to the task.

### **3.04 Performing Testing, Adjusting, and Balancing**

- A. Perform testing and balancing procedures on each system identified in accordance with the detailed procedures outlined in the referenced standards.
- B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- C. Patch insulation, ductwork, and housings using materials identical to those removed.

- D. Seal ducts and piping, and test for and repair leaks.
- E. Seal insulation to re-establish integrity of the vapor barrier.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

**3.05 Record and Report Data**

- A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.
- B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

End of Section

Not To Be Used For Bidding Purposes



## Section 23 3100 Ductwork

### Part 1 General

#### 1.01 Summary

- A. Extent of ductwork is indicated on Drawings and on Schedules and by requirements of this Section.
- B. All duct dimensions shown on Drawings are internal. All ducts shall be supported in a secure manner and shall be subject to the approval of ENGINEER. System shall be in accordance with SMACNA Standards for HVAC duct construction.
- C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to Work of this Section.

#### 1.02 Submittals

- A. Shop Drawings: Submit in accordance with Section 01 3300, Submittal Procedures, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Provide Layout Drawings (drawn to scale) for all duct systems.
  - 2. Submit technical product data and installation instructions for ducts and fittings. Include pressure ratings, data showing extent of corrosion resistance to chemicals being handled, compliance with standards listed, duct gauges, reinforcement methods, and other data necessary to show compliance with specifications.
- B. Record Drawings: At Project closeout, submit record drawings of installed products, in accordance with requirements of Section 01 7700, Closeout Procedures.
- C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01 6000, Product Requirements, operation and maintenance manuals for items included under this Section.

#### 1.03 Quality Assurance

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. SMACNA Compliance: Comply with all applicable SMACNA standards for fabrication and installation of ductwork, including:
  - 1. "HVAC Duct Construction Standards, Metal and Flexible."
  - 2. "Rectangular Industrial Duct Construction Standards."
  - 3. "Round Industrial Duct Construction Standards."
  - 4. "Fibrous Glass Duct Construction Standards."
- C. NFPA Compliance: Comply with following standards:
  - 1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

#### **1.04 Delivery, Storage, and Handling**

- A. Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

## **Part 2 Products**

### **2.01 Manufacturers**

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Ductwork Materials:
    - a. Foremost.
    - b. United-McGill.

### **2.02 Ductwork Materials**

- A. Exposed Ductwork Materials: Where ductwork is exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections including those which would impair painting.
- B. Sheet Metal: Except as otherwise indicated, provide galvanized sheet steel complying with ASTM A 527, lockforming quality; G90 zinc coating in accordance with ASTM A 527, and mill phosphatized for exposed locations. Paint new ductwork to match existing. Touch up existing duct where damaged.

### **2.03 Fabrication - General**

- A. Shop fabricate ductwork in 4-, 8-, 10- or 12-foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with centerline radius equal to 1.5 times associated duct width, and fabricate to include turning vanes in elbows where shorter radius is necessary. Square and rectangular mitered elbows shall have turning vanes supplied in Section 23 3300, Ductwork Accessories. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- C. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Section 23 3300, Ductwork Accessories, for accessory requirements.

### **2.04 Rectangular Metal Ductwork Fabrication**

- A. Rectangular Ductwork and Fittings: Conform to the requirements of the SMACNA "HVAC Duct Construction Standards," and to SMACNA "Rectangular Industrial Duct Construction Standards," except as otherwise required by this Specification.

## 2.05 Miscellaneous Ductwork Materials

- A. Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Duct sealant shall be UL listed.
- C. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components or longitudinal seams in ductwork.
- D. Ductwork Support Materials: Except as otherwise indicated, provide hot dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of ductwork. Paint ductwork support materials to match ductwork.
  - 1. The bottom corners of the duct shall be protected by angles to prevent being cut by the straps.
  - 2. Hangers for round duct shall be the sling or saddle type.
  - 3. All hangers shall provide a means of vertical adjustment after erection.
  - 4. All ductwork shall be fabricated and installed so as to entirely eliminate any vibration or duct noise using fabric sleeves at fans, etc., as described below.

## Part 3 Execution

### 3.01 Inspection

- A. Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

### 3.02 Installation of Metal Ductwork

- A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5 percent leakage for systems rated 3 inches and under; 1 percent for systems rated over 3 inches) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8-inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
- B. Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in Work.
- C. Field Fabrication: Complete fabrication of Work at Site as necessary to match shop-fabricated work and accommodate installation requirements.
- D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details, and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts

close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1-inch clearance outside of insulation. Do not encase horizontal runs in solid partitions except as specifically shown. Coordinate layout with lighting layouts and similar finished work.

- E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2 inches. Fasten to duct and substrate.
  - 1. Where ducts pass through fire-rated floors, walls, or partitions, provide fire-stopping between duct and substrate.
- F. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls, and other associated work of ductwork system.
- G. Install metal ductwork in accordance in SMACNA, HVAC Duct Construction Standards.

### **3.03 Field Quality Control**

- A. Leakage Tests: After each duct system is completed, test for duct leakage in accordance with SMACNA, HVAC Air Duct Leakage Test Manual. Repair leaks and repeat test until total leakage is less than 1 percent of system design air flow for duct classes over 3 inches and 5 percent for duct classes under 3 inches.

### **3.04 Equipment Connections**

- A. Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery.

### **3.05 Adjusting and Cleaning**

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Balancing: Refer to Section 23 0590, Testing, Adjusting and Balancing, for air distribution balancing of metal ductwork; not Work of this Section. Seal any leaks in ductwork that become apparent in balancing process.

End of Section

## Section 23 3300 Ductwork Accessories

### Part 1 General

#### 1.01 Summary

- A. Section Includes: Ductwork accessories Work is indicated on Drawings and on Schedules, and by requirements of this Section.
- B. Types of ductwork accessories required include:
  - 1. Registers, grilles, and diffusers.
  - 2. Dampers.
  - 3. Turning vanes.
  - 4. Duct hardware.
  - 5. Duct access doors.
  - 6. Flexible connections.
- C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to Work of this Section.

#### 1.02 Submittals

- A. Shop Drawings: Submit in accordance with Section 01 3300, Submittal Procedures, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.
  - 2. Schedule of air outlets and inlets indicating Drawing designation, room location, number furnished, model number, size, and accessories furnished.
  - 3. Data sheet for each type of air outlet and inlet, and accessory furnished indicating construction, finish, and mounting details.
  - 4. Performance data for each type of air outlet and inlet furnished, including aspiration ability pressure drop, throw and drop, and noise criteria ratings. Indicate selections on data.
  - 5. Submit manufacturer's assembly-type Shop Drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
- B. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01 6000, Product Requirements, operation and maintenance manuals for items included under this Section.

### 1.03 Quality Assurance

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
  - 1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
  - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70, "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets."
  - 3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555, "Fire Dampers and Ceiling Dampers."
  - 4. NFPA Compliance: Comply with applicable provisions of NFPA 90A, "Air Conditioning and Ventilating Systems."
  - 5. ARI Compliance: Provide air terminals which have been tested and rated in accordance with ARI 880, "Industry Standard for Air Terminals," and bear ARI certification seal. Test and rate air outlets and inlets in accordance with ARI 650, "Standard for Air Outlets and Inlets."
  - 6. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062, "Certification, Rating and Test Manual."
  - 7. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
  - 8. AMCA Compliance: Test and rate louvers in accordance with AMCA 500, "Test Method for Louvers, Dampers and Shutters."
  - 9. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.

### 1.04 Delivery, Storage, and Handling

- A. Deliver ductwork accessories wrapped in factory-fabricated fiberboard-type containers. Identify on outside of container type of device and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in equipment.
- B. Store ductwork accessories in original cartons and protect from weather and construction work traffic. Where possible, store indoors. When necessary to store outdoors, store above grade and enclose with waterproof wrapping.

## Part 2 Products

### 2.01 Manufacturers

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Registers, Grilles, and Diffusers:
    - a. Carnes.
    - b. Titus.
    - c. Tuttle and Bailey.

2. Dampers:
  - a. Arrow United Industries.
  - b. Ruskin.
3. Turning Vanes:
  - a. Anemostat Products Division, Dynamics Corp. of America.
  - b. Hart and Cooley Manufacturing Co.
  - c. Titus.
4. Duct Hardware:
  - a. Ventfabrics, Inc.
  - b. Young Regulator Co.
5. Duct Access Doors:
  - a. Air Balance, Inc.
  - b. Ruskin Manufacturing Co.
  - c. Ventlock.
6. Flexible Connections:
  - a. American/Elgen Co., Energy Division.
  - b. Ventfabrics, Inc.

## **2.02 General**

- A. Ductwork accessories shall be corrosion-resistant where noted on Drawings and as noted herein. Refer to Section 22 0500, Plumbing/HVAC General Requirements for corrosion-resistant requirements.

## **2.03 Registers, Grilles, and Diffusers**

- A. All grilles and diffusers shall be sized for capacities and air patterns as shown on Drawings.
- B. Style: CONTRACTOR shall furnish equipment equal to the following:
  1. Supply Registers: Double deflection, 3/4-inch spacing, extruded aluminum with opposed-blade damper, similar to Titus 300 series.

## **2.04 Dampers**

- A. Manual Dampers: CONTRACTOR shall furnish and install dampers as shown on Drawings and where required to properly balance the duct system as described by the Associated Air Balance Council.
- B. Rectangular Ducts: Provide multiple opposed-blade type dampers. Provide 9-inch maximum blades made from 16-gauge galvanized steel or aluminum. Provide neoprene edging and stops, channel iron frames painted with 2 coats of rust-resistant paint and locking quadrants.

## **2.05 Turning Vanes**

- A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2-inch-wide curved blades set at 3/4-inch o.c., supported with bars perpendicular to blades set at 2-inch o.c., and set into side strips suitable for mounting in ductwork.

- B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

## **2.06 Duct Hardware**

- A. Provide duct hardware manufactured by one manufacturer for all items on Project for the following:
  - 1. Test Holes: Provide in ductwork, at fan inlet and outlet and elsewhere as indicated, duct test holes consisting of slot and cover for instrument tests.
  - 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 inches. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

## **2.07 Duct Access Doors**

- A. Provide where indicated, duct access doors of size indicated. Also provide access doors of each automatic and fire damper, at each humidifier (at the entering side of each coil installed in a field-fabricated casing), at each duct type humidity controller or transmitter, and at any device requiring inspection or maintenance.
- B. Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12 inches high and smaller, two handle-type latches for larger doors.

## **2.08 Flexible Connections**

- A. Provide flexible duct connections wherever ductwork connects to vibration isolated equipment and at each air unit. Construct flexible connections of neoprene-coated flame-proof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

# **Part 3 Execution**

## **3.01 Inspection**

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

## **3.02 Installation of Ductwork Accessories**

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90-degree elbows in supply and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against system air pressure. Latches shall be operable from either side, except outside only where duct is too small for person to enter.



- D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

**3.03 Field Quality Control**

- A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak-proof performance.

**3.04 Adjusting and Cleaning**

- A. Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
  - 1. Final positioning of manual dampers is specified in Section 23 0590, Testing, Adjusting and Balancing.
- B. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

End of Section

Not To Be Used For Bidding Purposes

## Section 23 3400 Fans

### Part 1 General

#### 1.01 Summary

- A. Section Includes: Fan work as indicated on Drawings and Schedules and by requirements of this Section.
- B. Types of fans required for Project include the following:
  - 1. Cabinet fans (CF).
  - 2. Wall fans (WF).
  - 3. In-line fans (IF).
- C. Refer to Division 26 Sections for the following work; not Work of this Section.
  - 1. Power supply wiring from power source to power connection on fan motors. Include starters, disconnects, and required electrical devices, except where specified as furnished or factory installed by manufacturer.
  - 2. Interlock wiring between fan units; and between fans and field-installed control devices.
    - a. Interlock wiring specified as factory installed, is Work of this Section.

#### 1.02 Submittals

- A. Shop Drawings: Submit in accordance with Section 01 3300, Submittal Procedures, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Assembly-type Shop Drawings showing fan dimensions, required clearances, construction details, and field connection details.
  - 2. Manufacturer's technical product data for fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gauges and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.
    - a. Indicate fan pressure volume curve and horsepower curve on fan performance curves.
  - 3. Manufacturer's electrical requirements for power supply wiring to fan units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.
- B. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01 6000, Product Requirements, operation, and maintenance manuals for items included under this Section.

#### 1.03 Quality Assurance

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fans, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

- B. Codes and Standards:
1. AMCA Compliance: Provide fans bearing the AMCA Certified Ratings Seal. Sound rate fans in accordance with AMCA 300, "Test Code for Sound Rating Air Moving Devices."
  2. ASHRAE Compliance: Test and rate fans in accordance with ASHRAE 51 (AMCA 210), "Laboratory Methods of Testing Fans for Rating."
  3. UL Compliance: Provide fans electrical components which have been listed and labeled by UL.

#### **1.04 Delivery, Storage, and Handling**

- A. Deliver fans with factory-installed shipping skids and lifting lugs; pack components in factory fabricated, protective containers.
- B. Handle fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to fan manufacturer.
- C. Store fans in clean, dry place and protect from weather and construction traffic.
- D. Comply with manufacturer's rigging and installation instructions for unloading fans and moving them to final location.

#### **1.05 Extra Materials**

- A. Furnish to OWNER, with receipt, 1 spare set of belts for each belt-driven fan.

### **Part 2 Products**

#### **2.01 Manufacturers**

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  1. Cabinet Fans:
    - a. Greenheck
    - b. American Air Filter.
    - c. McQuay, Inc.
    - d. The Trane Co.
  2. Wall Fans:
    - a. Greenheck.
    - b. Jenn Fan.
    - c. Loren Cook Company.
  3. In-Line Fans:
    - a. ACME Engineering and Manufacturing.
    - b. Greenheck.
    - c. Loren Cook.

## 2.02 Equipment

- A. The equipment shall be factory built and factory tested. Repair or replace any items which fail to obtain specified performance. All fans shall be statically and dynamically balanced and tested.
- B. Fan ratings shall be based upon tests performed in accordance with the test code set up by the Air Moving and Conditioning Association. Each fan shall carry, near the manufacturer's nameplate, the seal authorized by AMCA indicating that the ratings are certified.
- C. Fans having explosion-proof and corrosion-resistant requirements are noted on Drawings. Refer to Section 22 0500, Plumbing/HVAC General Requirements, for explosion-proof and corrosion-resistant requirements.
- D. On the fan performance curves, the fan volume selection point shall be a minimum of 15 percent greater than the volume at the peak of the pressure volume curve. Brake horsepower at the selection point shall not exceed 95 percent of the rated motor horsepower.

## 2.03 Cabinet Fans (CF)

- A. Casing: Provide 18-gauge steel casing, reinforced with steel angle framework. Furnish removable panels in fan and coil sections to provide access to all internal parts. Paint casing with epoxy primer and finish with baked-on enamel or provide galvanized steel.
  - B. Centrifugal Fans: Fans shall be statically and dynamically balanced and tested after being installed in factory-assembled fan sections. Install fans on shafts supported by permanently sealed or lubricated ball bearings. Provide adjustable drives. Provide externally mounted grease fittings for lubricated fan bearings. Fan shafts shall not pass through their first critical speed as unit comes up to rated rpm.
  - C. Motors: Provide totally enclosed, fan cooled, premium efficiency motors, factory installed and wired to a junction box. Mount junction box on the outside of the fan casing.
  - D. Insulate unit interior with 1-inch fiberglass-type insulation securely fastened with adhesive.
  - E. Filter Box: Furnish filter rack with 1-inch throwaway, low-velocity type filters. Filter velocity shall not exceed 500 fpm. Provide access doors on both sides. Filters shall fit snugly to prevent air bypass. Both sides of the filter box shall be flanged for fastener holes.
  - F. Coils: Provide chilled water and hot water coils with aluminum fins mechanically bonded to 1/2-inch O.D. seamless copper tubes. Factory test coils at 400 psi.
  - G. Drain Pan: Provide galvanized steel pan under entire cooling coil with 3/4-inch drain connections at both ends.
  - H. Mixing Box: Provide opposed-blade, low leakage dampers with edge and jamb seals. Provide interconnecting linkage components for left- or right-hand attachment onto 1/2-inch rods. Provide access panels on each side of mixing box. Provide with duct connection flanges and necessary fastener holes.
- Isolators: Provide rubber-in-shear mounts.

## 2.04 Wall Fans (WF)

- A. Provide direct-drive or belt-drive wall fans with complete assembly of fabricated steel, welded construction, and an aluminum propeller.
- B. Motors: Provide totally enclosed, fan cooled, premium efficiency motors.
- C. Accessories: Provide with wire guards, weatherproof aluminum gravity shutters, and speed controller.

## 2.05 In-Line Fans (IF)

- A. Fans shall be axial, vane-axial, or centrifugal as noted on Drawings.
- B. Unit shall be belt-driven or direct-driven as noted on Drawings. Provide belt-driven fans with adjustable drives.
- C. Provide heavy-duty, grease-lubricated ball or roller bearings. Fans shall have airtight door of ample size to allow complete inspection. The housing shall be flanged to fit into the ductwork.
- D. Motors: Provide totally enclosed, fan cooled, premium efficiency motors.
- E. Guards: Motor belts shall be protected with sheet metal guards. Guards shall be easily removed for inspection. Provide openings located at each shaft center for rotation checking. Securely fasten the guard to the fan. The guard shall comply with all the local and State safety codes.
- F. Wheels: For axial or vane-axial fans, provide wheels with aluminum propeller blades mounted in a cast aluminum hub.
- G. For in-line centrifugal fans, provide backward-curved, non-overloading wheels.
- H. Accessories: Motor cover, inlet safety screen, discharge safety screen, mounting feet, inlet bells, and companion flanges.

## Part 3 Execution

### 3.01 Inspection

- A. Examine areas and conditions under which fans are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

### 3.02 Installation of Fans

- A. Install fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices to ensure that fans comply with requirements and serve intended purposes.
- B. Access: Provide access and service space around and over fans as indicated, but in no case less than that recommended by manufacturer.
- C. Support: Provide 4-inch-high concrete pad under floor-mounted fans.
- D. Isolation: Set fans on vibration isolators; fasten in accordance with manufacturer's installation instructions.
- E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring instructions submittal to electrical Installer.
  - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with fan start-up until wiring installation is acceptable to fan Installer.
- F. Ductwork Connections: Refer to Division 23, Ductwork Sections. Provide flexible connections on inlet and outlet duct connections.

**3.03 Field Quality Control**

- A. Upon completion of installation of fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field-correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

**3.04 Adjusting and Cleaning**

- A. Start-up, test, and adjust fans in presence of manufacturer's authorized representative.

End of Section

Not To Be Used For Bidding Purposes

## Section 26 0500 Electrical General Requirements

### Part 1 General

#### 1.01 Description

A. Scope of Work

1. These Specifications and the accompanying drawings contemplate the furnishing and installation of all materials, equipment, supplies, testing, adjustments, labor, and supervision required for the complete performance of all operations relating to the electrical and instrumentation.
2. The CONTRACTOR shall be held responsible for the complete and satisfactory accomplishment of all Work inclusive of whatever miscellaneous material and/or appurtenances are required to perfect the installation and demonstrate that all electrical systems will operate satisfactorily under normal operating conditions.
3. The CONTRACTOR shall be responsible for all electrical connections to equipment. Electrical connections in addition to making wire connections shall include, but not be limited to, furnishing, installing, and testing circuit protection devices, motor overload devices, conduits, and fittings needed to ensure a complete and operable electrical installation.

B. Related Work Specified Elsewhere

1. Cast-in-Place Concrete: Section 03 3000
2. Basic Materials and Methods: Section 26 0510

C. Responsibility

1. It shall be the responsibility of the CONTRACTOR to furnish a complete and fully operating system. The CONTRACTOR shall be responsible for all details which may be necessary to properly install, adjust, and place in operation the complete installation. The CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from the Plans and Specifications.

D. Apportionment of the Work

1. The CONTRACTOR shall classify and apportion all materials and performance of all labor to the several trades involved in accordance with all local customs, rules, regulations, jurisdiction awards, decisions, etc., insofar as they may apply and as required to efficiently execute the Work involved in this Contract.

E. Cooperation of the Contractor

1. The CONTRACTOR shall coordinate the work of Subcontractors of each trade to avoid interference in the Work and to avoid delays in the construction. He shall coordinate the Work of all Subcontractors to obtain a first-class workmanlike system.
2. Where interference occurs as a result of poor cooperation between Subcontractors and the coordination on the part of the CONTRACTOR, the OWNER reserves the right to change the Work in hand to resolve the interferences and such changes will not be considered as extras.

- F. Damage to Other Work
1. The CONTRACTOR will be held responsible for all damage done by his workmen. All patching and repairing of damaged Work shall be done by the CONTRACTOR.
- G. Maintenance Prior to Final Acceptance
1. The CONTRACTOR shall be responsible for the maintenance of equipment and systems installed until final acceptance by the OWNER, and shall take such measures as necessary to ensure adequate protection of all equipment and materials during delivery, storage, installation, start up, temporary operation, and shut down.
- H. Accessibility
1. All equipment shall be installed so as to be readily accessible for operation, maintenance, and repair, subject to the approval of the ENGINEER.
- I. Cutting and Patching
1. The CONTRACTOR shall perform all cutting and patching that may be necessary for the installation of the Work.
  2. Major wall penetrations shall not be made without the written consent of the ENGINEER unless they are called for on the construction drawings.
  3. Structural steel shall not be cut, welded, or altered in any way without the written consent of the ENGINEER.

## 1.02 Quality Assurance

### A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - The American National Standards Institute
2. ASA - Acoustical Society of America
3. ASTM - The American Society for Testing Materials
4. ETL - Electrical Testing Laboratories
5. IEEE - The Institute of Electrical and Electronic Engineers
6. ICEA - The Insulated Cable Engineers Association
7. ISA - The Instrument Society of America
8. ITL - Independent Testing Laboratories
9. JIC - Joint Industrial Conference
10. NACE - National Association of Corrosion Engineers
11. NEC - The National Electric Code
12. NEMA - The National Electrical Manufacturers Association
13. NESC - The National Electrical Safety Code
14. NFPI - The National Fire Protection Institute



15. OSHA - Federal Occupational Safety and Health Act
  16. UL - Underwriters Laboratories, Inc.
  17. FM - Factory Mutual Insurance Underwriters
- B. Erector Qualifications
1. All Work shall be performed in accordance with latest accepted standards and practices for the trades involved. The workmanship shall be subject to the approval of the ENGINEER at all times.
  2. Only experienced craftsmen will be allowed to perform the items of Work as required within this Project.
- C. Requirements of Regulatory Agencies
1. All materials and equipment required for the Work and their installation shall conform to all national, state, county, and local codes, rules, regulations, and ordinances. Each contractor shall secure all permits, inspections, and tests required in connection with his Work.
  2. Any changes in the drawings and/or Specifications required to conform to the above codes, laws, rules, and/or regulations shall be taken up with the ENGINEER by the CONTRACTOR before submitting his Proposal. After entering into the Contract, the CONTRACTOR shall be held responsible to make all changes required to conform to the above ordinances, laws, rules, and/or regulations without extra expense to the OWNER, except in the instance of ordinances, laws, rules, and/or regulations which are revised or enacted subsequent to the time of signing the Contract.

### 1.03 Submittals

- A. Schedule
1. The CONTRACTOR shall submit a schedule in accordance with Section 01 3300, Submittal Procedures, for review to the ENGINEER outlining the steps to be taken to maintain electrical service and showing the coordination effort which will be taken to coordinate the work between the various trades.
- B. Samples
1. When directed by the ENGINEER or required by the Specifications, the CONTRACTOR shall submit samples of materials and accessory equipment such as lighting fixtures, switches, receptacles, etc.
  2. The CONTRACTOR shall not use these materials in the Work until the ENGINEER has had ample time to determine the products suitability and compliance with the Specifications. In general, two weeks shall be considered ample time to approve or reject the submitted sample.
- C. Shop Drawings and Product Data
1. Submit shop drawings and product data as required in Section 01 3300, Submittal Procedures. The CONTRACTOR shall submit the following types of information for approval by the ENGINEER before any equipment is installed.
    - a. Catalog Cuts and/or Product Data Sheets - Catalog cuts shall be provided for standard manufactured items such as conduit and conduit fittings, electric heaters, lighting fixtures, lighting panels, instruments, motors, switches, transformers, wire, etc. Each sheet shall identify the exact equipment for

which it is intended. All pertinent information such as physical dimensions, current rating, horsepower, kilowatt rating, phase, power factor, voltage, NEMA classifications, and material type shall be indicated. Also shown shall be approved listings such as UL label or other testing agencies.

2. Vendors Standard Drawings - 24" x 36" drawings are preferred, however, where a manufacturer's standard equipment is being used, his "full size" standard drawings may be submitted for approval provided the following information is included on the drawings:
  - a. Identity of equipment for which drawing is intended.
  - b. Optional features to be used for this Project identified.
  - c. Field connections clearly identified complete with necessary terminal and wire numbers.
  - d. Sequence of operation shall be written on the drawing unless the control diagram is easily understood without a sequence of operation.
3. Note: Sequence of operation will be required if determined necessary by the ENGINEER.

D. Process Control Drawings

1. The CONTRACTOR shall submit wiring diagrams of each piece of equipment, termination cabinet, starter, switch, relay, indicator, controller, recorder, annunciator, telemetering equipment, etc.
2. All drawings shall be 24" x 36", reproducible media, with border, title block, symbols, etc., as used on the Contract drawings and approved by the ENGINEER. Ladder diagrams and wiring diagrams shall conform to JIC format and include line numbers, item numbers, source of power, terminal numbers, wire numbers, etc. Wire numbers and item numbers shall be assigned using the line numbers on the ladder diagrams.
3. Where applicable, and if the CONTRACTOR desires, he may purchase reproducible media or electronic files (when approved by the ENGINEER) of the process control drawings from the ENGINEER, modify these drawings as required, and utilize them as shop drawings.
4. Note: bond copies will be acceptable for the approval issue only.

E. Test Reports

1. When directed, the CONTRACTOR shall submit the manufacturer's test reports on any equipment proposed for this Project.
2. The CONTRACTOR will maintain a complete set of test records covering all tests required by this Specification. The records will include the date, equipment or system tested, testing conditions, test results, and CONTRACTOR verification. The records will be available for review during construction and will be submitted to the ENGINEER upon completion of the Project.

F. Certificates

1. The CONTRACTOR, upon completion of his portion of the Project, shall secure and present to the ENGINEER a certificate of inspection and approval from the department having jurisdiction over his work, if such be issued. The CONTRACTOR shall pay all fees in connection with the above requirements.

G. Operation and Maintenance Data

1. Provide maintenance manuals as required in 01 3300, Submittal Procedures, for the mechanical bar screen, the washer-compactor, and the main control/instrumentation panels.

H. Record Drawings

1. It shall be the responsibility of the CONTRACTOR to provide all drawings pertaining to his Work. All drawings including both manufacturer's drawings and engineer design drawings shall be on reproducible media as approved by the ENGINEER. Electronic record drawings will be acceptable when approved by the ENGINEER.
2. The drawing set shall include site plan and floor plans of each elevation showing the location of all equipment, lighting fixtures, embedded conduit, grounding, conduit size, conduit routing, wire size, etc. Schematic ladder diagrams for each piece of equipment and system using JIC format. Wiring diagrams of each piece of equipment, termination cabinet, starter, switch, relay, indicator, controller, recorder, annunciator, telemetering equipment, etc. The CONTRACTOR shall accurately maintain the set of drawings and submit prints at various stages of the Work, upon request of the ENGINEER. The final revised record drawings shall be turned over to the ENGINEER upon completion or termination of CONTRACTOR's responsibility to this Contract. The CONTRACTOR shall purchase mylars of the design drawings from the ENGINEER.

**1.04 Delivery, Storage, and Handling**

A. Storage

1. All electrical equipment and materials shall be stored in a location and manner to protect against damage.

B. Delivery and Handling

1. Materials and equipment shall be delivered, unloaded, and handled in a manner to protect against damage. The CONTRACTOR shall repair or replace all damaged or defective material at the ENGINEER's option and at no cost to the OWNER or the ENGINEER.

**1.05 Job Conditions**

A. Existing Conditions

1. The CONTRACTOR shall be responsible for determining the existing conditions at the time the electrical work begins and arrange for surveys, trenching, concrete work, conduit sleeves, and any other work necessary to perform the electrical installation.

B. Environmental Requirements

1. The CONTRACTOR shall exercise caution during installation and afterward to assure all equipment is protected from adverse environmental conditions such as temperature, wind velocity, humidity, rain, ice, etc.

C. Protection of Work and Property

1. All materials and equipment both before and after erection shall be properly protected and kept in a clean condition.
2. All conduit ends and parts of equipment left unconnected shall be capped, plugged or properly covered to prevent the intrusion of foreign matter.
3. The use of tarpaulins or plastic sheets for temporary enclosures, protection of materials, etc., will not be permitted in areas where burning and/or welding

operations are going on or in any location where there may be the slightest hazard of their use contributing to a fire.

4. Any equipment which has been installed and later becomes damaged shall be replaced or repaired at the ENGINEER's option at the CONTRACTOR's expense.

D. Sequencing

1. The CONTRACTOR shall so schedule his Work to assure that he does not delay the work of any other trades. He shall also supply sleeves, supports, anchors, hangers, and other items that are to be included in the work of other trades and provide information for positioning.

## Part 2 Products

### 2.01 Materials

- A. All material and equipment furnished and installed by the CONTRACTOR for the permanent Work shall be new, unused, of the best quality of make specified, shall be free from defects of any character, and shall be listed as approved by the UL and/or FM.
- B. Equipment with aluminum buses, aluminum conduits, fittings, supports and conductors are not acceptable.
- C. Outdoor electrical equipment shall be weatherproof, NEMA 4X (stainless steel), unless otherwise indicated.
- D. Unless otherwise specified in other Division 26 sections, the sheet metal surfaces of equipment enclosures shall be coated with a rust resisting primer.
- E. Over the primer, a corrosion resistant baked enamel finish shall be applied. The color shall be ASA No. 49, medium light gray.

## Part 3 Execution

### 3.01 General

- A. The CONTRACTOR shall install electrical work in accordance with the codes and standards specified, except where more stringent requirements are indicated or specified, verify that materials and equipment properly fit the installation space with clearances conforming to the codes and standards specified except where greater clearance is indicated. Perform work as required to correct improper installations, at no additional cost to the OWNER.

### 3.02 Electrical Supervision

- A. In addition to supervision required under the General Conditions, the CONTRACTOR shall assign a competent representative to supervise the electrical construction work from beginning to completion and final acceptance.

### 3.03 Inspection

- A. The CONTRACTOR shall inspect each item of material and equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for installation of electrical work.

### 3.04 Preparation

- A. Prior to installing electrical work, the CONTRACTOR shall ensure that installation areas are clean, shall maintain the areas in a broom-clean condition during installation operations, shall clean, condition, and service equipment in accordance with the manufacturer's instructions, approved submittals, and other requirements indicated or specified.

### 3.05 Workmanship

- A. The CONTRACTOR shall employ skilled craftsmen experienced in installation of the types of electrical materials and equipment specified. The CONTRACTOR shall use specialized installation tools and equipment as applicable and produce installations free of defects.

### 3.06 Field Quality Control

#### A. Equipment Start-Up

1. After completion of the installation, all systems and equipment shall be tested by the CONTRACTOR in the presence of the ENGINEER under actual operating conditions. Tests shall be performed according to manufacturer's recommendations.
2. The CONTRACTOR shall include with his bid the services of all required Equipment Manufacturer's field service technicians for a period necessary to complete the work to the satisfaction of the ENGINEER and OWNER.
3. This service shall be for the purposes of check-out, initial start-up, certification, and instruction of plant personnel.
4. A written report covering the technician's findings and installation approval shall be submitted to the ENGINEER covering all inspections and outlining in detail any deficiencies noted.
5. Specific requirements, if any for a particular system or piece of equipment are contained in the particular specification sections. The CONTRACTOR's responsibility relative to coordinating these services is contained in Section 01 7700, Closeout Procedures.

#### B. Manufacturer's Supervision and Field Installation Check

1. Where specified, electrical equipment manufacturer shall furnish the services of an authorized representative especially trained and experienced in the installation of his equipment to 1) supervise the equipment installation in accordance with the approved submittals and manufacturer's instructions; 2) be present when the equipment is first put into operation; 3) inspect, check, adjust as necessary, and approve the installation; 4) repeat the inspection, checking, and adjusting until all trouble or defects are corrected and the equipment installation and operation are acceptable; and, 5) prepare and submit the specified Manufacturers' Certified report. Include all costs for representative's services in the contract price.

#### C. Final Operation Tests

1. The CONTRACTOR shall test all electrical systems for not less than 168 hours, with no interruptions except for normal maintenance or corrective work. Conform to the approved test plan. Coordinate with final operation test required under Section 40 0500, Process Equipment General Requirements.
  - a. Testing Materials - The CONTRACTOR shall furnish labor, instruments, recorders, gages, materials, and power for tests as required.
  - b. Testing Methods - The CONTRACTOR shall operate systems continuously 24 hours a day under constant inspection of trained operators. Cause variable

speed equipment to cycle through the applicable speed range at a steady rate or change. Induce simulated alarm and distressed operating conditions, and test controls and protective devices for correct operation.

End of Section

Not To Be Used For Bidding Purposes

## Section 26 0510 Basic Materials and Methods

### Part 1 General

#### 1.01 Description

- A. Requirements specified in Section 26 0500, Electrical General Requirements, are part of this Section. This section forms a part of all other sections of Division 26, unless otherwise indicated.
- B. Related Work Specified Elsewhere
  - 1. Cast-in-Place Concrete: Section 03 3000
  - 2. Electrical General Requirements: Section 26 0500

#### 1.02 Submittals

- A. The CONTRACTOR shall submit for the ENGINEER's approval material lists, shop drawings, and factory test reports, to the extent required in this section and Section 26 0500, Electrical General Requirements.

### Part 2 Products

#### 2.01 Basic Equipment and Materials

- A. Service
  - 1. Power distribution is 480 volt, 3 phase, 3 wire plus ground wire.
  - 2. Motors 1/2 HP and larger shall be 3 phase 3 wire plus grounding conductor: motors under 1/4 HP shall be 208 or 120 volt single phase (2 wire plus ground wire) either single pole or capacitor starting only.
- B. Disconnect Switches
  - 1. Provide heavy-duty rated disconnect switches of the types and ratings, as indicated on the Plans. Disconnect switches shall be NEMA 7 hazardous locations, 3-pole, and rated for 600 VAC minimum. All disconnect switches shall be provided with a pad-lockable operating handle. Disconnect switches shall be manufactured by Square D, Allen Bradley, General Electric, or Eaton Cutler-Hammer.
- C. Wire Size and Insulation (low voltage)
  - 1. Wire for all branch circuits, including power and lighting shall consist of No. 12 minimum size copper conductors, type XHHW-2 or THWN-2, insulated with Underwriters' approved 600 volt insulation, and in accordance with the following:
  - 2. All rubber and rubber-like insulated wire and cable shall be manufactured and tested in accordance with ICEA Publication No. S-19-81 (latest edition), NEMA Publication No. WC3.

3. All thermoplastic insulated wire and cable shall be manufactured and tested in accordance with ICEA Publication No. S-61-402 (latest edition), NEMA Publication WC5.
4. All cross-linked polyethylene insulated wire and cable shall be manufactured and tested in accordance with ICEA Publication No. S-66-524 (latest edition), NEMA Publication No. WC7.
5. Indoor lighting branch circuits and 120 volt receptacle circuits shall be single conductor solid copper, 600 volt insulation, Type THWN-2 moisture and heat resistant thermoplastic approved by N.E.C. for operating temperature of 75°C and for installation in wet or dry locations.
6. Type "XHHW-2" heat resistant wire shall be used for wiring of recessed fixtures, and between fixtures and their adjacent outlets.
7. For 480 volt standard service, single conductor stranded copper cable shall have corona, ozone, heat and moisture resistant cross-linked polyethylene 600 volt insulation, or approved equal, rated to withstand a copper temperature of 90° C. without deterioration. It shall meet applicable ICEA Standards, and be UL labeled XHHW-2.
8. All wire and cable, including feeders, main and branch circuits, shall be color coded as follows:

<u>208/120 Volt</u>		<u>480/277 Volt</u>	
<u>Color</u>	<u>Phase</u>	<u>Color</u>	<u>Phase</u>
Black	A	Brown	A
Red	B	Orange	B
Blue	C	Yellow	C
White	Neutral	Gray	Neutral
Green	Ground	Green	Ground

9. Conductors No. 8 and smaller shall have color coded insulation, Conductors No. 6 and larger shall have terminations and conductors in pull boxes taped with colored tape, not less than two inches wide.
10. All wire and cable shall be continuous in the same color code and type to its extreme termination point. The use of different type of insulated wire to the same device or equipment will not be accepted. Manufacturers shall be Anaconda, General Cable, General Electric, Okonite, Triangle, or equal.

D. Control Wiring

1. Control circuit, single conductor field wire shall be No. 14 AWG, stranded copper with 30-mil thick wall of cross-linked polyethylene or polyvinyl chloride insulation rated to withstand a copper temperature of 90°C at 600 volts without deterioration. It shall meet applicable ICEA Standards.
2. Multi-conductor control cable shall consist of individual conductors, No. 14 AWG, stranded copper with 30-mil thick wall of insulation rated to withstand a copper temperature of 75° without deterioration. The insulation shall be a 20-mil wall of polyethylene with a 10-mil thick polyvinyl chloride jacket. The individual conductors shall be identified per Paragraph 5.6.3. of ICEA Publication No. S-61402 and shall be cabled together with suitable fillers and binder tape to give the completed cable a substantially circular cross section.
3. An overall sheath of black polyvinyl chloride shall be applied to the cable and shall not be less than the following thickness:



<u>No. of Conductors</u>	<u>Jacket Thickness</u>
2 - 5	.045"
6 - 14	.060"
15 and above	.080"

4. The entire cable shall meet applicable ICEA Standards and tests for thermoplastic insulated cables.
5. All control wires to be identified with vinyl wire markers.

E. Panel Wiring

1. Panel wiring shall be a minimum 14 AWG-MTW, 60° rated for AC connections. Thermoplastic wire cover shall be rated at 600 volts and be colored red for AC wires; light blue shall be used for DC wires; canary yellow shall be used for wires interconnecting with other control panels or systems which may be energized from alternate power source; green shall be used on all ground wire connections; black wire shall be used for power source and white shall be used for power neutral.
2. All instrument shields shall be connected to a common ground termination in the control panel. Shields shall not be grounded in the field.
3. No splices of either control or instrument wiring shall be permitted outside of termination points.
4. All wires comprising the various control systems for this installation shall be identified at each termination with wire identification tags.
5. Numbered tags shall be of the type manufactured of laminated mylar and be capable of withstanding temperatures to 300° F. without deterioration and discoloration.
6. Each wire number shall be "solid" preprinted and not pieced from single and/or double-digit tags.

F. Shielded Single Pair Cable

1. For general shielded service, single-pair cables shall consist of two conductors, twisted together, served with a continuous aluminum mylar shield with grounding bleed wire and protected with an insulating jacket.
2. Individual conductors shall consist of a tinned, soft annealed copper conductor, stranded, insulated with a 24-mil thick wall of polyethylene. The twisted pair shall be color coded and sized as follows:

Runs under 400 feet	No. 16 AWG
Over 400 feet	No. 14 AWG

G. Multiple Conductor Shielded Cable

1. This cable construction shall be an assembly of twisted pairs cabled together and served with an overall aluminum mylar shield with grounding bleed wire, with an extruded jacket of polyvinyl chloride having a thickness as follows:

<u>Cable Size</u>	<u>Jacket</u>
3 and 7 pair	60 mils

2. Portable cords shall consist of flexible, bunch stranded, plain annealed copper conductors with a 600 volt heat and moisture resistant rubber insulation suitable for operation with a 60° C. copper temperature. Individual conductors shall be color

coded for identification and cabled with suitable high strength fillers to give the completed cable a circular cross section.

#### H. Conduits and Fittings

1. Conduits shall be manufactured in conformance with the latest published standards of ANSI, ASTM, and UL and shall be as follows:
2. All exposed interior and exterior conduits shall be rigid aluminum. Couplings and connectors shall be threaded type. All conduits buried in earth shall be Schedule 40 PVC.
3. Conduit terminations shall consist of double locknuts and insulated bushing, raintight connectors, or threaded hubs as applicable to maintain the rating of the enclosure to which it is being terminated.
4. All joints in conduits shall be made with standard couplings unless neither conduit can be turned; then, union shall be made with O.Z. Type "SP" split coupling or Erickson couplings. Running threads are not permitted.
5. Conduit expansion fittings shall be O.Z. Type "DX" with bonding jumper, as required.
6. PVC conduit material shall have tensile strength of 7,000 psi at 73.4° F, flexural strength of 11,000 psi, and compressive strength of 8,600 psi.
7. PVC conduit fittings and covers shall be of the same manufacturer as the PVC conduit.
8. Flexible liquid tight conduit shall be provided for connections to vibrating or rotating equipment. Conduit shall be UL listed for use in Class I Division 1 hazardous locations. Killark ECF-212, or equal with Appleton STN series fittings or equal, as required.
9. Flexible steel conduit similar to "Greenfield" shall not be permitted.
10. Provide conduit seal fittings UL listed for use in Class I Division 1 hazardous locations. Appleton, Crouse Hinds or equal.

#### I. Pull Boxes

1. Pull boxes, junction boxes, and cable support boxes of proper size and design shall be provided in accordance with the N.E.C. and as required to facilitate installation of wires. All boxes shall be sized in accordance with the N.E.C. Covers shall be gasketed and held in place with corrosion resistant machine screws. Cable supports for vertical runs shall be provided at code required locations, within pull or junction boxes. Boxes shall be NEMA 12 for inside and NEMA 4 316 stainless steel for outside use where exposed to the weather or where otherwise called for on the drawings.
2. Pull boxes located in "hazardous areas" shall be in strict accordance with National Electric Code requirements for the type of area classification and as identified on the drawings.

#### J. Outlet Boxes

1. Cast steel outlet boxes shall be used for every outlet and switch where called for on the drawings and as herein specified. All cast boxes shall meet the requirements for galvanized finish specified for steel conduits.
2. All outlet boxes for exposed work shall be of cast steel construction with threaded openings Type "FS" or "FD" unless noted otherwise.
3. Provide temporary caps on boxes similar to Gedney, "Red Caps" during construction.

#### K. Caution Tags

1. Each panel receiving power from a separate source which is not disconnected by the primary disconnect means shall have a laminated orange tag 3" wide x 1-1/2" high with 1/4-inch high white lettering reading:

"CAUTION SEPARATE VOLTAGE SOURCE"

L. Nameplates

1. Safety switches, lighting panels, starter enclosures, panelboards, etc., nameplates shall be of laminated white plastic with black lettering and shall be attached with sheet metal screws. Nameplates size shall be 2 1/2" wide x 3/4" high. First line character size 1/4-inch high, second line 3/16-inch high. For panel designations, refer to electrical panel schedule on drawings. All panelboards shall contain a typed circuit schedule inside of cover.
2. Field located instruments and devices shall be equipped and identified with 1" x 3" engraved nameplates (similar to the panelboard nameplates) and affixed to their respective devices in a positive but flexible method (wire strap or other similar means).

**2.02 Mixes**

- A. Patches, conduit sealing compound, fire stop compounds, etc., shall be mixed in accordance with the manufacturer's recommendations.

**2.03 Fabrication and Manufacture**

- A. The CONTRACTOR shall, to the degree possible, preassemble switchgear, panel boards, motor control centers, control panels, relay panels, etc. This preassembly should be done off site in a clean shop environment by the CONTRACTOR or manufacturer.
- B. Control panels, motor control centers, and switchgear shall be fabricated in sections not exceeding 10 feet in length, and provided with jumpers for field connections of bus and interconnecting wiring. Panels shall be provided with adequate lifting eyes.

**2.04 Equipment**

- A. All electrical devices furnished under this Contract will be of the most recent manufacture and received at the job site in the manufacturer's shipping container which clearly identifies the item. Only new electrical equipment will be acceptable. Used, rebuilt, or discontinued models will not be accepted for installation under this Contract.

**2.05 Acceptable Manufacturers**

- A. Only manufacturers recognized as producing new, top quality products meeting applicable standards will be considered acceptable.
- B. The ENGINEER may require the CONTRACTOR to furnish acceptable material from other sources of supply, if he finds the Work will be delayed or adversely affected in any way because the stated source of supply cannot furnish a satisfactory product in sufficient quantities or if it is known to be unsuitable for the purpose for which it is proposed to be used. The CONTRACTOR shall have no claim for additional compensation because of such requirement.

## Part 3 Execution

### 3.01 Contractor's Verification

- A. General - All dimensions which tie mechanical and/or electrical installations to the building structure shall be thoroughly field checked for accuracy and possibility of interference due to field conditions. Ignorance of such field conditions because of the CONTRACTOR's failure to field check the dimensions in question will be no excuse for additional compensation.
- B. Locations - All equipment rough-ins shall be field located except as otherwise shown on the drawings.
- C. Points of Termination - The points of connection and termination of related work under this Division of this Project are indicated on the Plans or stated in the Specifications, but in case of doubt as to such points of connection or termination, the decision of the ENGINEER shall be final.

### 3.02 Preparation

- A. All conduit, fittings, and accessories shall be free of foreign matter. All conduit ends shall be reamed and deburred to prevent damage to the wire and cable.

### 3.03 Installation

- A. General Requirements
  - 1. Electrical system layouts indicated on the Plans are generally diagrammatic and locations of outlets and equipment are approximate. Exact routing of conduits and wiring, locations of outlets and equipment shall be governed by structural conditions and obstructions. Equipment requiring maintenance shall be located and installed so that it shall be readily accessible.
  - 2. The CONTRACTOR shall not burn, cut or drill structural steel for the installation of conduit in any manner except where written permission is granted by the ENGINEER
  - 3. All wiring shall be installed in raceway, including low voltage work, except where otherwise shown or specified.
  - 4. Minimum conduit size shall be 3/4-inch unless noted otherwise.
  - 5. Conduit shall be installed to be concealed wherever possible, unless otherwise indicated. In unfinished mechanical equipment rooms where the exact location of ventilation ducts, etc., is not shown, install the conduit exposed and avoid interferences.
  - 6. Conduits shall be separated by at least 12 inches from parallel runs of steam or hot water piping.
  - 7. Rigid aluminum conduit shall be used for exposed service drops in mechanical equipment and process area rooms, in exposed outdoor areas, except where another type of raceway is specified. Locknuts shall be steel or malleable iron (as size requires).
  - 8. Conduit runs in floor slabs and direct buried underground between structures shall be rigid steel. All stub ups shall be rigid aluminum.
  - 9. Where PVC conduit is permitted as noted on drawings, underground PVC conduit runs shall be installed on approved plastic spacers and encased in a 3-inch Granular Material envelope with red-oxide pigmented concrete over top. Envelopes shall have

- a yellow colored, plastic, detectable caution tape buried a minimum of 12-inches above the conduit. Caution tape shall be labeled "Caution – Buried Electrical Lines".
10. Connections to vibrating or rotating equipment shall be made with flexible liquid tight conduit.
  11. Provide expansion fittings at all expansion joints and/or where required to compensate for expansion and contraction in long conduit runs. Connectors shall be compatible with flexible conduit used.
  12. All conduits shall be installed in floors and walls, wherever possible, unless otherwise indicated on the Plans or specified herein.
  13. Conduits in process areas shall be rigid aluminum and may be run exposed.
  14. All empty feeder and riser conduits shall contain one No. 10 AWG galvanized steel pull wire. Splicing of the pull wire will not be permitted.
  15. Conduit joints shall be set up tight. Runs shall be straight and true. Elbows, offsets, and bends shall be uniform and symmetrical.
  16. Multiple conduit runs exposed shall be mounted with rustproofed steel supports arranged so that each conduit is individually clamped or bolted.
  17. Concealed conduits or outlets installed flush in masonry or concrete construction shall be rigidly braced against movement during the construction period to ensure accurate termination points.
  18. Conduits hidden by suspended ceilings may be run exposed between ceiling construction and structural slab. All conduits, where exposed in service rooms, mechanical equipment rooms, etc., and other work areas, shall be racked in neat symmetrical lines with proper supports. Conduits shall be run at right angles and parallel to floors, ceilings, and walls.
  19. Underground conduit shall be tested to determine that all fittings are completely sealed. The tests shall be performed during and after installation of conduit, but before cable is pulled and before any conduit is encased in concrete.
  20. All 90° bends 1-1/4 inches and larger shall be made with factory elbows. Elbows of 3-inch conduit size and larger shall be long radius. Field bends shall be made so that the conduit will not be injured and the internal diameter shall not be effectively reduced. Factory elbows, nipples, and couplings shall be the same type as the conduit with which they are used.

#### B. Conduit Supports

1. Conduit supports shall be suitably spaced and secured so as to provide adequate mechanical support and shall meet the code requirements. Supports shall be of steel bar, unistrut, angle or channel and of a size to provide a firm, rigid support. Fabricated supports and mounting brackets shall be hot dip galvanized after fabrication and drilling is complete. Rod hangers may be used when laterally braced. Structural steel flanges of I beams or channels shall not be drilled. Prefabricated sections may be used with approval of the ENGINEER.
2. All electrical equipment including raceways, outlet boxes, panels, fixtures, etc., shall be substantially secured to the building structure. Inserts or insert bolts for support of the electrical equipment shall be installed during the building construction wherever practical.
3. Exposed multiple horizontal and vertical parallel runs of conduit shall consist of galvanized steel framing channels, conduit clamps, and rod hangers, where required, installed in accordance with the manufacturer's recommendation for the carried loads.
4. Where exposed isolated conduit needs clamping to flat surfaces, clamps shall consist of galvanized malleable iron, one-hole pipe straps for conduit up to and including 1-1/2 inches. Straps for conduits above 1-1/2 inches shall be two-hole, extra heavy steel. Steel bolts of appropriate size to fill the holes of the straps shall be used.
5. Conduit shall be supported in accordance with N.E.C.

C. Conduit Fittings

1. Conduit fittings shall be made of a compatible material as the conduit. All conduit fittings with blank covers shall have rubber gaskets except in clean, dry areas and shall be accessible after the Work is completed.

D. Sleeves and Inserts

1. The CONTRACTOR shall provide all openings and sleeves on walls and floors as required for his work. Inserts shall be the tapered nut type with lead alloy expansive retainer sleeve. The use of wooden plugs will not be permitted.

E. Taps and Splices

1. Splices and taps shall be made by means of screw type pressure connectors. Spring pressure type connectors may be used for No. 10 AWG conductors and smaller. Instrument pigtail splices shall be made with solderless crimp type connectors.
2. All connections for No. 8 wire and larger to switches, panels, and controllers shall be made with solderless lugs of proper style and size to handle full wire capacity.
3. Stranded cable terminations shall be equipped with solderless lugs.
4. No splices outside of enclosures will be allowed. No splices except for lighting fixture and instrument pigtail connections shall be permitted unless specifically indicated on the Plans or written approval is given by the ENGINEER.
5. All joints not supported and enclosed on terminal strips or equipment lugs shall be insulated with high-quality tape or material in an approved manner.

F. Wiring

1. All wiring for power, lighting, and low voltage control shall be run in one of the types of conduit described in these Specifications, unless indicated otherwise on the Plans.
2. Multi-wire branch circuits shall be color coded as stipulated in the National Electrical Code, and as herein specified.
3. Circuits feeding duplicate processing equipment shall be installed in separate conduits.
4. All instrumentation cable shall be run in conduits so as to isolate the cable from power or electrical wiring.
5. Cable insulation shall not be cut back beyond what is reasonably required to make connection, splice, or termination.
6. All wires and cables shall be tagged at both ends and in pull boxes or panel box gutters they pass through.
7. No conductors shall be pulled into any conduit run before all joints are made up tightly and the entire run rigidly secured in place.
8. Approved pulling-in compounds shall be permitted for ease of pulling cables. Pulling of cables shall in no way cause injury to conductors by elongation or to insulation by abrasion, binding, etc. Damaged cable shall be replaced.

G. Vibration and Shock Mounts

1. Each floor-mounted transformer shall be placed on vibration/shock pads of proper type and size to reduce sound transmission. Further, make primary and secondary connections with flexible conduit.

H. Foundations

1. The electrical subcontractor shall arrange with the CONTRACTOR to provide concrete pad foundations for all floor-mounted equipment installed under this Division. Pad shall be four inches high, unless noted otherwise.

I. Access Panels

1. Access panels or hatches shall be provided wherever electrical equipment concealed by the building construction requires access for inspection, operation, or maintenance. CONTRACTOR shall furnish all such panels required for access to his work. The CONTRACTOR shall install all panels.
2. A subcontractor requiring access panels shall confer with the CONTRACTOR in regard to access panel locations and shall, wherever practicable, group equipment requiring access such that a single panel will serve all and eliminate additional panels.

J. Grounding - The CONTRACTOR is responsible for providing all grounding, whether or not shown on the Plans, and all grounding shall be provided in accordance with NEC and local codes and ordinances. Grounding as shown on the plans is the minimum acceptable. Electrical grounding shall be grouped into two (2) classifications as follows: system grounding and equipment grounding.

1. System

- a. The neutral of the substation transformer, and all dry type transformers shall be effectively and solidly grounded to continuous and interconnected ground mats. All grounding electrode conductors shall be sized in accordance with the N.E.C. No splicing will be allowed in any of the grounding electrode conductors.
- b. Use of the metallic conduit or fittings or piping as a grounding path shall not be acceptable.

2. Equipment

- a. All metal or conducting type enclosure frames, raceways, cable trays, conduit, panelboards, substation, motor frames, switches, switch boxes, outlet boxes, junction boxes, lighting fixture frames, building steel, metal siding, rebar, piping, etc., shall be grounded by a green colored or bare equipment grounding conductor of size called for in tables of the most recent applicable N.E.C. edition.
- b. When a separate equipment grounding conductor is used, it must be contained within the same raceway or cable with the circuit conductors.
- c. Grounding rods, hereinafter referred to as ground rods, shall be solid cylindrical rods, 3/4-inch in diameter and 10 feet in length, or longer, as required to reach specified resistance. Rods shall be of copper-clad steel tinned at top end for connection.
- d. Resistance from the building ground loop to earth before connection to the building steel and the water system shall not exceed 2 ohms.
- e. Bare copper bar, cables, or fittings used for grounding shall not be installed in cinder fill or covered with soil containing cinders or other corrosive materials. Cables shall be installed with enough slack to prevent stresses.
- f. Where ground conductors pass through floor slabs, building walls, etc., and are not encased in rigid metal conduit as specified elsewhere, shall be provided with sleeves of transit, plastic, fiber or other approved nonmetallic material, and of the required size, shape, and length unless otherwise specified or indicated on the Plans.
- g. All bonding jumpers shall be copper and of a cross-sectional area at least equal to their corresponding grounding conductors. Where attached to

equipment, conduits, cabinets, etc., suitable approved solderless lugs, compression connectors or clamps shall be used. No soldered connections shall be used on grounding circuits at any point, except where ground conductors are attached to lead cable sheaths.

- h. All grounding mediums shall be bonded together. This shall include electric, telephone, antenna systems, ground and underground piping systems which enter the structure.
- i. All compression connectors, lugs, etc., used in grounding circuits in any location shall have bolts, nuts, etc., of silicone bronze alloy metal. Ground connections, clamps, etc., shall be as manufactured by Burndy Engineering Company, Thomas & Betts Company, Penn-Union Electric Company, or equal.
- j. Voltage surge protectors shall be installed at every incoming power feeder at each respective distribution panel, device panel, motor control center, switchgear and all miscellaneous panels, indoors or outdoors. The voltage surge protectors shall be voltage rated and energy absorption rated to match the rating of the respective electrical equipment to be protected. For example: all switchgear and motor control center shall utilize MCG Corporation Model No. SPC-277Y, rated voltage 277/480 volts, 3 phase wye, energy absorption 18,000 joules total, 3,000 joules per leg with clamp voltage at 1 mA of 460 volts; or equal, i.e., Leviton Company, Current Technology Corporation or Polyphaser Corporation.
- k. Lesser amperage panels shall utilize either MCG Corporations SPB series or SPA series, matched to equipment, or equal as noted above. Every installation shall be in conformance to local and state of Michigan ordinances, statutes and guidelines as well as per "IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits," ANSI/IEEE C62.41.
- l. The minimum number, spacing, and location of ground rods to be driven shall be per the site soil conditions during dry weather. All connections to ground rods shall be below finished grade level and shall be connected by a "cadweld", or other thermal process.
- m. Use of the water system as the grounding electrode shall not be acceptable. However, the water system shall be grounded to the grounding system.
- n. Taps and splices in grounding cables shall be made by the "cadweld", or equal process.
- o. Conduits which run to boxes or cabinets having concentric or eccentric knockouts which partially perforate the metal around the conduit and impair the electrical connection to ground shall be provided with approved bonding jumpers. Jumpers shall consist of a stranded, braided copper wire at least No. 6 AWG with solderless lug on each end. Jumper shall be connected inside the box to a stud or silicone bronze alloy bolt in the cabinet frame.
- p. Conduit expansion joints and telescoping sections of metal raceways not thoroughly bonded otherwise shall be provided with approved bonding jumpers of not less than No. 6 AWG stranded bare copper.

#### k. Electrical Equipment Identification

1. All electrical devices shall be labeled in a clear and permanent manner to identify its electrical circuit.
2. Motor circuits shall have the functional description on motor starter panel and distribution panelboard doors, remote safety switches and manual switches.
3. All receptacles and wall switches shall be identified using the distribution panel "letter designation" and circuit breaker numerical assignment.
4. Motor starters, switch boards, and panelboards shall have laminated plastic identification nameplates attached to the unit with screws as specified herein. Other



electrical devices shall be identified using 1/4-inch plastic adhesive-backed embossed tape securely fastened to the face of the device.

L. Painting and Finishing

1. All concealed iron work, panel boxes, junction and pull boxes, and support boxes not galvanized shall be given one coat of rust resisting paint inside and out. In addition, junction boxes shall be given one coat of white enamel inside only.
2. Equipment which was finish painted by the manufacturer or fabricator shall remain as is unless paint has become marred or damaged during installation, in which case the equipment shall be repainted to its original condition by the CONTRACTOR.

**3.04 Field Quality Control**

A. Requirements of Regulatory Agencies

1. All materials and equipment required for the work and the installation shall conform to all national, state, and local codes, rules, regulations, and ordinances. The CONTRACTOR shall secure all permits, inspections, and tests required in connection with his portion of the Project.

B. Tests

1. After the installation of apparatus and wiring has been completed, all electrical conductors shall be tested by the CONTRACTOR to ensure continuity, phasing, proper splicing, freedom from unwanted grounds, and insulation values.
2. A 1,000 volt hand-driven megger shall be used on all 600 volt insulated service conductors and a 500 volt hand-driven megger may be used on all lower voltage insulated service conductors. Conductors shall be isolated from other equipment during test and each cable shall be tested until reaching a constant value for 15 seconds.
3. All megger and high potential tests of multiple conductor cables shall be applied between one conductor and ground with all other conductors connected to the same ground. Each conductor shall be tested in like manner.
4. All wiring not measuring up to minimum ICEA field testing standards shall be replaced.
5. Minimum acceptable reading is 100 megohms for 600 volt insulated service conductors and 1.0 megohms for lower voltage insulated services such as instrumentation cables.
6. All tests shall be made with lightning arrestors removed and disconnections made at points of final termination.
7. Motor rotation shall be checked with the motor disconnected mechanically from equipment to be driven, to prevent damage to the equipment. Motor rotation shall be as directed by the equipment manufacturer and shall be checked for accuracy in cooperation with the manufacturer.
8. Do not test the equipment unless it is sufficiently lubricated.
9. Tests on Grounding
  - a. Inspect ground conductors and connections for conformance with design specifications and for satisfactory workmanship. Test resistance to earth of each ground rod and each ground grid. Test ground paths for equipment and structural steel grounding.
  - b. Maintain each ground rod isolated from the associated ground grid for tests on individual rods for resistance to earth.

- c. Include associated ground rods and interconnecting wiring in tests on each grid system for resistance to earth.
- d. Include ground bus on equipment, grid connection, and associated intermediate copper ground conductors in tests on ground paths for electrical equipment.
- e. Include structural steel connection, grid connection and intermediate conductor in tests on ground paths for structural steel.
- f. Test each ground rod for resistance to earth by a standard method. Use a Biddle ground tester or the method of using two auxiliary ground rods as described in IEEE Standard No. 550, paragraph 3.42. The IEEE method requires the use of AC test current. Place auxiliary test rods sufficiently far away from the rod under test so that the regions in which their resistance is localized do not overlap. Calculate ground resistance from the readings taken. Maximum acceptable resistance to earth at each ground rod: 25 ohms.
- g. If the resistance is found to be higher than 25 ohms, drive additional rods with a minimum separation of 10 feet and connect in parallel with the rod under test until 25 ohms or less is obtained, or increase the length of the rod under test until 25 ohms maximum is obtained.
- h. Test each isolated ground grid as specified for individual ground rods, except the maximum acceptable resistance to earth is five ohms. In tests on total ground systems, the maximum acceptable resistance to earth is two ohms.
- i. Test ground paths for electrical equipment and structural steel for continuity by applying a low voltage DC source of current, capable of furnishing up to 100 amperes. The ground path for electrical equipment using structural steel must conduct 100 amperes. Resistance as calculated from the current and voltage must not exceed 0.010 ohms.
- j. Grounding materials and connections must pass all inspections and must meet all specified maximum and minimum values.
- k. Make complete records of all tests. Include resistance values obtained, calculations of same, and methods of test and calculation.
- l. Notice of tests to be performed shall be sent to the ENGINEER and OWNER before tests are made.
- m. Duplicate certified records of all insulation tests shall be furnished to the ENGINEER.

### **3.05 Adjustment and Cleaning**

#### **A. Adjustments**

1. The CONTRACTOR shall be responsible for making any equipment and instrument adjustments necessary to provide a complete and safe working system under normal operating conditions. The equipment to be adjusted shall include, but not limited to, ground fault circuit interrupters, circuit breaker trip settings, motor starter overload settings, thermostats, pressure switches, level switches, limit switches, control instruments, etc. The CONTRACTOR shall provide a coordination study of the electrical system.

#### **B. Manufacturer's Services**

1. The services of a factory trained, qualified service representative of the equipment manufacturer shall be provided by the CONTRACTOR to inspect the complete equipment installation to ensure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system in trouble-free operation, and instruct the operating personnel in the proper

care and operation of the equipment furnished. This will be required for the main switch gear/motor control center, main control panel including all instrumentation and any other major equipment.

C. Cleaning and Finishing

1. Before turning the systems over to the OWNER, clean all fixtures, equipment, exposed metal surfaces, and leave all in clean condition at the end of the Work as specified elsewhere in the Contract Documents.

D. Final Inspection

1. Upon completion of the Work, the CONTRACTOR shall conduct a complete inspection of all items of Work and make whatever corrections and adjustments are deemed necessary to a well functioning system that will meet with the satisfaction of the ENGINEER and the OWNER.

End of Section

Not To Be Used For Bidding Purposes

## Section 31 2316 Structural Excavation and Backfill

### Part 1 General

#### 1.01 Scope

- A. This Section includes excavation for structures, removal and disposal of excavated materials, backfilling, backfill materials and compaction.

#### 1.02 Related Work Specified Elsewhere

- A. Temporary Erosion and Sediment Control: Section 01 5713
- B. Site Construction Performance Requirements: Section 01 8900
- C. Dewatering: Section 31 2319
- D. Seeding: Section 32 9219

#### 1.03 Reference Standards

- A. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:
  - 1. ASTM - ASTM International
  - 2. AASHTO - American Association of State Highway Transportation Officials
  - 3. PENNDOT - Pennsylvania Department of Transportation, Pub 408 Construction Specifications, latest edition.

#### 1.04 Submittals

- A. The testing laboratory shall provide the ENGINEER with two (2) certified copies of the test results of the compaction of the backfill. The testing for compaction and the certification of the test results shall be performed by a testing laboratory approved by the ENGINEER.

#### 1.05 Soil Erosion and Sedimentation Control

- A. The CONTRACTOR shall provide, maintain and remove such temporary and/or permanent soil erosion and sedimentation control measures as specified on the Plans or as determined by the ENGINEER. The measures shall prevent surface runoff from carrying excavated materials into the waterways, to reduce erosion of the slopes, and to prevent silting in of waterways downstream of the Work. Also, the measures should include provisions to reduce erosion by the wind of all areas stripped of vegetation, including material stockpiles.
- B. Comply with requirements of Section 01 5713, Temporary Erosion and Sediment Control.

## **Part 2 Products**

### **2.01 Granular Materials**

- A. Granular material gradation shall conform to the grading requirements for granular material, Classes I and II, as specified in current PennDOT Standards. The granular material shall be natural bank run sand.

### **2.02 Coarse Aggregate**

- A. The coarse aggregate gradation shall conform to coarse aggregate as specified in current PennDOT Standards.

## **Part 3 Execution**

### **3.01 Dewatering**

- A. The area within the vicinity of the new Work shall be dewatered in accordance with Section 31 2319, Dewatering prior to the excavation operation. The depth of the dewatering shall be sufficient to allow the excavation to remain in a dry condition during the construction of the structure, including the excavating, backfilling and compacting operations.

### **3.02 Sheeting, Shoring, and Bracing**

- A. The CONTRACTOR shall furnish, place and maintain at all times such sheeting, shoring, and bracing of the excavated area as may be required for safety of the workmen and for protection of the new Work or adjacent structures, including pavement, curbs, sidewalks, pipelines and conduits next to, or crossing the excavated area, and for the protection and safety of pedestrian and vehicular traffic.
- B. The CONTRACTOR shall be responsible for the complete design of all sheeting, shoring and bracing Work. The design shall be appropriate for the soil conditions, shall be of such strength, quality, dimension and spacing as to prevent caving or loss of ground or squeezing within the neat lines of the excavation, and shall effectively restrain movement of the adjacent soil. Prior to installing the sheeting, shoring or bracing, the CONTRACTOR shall submit Plans for this Work to the ENGINEER for informational purposes only.
- C. Sheeting, shoring, and bracing, and excavation shall conform to current federal or state regulations for safety.
- D. Where indicated on the Plans and where necessary in the Work, install and leave sheeting, shoring, and bracing in place. No extra compensation shall be paid to the CONTRACTOR for sheeting, shoring or bracing left in place unless otherwise indicated in the Proposal.
- E. Supports for pipes, conduits, etc., crossing the excavated area shall conform to the requirements of the owners of such facilities and if necessary, shall be left in place.
- F. The furnishing, placing, maintaining and removing of sheeting, shoring, and bracing materials shall be at the CONTRACTOR's expense unless otherwise indicated in the Proposal.
- G. The CONTRACTOR shall not remove the sheeting, shoring or bracing until the structure has obtained sufficient strength to support the external loads. The sheeting, shoring and bracing material shall not come in contact with the structure, but shall be installed so that no concentrated loads or horizontal thrusts are transmitted to the structure.

### 3.03 Excavation

- A. Excavation shall include the site clearing and grubbing, the excavating and disposing of all materials encountered, the supporting and protecting of all structures and/or utilities encountered above and below the ground surface, and the removal of water from the construction site. Excavation shall also include the removal of existing structures, as shown on the Plans or as determined by the ENGINEER.
- B. The CONTRACTOR shall keep the limits of his excavation operations within a reasonable close conformity with the location and grade, of each structure.
- C. The excavated materials shall be temporarily stored in a manner that will not cause damage to trees, shrubs, fences, improvements, utilities, private property or traffic. The excavated materials shall not be placed at such locations that will endanger the banks of the excavation by imposing loads thereon.
- D. The excavation shall be of sufficient size to allow for the construction of the new Work, the placing and compacting of the backfill and for the dewatering operation.
- E. When concrete is to bear on or against an excavated surface other than rock, special care shall be taken not to disturb the surface. The final removal of the foundation material to grade shall not be made until just prior to the placing of the concrete.
- F. Concrete shall not be placed until the depth of the excavation has been checked and the suitability of foundation material has been reviewed by the ENGINEER.
- G. Excavated material, determined by the ENGINEER as suitable for backfill may be used. All excess materials shall be disposed by the CONTRACTOR, at his expense, as specified in Section 01 8900, Site Construction Performance Requirements.
- H. The elevations for the bottom of footings shall be subject to such changes as are necessary to insure a satisfactory foundation. Any changes required shall be reviewed by the ENGINEER prior to making the change.
- I. The surface of all rock or other hard material upon which concrete is to be placed shall be free of all loose fragments, cleaned and cut to a firm surface. The surface shall be level, stepped or serrated, as shown on the Plans.
- J. All unsound material underlying proposed structures shall be removed and replaced with granular material approved by the ENGINEER, in layers not exceeding six (6) inches (150 mm) in depth. Each layer shall be compacted to 95% of maximum unit weight unless indicated otherwise on the Plans, or within these specifications.

### 3.04 Backfill

- A. Backfill material shall be placed only after the new Work and backfill material have been inspected by the ENGINEER.
- B. Backfill shall not be placed against any portion of the new Work until the required curing, surface finishing and waterproofing of such portions have been completed. Backfill which will place an unequalized horizontal loading on the new Work shall not be placed until the concrete has attained at least 70% of its design strength. To equalize horizontal loadings, the required backfill around the new Work shall be placed on opposite sides at the same time.
- C. Granular material shall be used for backfilling within three (3) feet (1 m) of all manholes, chambers, valve wells, valve boxes, other pipeline structures, footings, piers, abutments, columns, walls, foundations, etc., unless otherwise indicated in the Contract Documents.
- D. All spaces excavated and not occupied by the new Work or by the specified backfill material, shall be backfilled with suitable material from the excavation.

- E. After the backfill has been placed and compacted to the flow line elevation of any weep holes indicated on the Plans, the back end of each weep hole shall be covered with not less than two (2) cubic feet (0.5 m<sup>3</sup>) of coarse aggregate.
- F. Large stones, boulders, broken rocks, concrete, and masonry shall not be used in the backfill.
- G. The backfill shall be carried up to the surface of the adjacent ground or to the elevation of the proposed earth grade, and its top surface shall be neatly graded. Fills around all new Work shall be trimmed to the lines shown on the Plans or as directed by the ENGINEER.

### **3.05 Compacting Backfill**

- A. All backfill behind and around the new Work shall be placed in layers, not more than nine (9) inches in depth and shall be compacted to not less than 95% of the maximum unit weight.
- B. Areas where the density does not affect the construction, as determined by the ENGINEER, shall be compacted to not less than 90% of maximum unit weight.
- C. Backfill material shall be placed as specified in PennDOT, Section 206, except for the following modifications. The backfill material shall have a moisture content not greater than three (3) percent above optimum, at the time of compaction. If the material contains an excess of moisture, it shall be dried to the required moisture content before being installed.
- D. Each layer of material containing the required amount of moisture shall be compacted to not less than 95% of the maximum unit weight, unless otherwise specified on the Plans or authorized by the ENGINEER, before the succeeding layer is started.
- E. Compaction of the backfill will not be paid for separately but shall be considered incidental to the Work of backfilling and shall include all the Work of manipulating the soil to obtain the specified densities. No additional compensation will be allowed for any delay required to obtain the specified moisture content or the specified density.

### **3.06 Cleanup**

- A. Immediately following the placing and compacting of the backfill, the excess material shall be removed and disposed of by the CONTRACTOR, at his expense, as specified in Section 01 8900, Site Construction Performance Requirements.
- B. The construction area shall be graded and left in a neat, workmanlike condition.
- C. At a seasonally correct time, the disturbed area shall be raked, having topsoil placed thereon, fertilized and restored per the requirements of Section 32 9219, Seeding, or Section 32 9223, Sodding.

### **3.07 Testing**

- A. During the course of the Work, the ENGINEER may require testing for compaction or density of the backfill. The taking of samples and the testing required shall be performed by a testing laboratory approved by the ENGINEER. The cost for testing and sampling shall be at the expense of the OWNER.
- B. The testing laboratory shall furnish the ENGINEER with two (2) certified copies of the results of all tests. Testing procedures shall conform to current PENNDOT, Standards for Construction.
- C. The maximum unit weight, when used as a measure of compaction or density of soils, shall be understood to mean the maximum unit weight per cubic foot or per cubic meter as

determined by ASTM D1557, Method A, for granular materials, and Method D, for granular materials and all other soils.

**3.08 Defective Work**

- A. Any portion of the backfill which is deficient in the specified density shall be corrected by the methods meeting the approval of the ENGINEER. Any extra testing or sampling required because of apparent deficiencies shall be at the CONTRACTOR's expense.

End of Section

Not To Be Used For Bidding Purposes



## Section 31 2319 Dewatering

### Part 1 General

#### 1.01 Scope

- A. This Section includes all dewatering work complete with design of dewatering systems, construction and operation of dewatering systems, abandonment of dewatering systems, protection of personnel and structures, environmental protection and restoration.

#### 1.02 Related Work Specified Elsewhere

- A. Temporary Erosion and Sediment Control: Section 01 5713
- B. Site Construction Performance Requirements: Section 01 8900
- C. Structural Excavation and Backfill: Section 31 2316
- D. Cast-In-Place Concrete: Section 03 3000

#### 1.03 Design of Dewatering Construction

- A. Any Geotechnical Investigations made in relation to this Project are provided as reference documents. Interpretations of all data and reports, performing any additional investigations, and obtaining any additional data for construction purposes is the responsibility of the CONTRACTOR.
- B. The CONTRACTOR shall be responsible for the complete design of all structures and methods proposed for dewatering the project site, including the implementation of all materials, tools and equipment proposed for use in the Work. Temporary wiring associated with the dewatering shall comply with applicable portions of the National Electrical Code.
- C. Provide monitoring wells as necessary to determine the groundwater levels along the alignment and shaft locations.

#### 1.04 Soil Erosion and Sedimentation Control

- A. All dewatering systems design and construction shall conform to the provisions of the Erosion and Sediment Pollution Control Plan, the DEP Erosion and Sediment Pollution Control Program Manual, "Natural Resources and Environmental Protection Act" PA 451 of 1994; and Section 01 5713, Temporary Erosion and Sediment Control. Where applicable, the CONTRACTOR shall obtain and pay for all permits and inspections for dewatering construction in accordance with the provisions of all local government agencies having jurisdiction. No additional claim for compensation shall be allowed because of the CONTRACTOR's failure to obtain or pay for such permits and inspections.

- B. The CONTRACTOR, at his expense, shall provide, maintain and remove such temporary and/or permanent soil erosion and sedimentation control measures as specified on the Plans or as determined by the ENGINEER. The measures shall prevent surface runoff from carrying excavated materials into the waterways, to reduce erosion of the slopes, and to prevent silting in of waterways downstream of the Work. Also, the measures should include provisions to reduce erosion by the wind of all areas stripped of vegetation, including material stockpiles.

#### **1.05 Federal, State, and Local Regulations**

- A. Dewatering operations shall conform to the requirements of all federal, state and local agencies having jurisdiction.
- B. Dewatering water discharged to streams, drains or sewers may require permits from federal, state or local agencies having jurisdiction. The CONTRACTOR shall comply with all water quality requirements prior to discharging dewatering water. The CONTRACTOR shall be responsible for all testing and treatment required to meet water quality requirements prior to discharge. No discharges to sanitary sewers will be allowed without prior approval of local agencies with jurisdiction for the sanitary sewers.

#### **1.06 Protection**

- A. Take all steps necessary, during the Work of this Section, to protect surrounding property and adjacent buildings, private water supplies, roads, drains, sewers, structures and appurtenances. Adequate measures shall be taken to protect such property and construction from the effects of the dewatering operations.

#### **1.07 Submittals**

- A. Submit detailed plans indicating proposed type and location of dewatering wells, type and location of collection/conveyance piping, and point of disposal of pumped water. Do not begin any dewatering work until submittals and supporting data have been reviewed by ENGINEER.
- B. Dewatering system shall be designed by a professional with a minimum of seven years documented experience in the installation and design of dewatering systems. Submittal shall be signed and sealed by a registered professional engineer, stating that the proposed dewatering method is adequate to perform the required tasks.

### **Part 2 Products (Not Used)**

### **Part 3 Execution**

#### **3.01 General**

- A. Provide electrical power from local utility. Provide stand-by power and any other required auxiliary dewatering equipment to assure continuous dewatering capability. Dewatering, where required, shall be continuous. Dewatering will not be stopped during work stoppage without approval of the ENGINEER. Coordinate construction operations to minimize duration and extent of dewatering required.
- B. Dewatering wells are to use properly designed filters to prevent the migration of soil fines into the well.

### **3.02 Monitoring and Control**

- A. During dewatering operations, monitor ground water level with piezometers to ensure the design or specified groundwater elevation is maintained. Install monitoring wells with screens below the excavation level as required. Install wells at minimum 200-foot intervals located between dewatering wells. Provide access to monitoring wells by ENGINEER.
- B. Modify dewatering operation if geotechnical instrumentation or survey measurements indicates movement of structures, sheeting or embankments, or inability to lower groundwater as specified.
- C. Inspect wells and lines on a daily basis to ensure integrity and watertightness. Keep fittings and connections watertight to ensure release of sulfide to atmosphere from groundwater does not occur.

### **3.03 Existing Drainage Conditions**

- A. Prior to beginning any work, verify in the field the location, type and capacity of all existing drainage facilities and conditions which will affect the Work of this Section. No allowances shall be made for conditions found during the progress of the dewatering operations because of the CONTRACTOR'S failure to verify such conditions.

### **3.04 Existing Structures and Utilities**

- A. The CONTRACTOR shall make field verification of all existing structures and utilities at the site of the Work which are scheduled to remain and which may be affected by the Work of this Section. The CONTRACTOR shall be responsible for any damage to existing structures and/or utilities caused because of his Work and shall repair such damage at his expense to the satisfaction of the ENGINEER or utility owner.

### **3.05 Drainage of Excavations**

- A. The CONTRACTOR shall maintain all finished excavation Work free of water during the preparation of the subgrade and until the completion of the Work. No ground or surface water shall be discharged into any existing sanitary sewer. No unit of Work shall be constructed under water except as otherwise determined by the ENGINEER. Provide and maintain adequate dewatering equipment to remove and dispose of all surface or groundwater entering excavations, trenches or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the construction is complete.

- B. All excavations which extend down to or below the static groundwater elevation shall be dewatered by lowering and maintaining the groundwater level beneath such excavations a distance of not less than 12 inches (300 mm) below the bottom of the excavation. Drainage system methods shall not cause any damage to wells or adjacent property. All outlet drainage piping and conduit shall be kept clean and free from sediment. The CONTRACTOR shall be held responsible for the condition of all existing pipes, conduits and structures which he may use for drainage.

### **3.06 Dewatering Sumps and Pump Wells**

- A. Sumps and pump wells used as a part of the dewatering system shall be strongly sheathed and braced to protect the construction while in use. Tops of well casings must be covered to prevent animals and debris from entering and shall be 2 to 3 feet (0.6 to 0.9 m) above ground. Sumps and wells, when abandoned, shall be backfilled and compacted to the satisfaction of the ENGINEER.

### **3.07 Drilling**

- A. Methods used in drilling wells associated with dewatering systems shall be the responsibility of the CONTRACTOR and shall be acceptable to the ENGINEER. Drilling methods shall insure proper placement of well materials and shall not involve displacement of earth formations. Drilling shall be done with first class equipment of proper type and in good condition, acceptable to the ENGINEER.

### **3.08 Pumping**

- A. Equipment for pumping and pumping methods associated with dewatering systems shall be the responsibility of the CONTRACTOR and shall be acceptable to the ENGINEER. The CONTRACTOR shall construct or furnish adequate discharge piping to conduct and dispose of the water so as to prevent damage to existing structures or property. Pumping equipment shall be first class, acceptable to the ENGINEER, of proper type and size for the Work and in good condition. Provide all anchors and supports for pumping equipment.

### **3.09 Filling and Grading**

- A. Upon completion of dewatering Work for the Project, abandon and/or fill all holes, trenches, ditches and other earth excavations created by the Work of this Section and not scheduled to remain. Do all filling, backfilling and grading to restore excavations and earth banks to the lines and levels indicated on the Plans and as determined by the ENGINEER. All earth fills shall be compacted to a density equal to that of the surrounding undisturbed earth.

End of Section

## Section 32 9219 Seeding

### Part 1 General

#### 1.01 Scope

- A. This Section includes seeding complete with earth bed preparation, providing and placing topsoil, preparation and fertilizing topsoil, sowing of seed for lawns and other ground cover, protection of seeded areas, watering of seeded areas, mowing of seeded areas, protection and cleanup.

#### 1.02 Related Work Specified Elsewhere

- A. Site Construction Performance Requirements: Section 01 8900
- B. Sodding: Section 32 9219

#### 1.03 Requirements of Regulatory Agencies

- A. Provide soil supplement materials complying with the applicable requirements of the Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended.
- B. Provide seed conforming to the regulations of Chapter 71 – Seed of the Pennsylvania Seed Act 164 of 2004, effective January 29, 2005, and amendments. Meet other applicable regulations of the Seed, Testing and Certification Programs of the Pennsylvania Department of Agriculture (PDA), Bureau of Plant Industry.
- C. Chemical fertilizer shall be supplied in suitable bags with the net weight of the contents and guaranteed analysis shown on the container. Bulk shipments shall be accompanied by an analysis and net weight certification of the shipment. Custom mixed fertilizers shall be accompanied by a certification of the weight of each commercial fertilizer used in the mixture and a guaranteed analysis of each shipment expressed in percentages of total Nitrogen (N), total available Phosphoric Acid (P2O5) and total available Potash (K2O) included.

#### 1.04 Source Quality Control

- A. A seed mixture proposed for use in the Work shall have been tested for purity and germination by the Seed Producer within nine (9) months of sowing.

#### 1.05 Reference Standards

- A. ASTM - American Society for Testing and Materials
- B. PennDOT - Pennsylvania Department of Transportation, Pub 408 Construction Specifications, latest edition.

#### 1.06 Submittals

- A. Submit Seed Producers Certification that seed meets the requirements of these Specifications and conform to the State of Pennsylvania Seed Act referenced above under Article 1.03 of this Section.

- B. Where required, submit test reports for all seed proposed for use in the Work to the ENGINEER, showing results of purity and germination tests, compliance with regulatory agencies, dates and location of tests.

#### **1.07 Product Delivery, Storage, and Handling**

- A. All material shall be delivered to the Project site in their original, unopened containers. Containers shall be clearly marked showing, name of manufacturer, brand name, trade name or generic name of material, warranty of analysis, net weight of contents and date of packaging, where applicable.
- B. Seed shall be delivered to the site in durable bags, tagged or labeled to show date of tests, warranty of purity and germination analysis, name, lot number and net weight of contents.
- C. Commercial fertilizers shall be delivered to the site of the Work in the original unopened bags. Bags shall not exceed 100 pounds (45 kg) net weight each and shall be clearly marked with guaranteed analysis in a conspicuous location on each bag.
- D. Material shall be stored at the Project site, under shelter, off the ground and shall be protected from damage by moisture, temperature, exposure to elements, vandalism or other action which might otherwise impair their use.
- E. All materials proposed for use in the Work shall be handled in a manner that will protect the material and the personnel involved in the Work. Handle seed in a manner which will protect the mixture from contamination or deterioration.

#### **1.08 Environmental Requirements**

- A. Seeding is limited to the periods between April 20 and June 1, August 10 to October 1 and after November 20 for as long as weather permits preparation of the seed bed without irrigation and/or mulch. With the use of irrigation and/or mulch, seeding can be done from April 20 thru October 1 inclusively.
- B. Comply with the limitations placed on the use of certain soil protection materials because of prevailing temperatures as described in this Section.
- C. Comply with the limitation placed on seeding applications because of wind velocity as described in this Section.

#### **1.09 Protection**

- A. Provide suitably approved warning signs and barricades for protection of seeded areas from pedestrian or vehicular traffic. Protect all newly seeded areas during the progress of the Work and until completion of the turf establishment period.
- B. Protect all adjacent construction from topsoil spills and perform such cleanup of affected surfaces before it becomes compacted by traffic.

#### **1.10 Final Acceptance**

- A. The CONTRACTOR shall establish a dense cover of seeded grass on all disturbed areas. These areas shall be maintained until final acceptance of the Work by the ENGINEER. The ENGINEER will inspect the turf to insure that the grass seed is well established, weed free, in a growing and vigorous condition. Areas that do not meet the approval of the ENGINEER shall be re-seeded at the CONTRACTOR's expense.

## Part 2 Products

### 2.01 Seed

- A. Seed and seeding mixtures shall be certified, mature, clean, dry, new crop seed products suitable for the specified applications and meeting the requirement of PennDOT Section 804.
- B. The specific mixture to be used shall be as specified on the plans and shall conform with PennDOT 804.2(b).
- C. Hydroseeding shall consist of a blend of seed, fertilizer and hydromulch.

### 2.02 Mulching Material

- A. Straw:
  - 1. Small grain straw or grass or marsh hay acceptable to the ENGINEER.
- B. Wood Excelsior:
  - 1. Green wood fibers baled or blanket of type and manufacture acceptable to the ENGINEER.
  - 2. Wood excelsior shall be made of green timber fiber baled so that the bales weigh 80 to 90 pounds at the time of manufacture.
  - 3. Wood excelsior blankets shall be made of a uniform web of interlocking fibers with a backing of fabric netting on one (1) side only. The fabric net shall have a mesh size not exceeding 1-1/2" x 3" (40 mm x 75 mm) and shall be a woven of either cotton cord, twisted paper cord or a synthetic, biodegradable fiber. Blankets shall be produced in the form of a tightly compressed roll 36 inches  $\pm$  1-inch (900mm  $\pm$  25 mm) wide and approximately 120 feet (36 m) long. Blanket shall have a fiber net on the outside of the fiber mat. Blanket roll weight, when manufactured, shall average 85 pounds (38 kg)  $\pm$  10%. Each roll shall have separator sheets of 40 pound Kraft paper placed at the beginning and at the end of each roll to facilitate unrolling and handling at the job site. The Kraft paper sheet at the end of each roll shall also form a wrapper for the roll.
- C. Netting:
  - 1. Twisted Kraft paper or synthetic fiber, biodegradable woven mesh net material suitable for the application and acceptable to the ENGINEER.
  - 2. The net shall consist of a biodegradable mesh with openings not to exceed 1-1/2" x 3" (40 x 75 mm)
  - 3. The net shall be furnished in widths of not less than 35 inches (900 mm).
- D. Proprietary Mulch Material:
  - 1. Biodegradable natural and/or synthetic materials suitably fabricated and acceptable to the ENGINEER.

### 2.03 Mulch Anchoring Material

- A. Emulsified Asphalt:
  - 1. ASTM D977, Rapid Setting (R.S. 1 or 2), Medium Setting (M.S. 2 or 2h) or Slow Setting (S.S. 1).

- B. Mulch Anchoring Tool
  - 1. Suitable unit having a series of flat, notched discs for punching and anchoring mulch in soil, or a regular farm disc weighted and set nearly straight as a substitute.
- C. Latex Base Adhesive:
  - 1. Latex base adhesive mixed with water at a ratio of 25 gallon of water to 1 gallon adhesive with 25 pounds of recycled newsprint as a tracer (14 L of adhesive with 0.35 kL of water with 28 kg of newsprint).
- D. Recycled Newsprint:
  - 1. Mix 7 pounds of newsprint with 7 gallons of water (60 kg of newsprint with 1000 L of water).
- E. Guar Gum:
  - 1. Mix 1 pound of dry adhesive with 26.5 gallons of water with 5 pounds of recycled newsprint as a tracer (55 kg adhesive / 12 200 L water / 280 kg newsprint).

**2.04 Fertilizer**

- A. Fertilizer shall be a standard commercial grade fertilizer, conforming to state regulations, of the type recommended for grasses. The fertilizer shall contain slow release nitrogen amounting to 75% of the nitrogen available. Fertilizer shall be uniform in composition, free flowing and suitable for application with method selected. Fertilizer for hydraulic seeding shall be soluble or ground to a fineness that will permit complete suspension of all insoluble particles in the slurry.

**2.05 Agricultural Liming Materials**

- A. Burnt lime (quick lime), hydrated lime, limestone (calcite and dolomite), marble shells and by-products shall conform to the requirements of ASTM C602.

**2.06 Water**

- A. Free of matter harmful to plant growth.

**2.07 Staples**

- A. Wire staples for holding mulching materials in place shall be not less than six (6) inches (150 mm) long No. 11 (U.S. Steel Gage) steel wire or longer.

**2.08 Topsoil**

- A. Topsoil shall be fertile, friable, sandy clay loam without admixture of subsoil. Topsoil is to be free of glass, stones greater than one (1) inch (25 mm) in any dimension, weeds, undesirable grasses and other extraneous materials. Topsoil shall have the following range of values:

Quality Parameter	Range of Value
Soil pH	5.0 to 7.5
Soluble Salts	500 ppm max
organic content	5 to 30 %
silt content	35% to 50%



clay content	5% to 10%
deleterious mat'l*	5% max

\*rock, gravel, stone, sticks, roots, sod, etc.

- B. Compost may be mixed with topsoil to obtain the desired content. Topsoil is to be final screened thru a 5/8-inch (15 mm) maximum mesh screen prior to delivery to the Project site. ENGINEER shall review source and final screen results prior to release of topsoil. CONTRACTOR shall submit a certified analysis of the topsoil from each source to the ENGINEER. Topsoil shall be placed in 3-inch (75 mm) minimum thickness throughout, or as specified in the plans or Specifications.
- C. The CONTRACTOR shall obtain his own topsoil borrow pit source and shall obtain all necessary permits and agreements for the use of such borrow pits at his own expense.

## 2.09 Improved Topsoil

- A. Improved topsoil shall consist of a mixture of 2/3 topsoil and 1/3 compost. Compost shall be mature/stabilized, humus-like material derived from the aerobic decomposition of yard waste (i.e., grass clippings and leaves) or other materials as designated compostable as permitted by a DEP Bureau of Waste Management site under industry standards, and U.S. EPA regulations and shall be in compliance with all federal and state laws. The improved topsoil mixture shall have a dark brown or black color, be capable of supporting plant growth without ongoing addition of fertilizers or other soil amendments and shall not have objectionable odor. The mixture shall be free of glass, plastic, metal, and other contaminants, as well as viable weed seeds and other plant parts capable of reproducing. The mixture shall be such that no visible water or dust is produced when handling it.
- B. The manufacturer of the compost shall maintain annually on file, test data and a statement to show that the following criteria are being met by the compost provided for the project.
  1. The composition of the compost shall be within the following range of values

Quality Parameter	Range of Value
Soil pH	6 to 7.5
Soluble Salts	2 to 5 mmho/cm
Carbon/Nitrogen Ratio	13 to 20 parts Carbon to 1 part Nitrogen
Inerts	< 1%
Organic matter	35 to 55 %
Nitrogen	1 to 2 %
Phosphorus	0.2 to 0.8 %
Potassium	0.5 to 1.5 %
Unit Weight	535 to 775 Kg/m <sup>3</sup>
Moisture Content	40 to 50 %
Particle Size	< 20 mm maximum
Water Holding Capacity	> 100%
Heavy Metals	None

2. Maturity/Stabilization – An acceptable test that can demonstrate Maturity/Stability.

3. Temperature – The compost material must have undergone the procedure to significantly reduce the pathogen level as referenced in EPA 40 CFR, Part 257 Regulations, Federal Register Vol. 58, No. 32, dated 2/19/93; Rules and Regulations. The temperature must be maintained at 40° C for 5 days with a temperature exceeding 55° C for at least 4 hours.
  4. Pathogens and Trace Elements – Shall meet the requirements of EPA 40 CFR; Part 503 Regulations, Federal Register Vol. 58, No. 32, dated 2/19/93; Rules and Regulations.
- C. To comply with the annual filing requirements the supplier of the compost shall certify that the compost meets the applicable requirements of the Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended; and EPA 40 CFR, Part 257 and 503 Regulations, Federal Register Vol. 58, No. 32; dated 2/19/93; Rules and Regulations.
- D. A data sheet shall accompany the certification.
- E. The data sheet shall show the following:
1. Standard compost total nutrient test results, including N, P, K, Ca, Mg, Mn, Cu, Fe total carbon, pH, as provided by an acceptable testing laboratory.
  2. Organic content
  3. Inert contamination
  4. Soluble salts
  5. Carbon/Nitrogen ratio
  6. Proof of maturity/stability acceptable to the Pennsylvania Department of Agriculture

## **Part 3 Execution**

### **3.01 Preparation of Subgrade**

- A. Complete all fine grading within the areas to be covered with topsoil necessary to bring the surface of the proposed subgrade to the elevations indicated on the Plans and parallel to the proposed finished grade. The surface of the subgrade immediately prior to being covered with topsoil shall be raked or otherwise loosened to a minimum depth of two (2) inches (50 mm) to facilitate making a bond between the subsoil and the topsoil.

### **3.02 Preparation of Soil**

- A. After the areas to be seeded have been brought to the required grade and properly trimmed and cleaned up, the existing soil shall be brought to a friable condition by harrowing or otherwise loosening and mixing to a depth of at least four (4) inches (100 mm). All lumps and clods shall be thoroughly broken. When the area to be seeded has been prepared and covered with a layer of topsoil as specified under Article 3.01 of this section, this operation will not be required.

### **3.03 Preparation of Mulch Material**

- A. When seed is to be sown through mulch which has been in place for a period of more than two (2) weeks or which is being held in place by a surface-applied coating of asphalt emulsion or other adhesive, the mulched area shall be prepared for seeding by discing, a spike-toothed harrow, or by other means acceptable to the ENGINEER.

### 3.04 Placing and Spreading Topsoil

- A. Topsoil shall be placed and spread over the area designated on the Plans, or as determined by the ENGINEER, to a depth of four (4) inches,  $\pm$  1-inch (100 mm  $\pm$  25 mm) or to such depth as specified on the plans. In all cases, topsoil shall be placed to a depth sufficiently greater than that shown on the Plans or specified so that, after natural settlement or rolling, the completed Work will conform to the lines, grades and elevations shown on the Plans. Spreading of topsoil shall be completed in such a manner that seeding as specified can proceed without additional moving of topsoil. Topsoil furnished and placed shall be considered incidental to seeding unless otherwise specified in the Proposal.
- B. After topsoil is spread, all large earth lumps, rocks, roots, debris, or other foreign matter shall be raked and removed from the topsoiled area and legally disposed of by the CONTRACTOR.

### 3.05 Fertilizing

- A. Chemical fertilizer shall be applied on the prepared soil surfaces at a minimum rate of 1/3 ton per acre (666 lbs/ac.) (750 kg/ha) of 12-12-12 fertilizer, or such other rate of another fertilizer mixture that yield 240 lbs/acre (270 kg/ha) of nutrient. Dry fertilizers shall be thoroughly disced, harrowed or raked into the soil to a minimum depth of not less than 1-inch (25 mm). Where hydraulic seeders are used for sowing seed, one half the recommended rate of fertilizer may be spread in combination with such sowing with the balance incorporated into the soil prior to seeding. In all other cases, fertilizer shall be incorporated into the soil before any seeding is started.

### 3.06 Seeding

- A. Seed of the kind required shall be sown at the rate as specified in Table 2. Seed shall be sown in the presence of an inspector by mechanical spreader, hydraulic seeder or broadcasting. The broadcasting method shall be used for sowing seed only in areas inaccessible to mechanical spreading equipment. Seeding during winds above 15 miles per hour (25 km/hr) shall not be permitted.
- B. Prior to placing seed materials, water topsoil to a depth of four (4) inches (100 mm) at least 48 hours prior to seeding operations to obtain a loose friable seed bed. Time and depth of watering operations shall be varied at the direction of the ENGINEER for varying conditions at the site of the Work.
- C. Broadcasting methods for sowing seed materials shall be accomplished by spreading one-half of the specified amount of seed in one direction and then broadcasting the remaining one-half of the seed at right angles to the first seeding pattern using the same broadcast method. Rate of broadcast shall be as specified herein or per the written recommendations of the Producer of the seed material used. Roll seeded area with roller weighing a maximum of 150 pounds/foot (225 kg/m) of width.
- D. Hydroseeding shall be performed using suitably acceptable hydraulic seeding equipment and a homogeneous slurry solution of water, seed, fertilizer and suitable mulch material as approved by the ENGINEER. Seed slurry mixture shall be distributed uniformly at a rate approved by the ENGINEER for the seed materials, fertilizer and/or mulch materials used to suit the seed application rate. Seed application rate shall be 300 lbs/acre (340 kg/ha).

### 3.07 Mulching

- A. Mulching shall consist of placing a mulch material on areas that have been or are to be seeded. Mulch shall be placed in a loose enough condition so as to allow penetration of sunlight and

circulation of air, but thick enough to shade the ground, reduce rate of water evaporation and prevent or reduce erosion by wind or water. Mulch shall be secured with suitably acceptable anchoring material.

- B. For surfaces and slopes on which power equipment can be operated, satisfactory mulching materials include the following:
- C. Small grain wheat straw or grass hay applied at 1-1/2 to two (2) tons per acre (3.5 to 4.5 metric ton/ha) with disc packer, asphalt or netting tie-down.
- D. Wood chips applied at six (6) to nine (9) tons per acre (13.5 to 20.0 metric tons/ha).
- E. Asphalt emulsion alone at 600 to 1,200 gallons per acre (5.5 to 11.0 kl/ha). (This application is suitable for limited periods of time and where trampling by either people or animals will not occur.)
- F. For surfaces and slopes where power equipment cannot be operated, satisfactory mulching materials include the following:
- G. Straw or grass hay applied at 1-1/2 to two (2) tons per acre (3.5 to 4.5 metric tons/ha), anchored with asphalt or netting tie-down.
- H. Asphalt emulsion alone at 600 to 1,200 gallons per acre (5.5 to 11.0 kl/ha). (Limited to areas where tracking is not a problem.)
- I. Commercially available erosion control netting of jute, paper or biodegradable synthetics.
- J. Continuous filament fiberglass at 1,000 pounds per acre (1100 kg/ha) anchored with 150 gallons (1400 l/ha) of asphalt emulsion.
- K. Anchor straw or hay mulch by the methods as specified herein.
- L. Wood chips will not need anchoring when used on workable slopes.
- M. Commercially manufactured netting and/or fiberglass materials shall be anchored in accordance with the manufacturer's printed instructions for the material used.
- N. Punch and anchor mulch material into soil using mulch anchoring tool. Soil must be moist, free of stones and loose enough to permit disc penetration to a depth of three (3) inches (75 mm).
- O. Blow on liquid or emulsified asphalt materials with the straw or hay mulch or spray or sprinkle asphalt tie-down materials immediately after mulch is spread.
- P. Apply emulsified asphalt at 0.04 gallons per square yard (0.2 l/m<sup>2</sup>). Do not apply emulsified asphalt during freezing weather since it contains approximately 50% water. Apply liquid (cut back) asphalt at approximately 0.10 gallons per square yard (0.45 l/m<sup>2</sup>). Liquid asphalt may be applied during freezing weather since it is cut back with kerosene.

### **3.08 Conversion from Soil Protection to Permanent Vegetation**

- A. Following straw or hay mulching, grass seeding can be made in early spring by broadcasting seed directly into the mulch. Fertilizer or lime, where needed, should be incorporated into the soil before mulching.
- B. Asphalt emulsion alone can be readily incorporated into the soil by ordinary tillage before seeding.
- C. Wood chip mulch may be removed before seeding or incorporated deeply into the soil. If wood chips are incorporated into the soil, the addition of extra nitrogen fertilizer to the soil will be required to provide nitrogen in the new seeding.

- D. Fiberglass mulch shall be removed before seeding because of its permanence. Care shall be taken to prevent fiberglass filaments left in place from becoming entwined or wound around shafts of power mowers or other power equipment.
- E. Acceptable proprietary netting and erosion control materials shall be disposed of in accordance with the manufacturer's printed instructions for the material used prior to any seeding operations.

### **3.09 Turf Establishment**

- A. Seeded areas shall be watered whenever excessive drying is evident during the period set for establishment. Watering shall be done in a manner that will prevent erosion due to the application of excessive quantities and the watering equipment shall be of a type that will prevent damage to the cultivated surfaces. The CONTRACTOR shall be responsible for the proper care of the seeded areas until final acceptance of the entire Work covered by the Contract.
- B. The seeded areas shall be mowed with mowing equipment acceptable to the ENGINEER to a height of two (2) inches (50 mm) whenever the average height of grass establishment reaches four (4) inches (100 mm). When the amount of cut grass is heavy, cut grass shall be removed to prevent destruction of the underlying grass. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed, or in the case of rank growths, shall be uprooted, raked and legally disposed of from the area.
- C. Reseed and mulch areas larger than four (4) square inches (25 cm<sup>2</sup>) not having a dense, uniform, vigorous stand of grass acceptable to the ENGINEER.
- D. The establishment period shall extend for a period from the time of seeding until the seeded area has a uniform stand of grass acceptable to the ENGINEER. The minimum period shall be 30 days.
- E. If after 60 days from the initial seeding a dense, uniform, vigorous stand of grass has not been established by the CONTRACTOR, the OWNER may reseed the defective areas and all costs will be deducted from the CONTRACTOR's payments.

End of Section

## Section 40 0500 Process Equipment General Requirements

### Part 1 General

#### 1.01 Scope of Work

- A. This Section includes general provisions and requirements for all equipment specified in the Process Integration Subgroup (Division 40) to be furnished and installed as indicated on the Plans complete with safety guards, anchor bolts and lubrication. This Section also includes component name plates, structural process modification requirements and maintenance prior to final acceptance.
- B. Related Work Specified Elsewhere
  - 1. Cast-in-Place Concrete: Section 03 3000
  - 2. Division 26: Electrical

#### 1.02 Quality Assurance

- A. Reference Standards - Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:
  - 1. AFBMA - Antifriction Bearing Manufacturing Association
  - 2. ANSI - American Standards Association
  - 3. AMCA - Air Moving and Conditioning Association
  - 4. ASA - American Standards Association
  - 5. ASTM - American Society for Testing Materials
  - 6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
  - 7. ASME - American Society of Mechanical Engineers
  - 8. AWWA - American Water Work Association
  - 9. FM - Factory Mutual
  - 10. NEMA - National Electrical Manufacturers' Association
  - 11. NFPA - National Fire Protection Association
  - 12. UL - Underwriters Laboratories, Inc.
- B. Deviations and Modifications
  - 1. Motor Size - Deviation from motor sizes specified or indicated on the Plans recommended to accommodate any particular piece of equipment specified in various Sections of this Division shall strictly comply with these Specifications. The CONTRACTOR shall include with his bid any additional engineering and construction costs necessary to redesign the mechanical and/or electrical services recommended through CONTRACTOR by equipment manufacturer or supplier. No deviations will be permitted without written approval by the OWNER.
  - 2. Structure/Mechanical Modification - Modifications to the structure or process configuration recommended for ease of installation, operation or maintenance for a particular piece of equipment specified in various Sections of these Specifications shall strictly comply with these Specifications. The CONTRACTOR shall include with his bid any additional engineering and construction costs necessary to perform modifications recommended through the CONTRACTOR by equipment manufacturer or supplier. No modifications will be permitted without written approval by the OWNER.

C. Workmanship

1. All Work shall be performed in accordance with latest accepted standards and practices for the trades involved. The workmanship shall be subject to the approval of the ENGINEER at all times.
2. Only craftsmen experienced in the Work to be performed will be allowed to do the Work. This applies particularly to skilled trades such as welding, pipe fitting, plumbing, and sheet metal work.

D. Codes, Ordinances, Permits, and Inspections

1. All materials and equipment required for the Work and their installation shall conform to the laws of the Commonwealth of Pennsylvania and to all the codes, rules, regulations, and ordinances of the locality where the Work is to be performed. The CONTRACTOR shall secure all permits, licenses, inspections and tests required in connection with his Work. Upon completion of the Work, the CONTRACTOR shall secure and present to the OWNER a certificate of inspection and approval from the department having jurisdiction over his Work, if such be issued. All fees in connection with the above requirements shall be paid by the CONTRACTOR.
2. Any changes in the drawings and/or Specifications required to conform to the above codes, laws, rules and/or regulations shall be taken up with the ENGINEERS' office by the CONTRACTOR before submitting his proposal.
3. After entering into the Contract, the CONTRACTOR shall be held to make all changes required to conform to the above ordinances, laws, rules, and/or regulations without extra expense to the OWNER, except in the instance of ordinances, laws, rules, and/or regulations which are revised or enacted subsequent to the time of signing the Contract.

E. Design Drawings

1. The general arrangements, design, and extent of the Work prescribed in these Specifications are indicated and/or detailed on the accompanying drawings. Any discrepancies which may occur on the drawings and/or in the Specifications shall be called to the attention of the ENGINEER. No changes or alterations in the Work shall be made because of said discrepancies until approval of such changes or alterations has been secured from the ENGINEER.
2. In the event of disputes arising because of discrepancies between drawings of the various Trades, such disputes shall be taken up with the ENGINEER whose decisions will be final.
3. All dimensions which tie mechanical, process and/or electrical installations to the building structure shall be thoroughly field checked for accuracy and possibility of interferences due to field conditions. Ignorance of such field conditions because of the CONTRACTOR's failure to field check the dimensions in question will be no excuse for additional compensation.

F. CONTRACTOR's Interface

1. The CONTRACTOR shall be responsible to coordinate the furnishing and installation of all materials and labor required for a complete and operable facility.
2. The CONTRACTOR shall be responsible to include adequate appurtenances to complete installation of equipment furnished by him including motor starters when furnished as an integral part of a packaged piece of equipment or integral mechanical equipment system.

3. The CONTRACTOR shall be responsible for furnishing and installing the necessary piping to provide a complete and operable installation of all equipment and fixtures whether or not furnished by the CONTRACTOR.

G. Apportionment of the Work

1. The CONTRACTOR shall classify and apportion all materials and performance of all labor to the several trades involved in accordance with all local customs, rules, regulations, jurisdictional awards, decisions, etc., insofar as they may apply and as required to efficiently execute the Work involved in this Contract regardless of the classification indicated in these Specifications.

H. Surveys

1. The CONTRACTOR shall layout and establish the lines and grades of all pipes in accordance with the drawings and he shall employ a competent surveyor registered in the state of Pennsylvania for this Work. In the event of unforeseen obstructions, the CONTRACTOR shall confer with the ENGINEER and obtain his written approval before proceeding with any Work deviating from the governing drawings. The CONTRACTOR shall assume full responsibility for locations and grades throughout the Work.

I. Locations

1. All process equipment, plumbing fixtures, and mechanical equipment shall be in the exact locations as determined by the ENGINEER. It shall be the duty of the CONTRACTOR to request such exact locations from the ENGINEER sufficiently in advance of the time when such information will be required at the buildings so as not to interfere with progress of his Work.

J. Points of Termination

1. The points of connection and termination of the Work under these sections of the Specifications are shown on the drawings or stated in the Specifications, but in case of doubt as to such points of connection or termination, the decision of the ENGINEER shall be final.

K. Local Utilities

1. The CONTRACTOR shall be responsible for coordinating, obtaining service, including costs and advising the ENGINEER and utility company(s) as to installation schedules.

**1.03 Submittals**

A. Shop Drawings and Product Data

1. Submit shop drawings and product data as required in Section 01 3300, Submittal Procedures, of these Specifications. Submittals where specified in various Sections of these Specifications will be reviewed for circuit design and representation, quality of proposed equipment, availability of components and compatibility to overall control and operation.



B. Certificates

1. Each equipment manufacturer or supplier shall submit written certification that all equipment furnished is in compliance with the Occupational Safety Standards as specified in other Sections of this Division.

C. Installation Inspection Report

1. Submit inspection report performed on installed equipment made by the representative of manufacturer or supplier. Report shall certify that equipment has been properly installed, lubricated, ready for operation and results of test operation. Include noise level and vibration readings.

D. Operation and Maintenance Data

1. The CONTRACTOR shall submit operating instructions, repair parts lists, equipment manuals, and automatic control diagrams. The submittals shall be as required in Section 01 3300, Submittal Procedures.
2. The CONTRACTOR shall also provide the ENGINEER with additional copies of the above material, each copy to be bound in book or pamphlet form with approved fastenings and covers. Each bound copy shall include a set of the finally approved shop drawings of all equipment, fixtures, and accessories used on this Project.

E. Record Drawings

1. Submit record drawings as required in Section 01 7700, Closeout Procedures. Drawings shall be 24" x 36" mylars of the Plans obtained from the ENGINEER and paid for by the CONTRACTOR, clearly marked by the CONTRACTOR with accurate field dimensions locating mechanical systems, equipment, piping, component parts, etc.

F. Pump Record Card

1. The CONTRACTOR shall complete and submit a Pump Record Card as attached at the end of this section, for all pumps and mixers used on this project, prior to final payment.

G. Balance Report

1. Submit a balance report upon completion of checking, adjusting, and balancing of process equipment as specified herein. This report shall be in a tabulated form with each piece of equipment and/or outlet identified by an equipment or other number, location, and include the following:
  - a. Pumped Fluid Systems:
  - b. Pumps - design rpm - actual rpm
  - c. Pump Motors - full load amps - operating amps
  - d. Pump Capacities - design gpm - actual gpm
  - e. Pump Pressures - design head - actual head
  - f. Balancing valves and flow fittings - required gpm - actual gpm

**1.04 Product Delivery, Storage, and Handling**

- A. Materials and equipment distributed, stored and placed upon or near the site of the work shall at all times be so disposed as not to interfere with work being prosecuted by other

contractors in the employ of the OWNER, or with street drainage, fire hydrants or with access thereto, and not to hinder any more than may be necessary, the ordinary traffic of the street.

- B. Materials may be stored on the site in locations designated by the OWNER.
- C. All materials and equipment shall be handled in a manner to avoid damage or breakage and delay in the completion of the Work. The CONTRACTOR shall repair or replace, without cost to the OWNER and to the satisfaction of the OWNER, all items damaged or broken as a result of his operation.
- D. All machined surfaces of the equipment subject to corrosion shall be protected by coating with grease immediately after finishing.
- E. All flanges shall be protected prior to installation by means of wooden flanges bolted in place.
- F. Pump casings shall be thoroughly drained of all water.
- G. All parts of the equipment shall be carefully crated to facilitate shipping and handling. The crates shall be constructed to completely protect the equipment and shall be sufficiently strong to permit lifting and skidding without requiring additional bracing or reinforcement.
- H. The CONTRACTOR shall notify the ENGINEER not less than two days in advance of the delivery of any equipment.
- I. All materials shall be so delivered, stored, and handled as to prevent the inclusion of foreign materials and/or damage by water, breakage or other causes. Packaged materials shall be delivered in original unopened containers and shall be stored until ready for use. Packages or materials showing evidence of damage or contamination, regardless of cause, will be rejected. All materials which have been stored shall be subject to retest and shall meet the requirements of these Specifications at the time they are used in the Work and at the time of final acceptance of the Work.
- J. The CONTRACTOR shall obtain a letter from the equipment manufacturer describing the recommended methods of outdoor or indoor storage of the equipment at the site and shall fully comply with such recommendations to be eligible for partial payments on such equipment.
- K. All materials to be incorporated in the Work shall be properly arranged, covered and protected, and the CONTRACTOR shall be solely responsible for the safety of the same. Material improperly stored shall not be included in estimates for partial payment, or if already included, shall be deducted from subsequent estimates.

#### **1.05 Job Conditions**

- A. Protection and Maintenance
  - 1. CONTRACTOR shall be provided adequate protection of installed equipment and systems until final acceptance by the OWNER. All maintenance of installed equipment shall be the responsibility of the CONTRACTOR until final acceptance by the OWNER.

## 1.06 Cutting and Patching

- A. All minor cutting that may be necessary for the installation of the Work and any minor patching as a consequence thereof shall be done by the CONTRACTOR after review by the ENGINEER.
- B. All major cutting of the structure necessary for the installation of the mechanical Work and major repairs required as consequence thereof shall be done by the CONTRACTOR, after review by the ENGINEER.

## Part 2 Products

### 2.01 Materials

- A. When specific manufacturers or trade names are mentioned in these Specifications, and/or on the drawings, they are used as the design criteria and to establish a minimum of quality standard.
- B. Any substitution made that may affect building size or process function shall be deemed to be made for the convenience of the CONTRACTOR, and all shall be brought to the attention of the ENGINEER at an early date for consideration. Any additional costs resulting therefrom shall be borne by the CONTRACTOR.
- C. The CONTRACTOR shall accept full responsibility that said substitution shall function as required by the process and shall not require additional building space or additional structural requirements. The CONTRACTOR shall also be responsible for all redesign expenses incurred because of the substitution.
- D. Any items required to complete the Work and not specifically mentioned herein, shall conform fully to the quality pattern established by these Specifications.
- E. All materials shall be new and be the standard products of the manufacturer. Seconds, rejects, or damaged materials will be rejected by the CONTRACTOR. The ENGINEER reserves the right to disapprove and reject any materials, proposed or installed which fail to meet these quality standards. The CONTRACTOR shall, at his own expense, remove and replace with approved materials, any materials which do not comply with these standards.

### 2.02 Fabrication

- A. Provide for possible adjustments in the field of mechanical and process work fabrications. Adjustments shall allow for adjustment to avoid interferences, installation of equipment or connecting to other Work.

### 2.03 Equipment

- A. General
  - 1. Unless furnished as integral parts of mechanical or process equipment, appurtenances such as remote operation switches or push buttons, pilot lights, starter relays, overloads or other items shall conform to and be installed as specified herein and any related Sections.

B. Low Voltage Motors (600 Volts and Below)

1. General Requirements

- a. Scope - This Specification covers three phase squirrel cage induction motors NEMA Design "A", "B", and "C" high efficiency motors.
- b. Standards - All motors shall be in accordance with NEMA Standard MG1-1978, or the latest revision insofar as it is applicable. Motors shall also comply with the applicable portions of the National Electric Code.

2. Electrical Requirements

- a. Voltage and Frequency - Motors 1/3 HP and smaller shall be rated for service on 120 volt, single-phase service, unless identified differently in the Specifications or on the Drawings. Standard motors 1/2 HP through 100 HP shall be rated 230/460 volts; motors above 100 HP shall be rated 460 volts. Motors will be rated for operation on a three phase, 60 HZ power supply.
- b. Operating Characteristics
  - 1) Torques - Motors shall meet or exceed the locked rotor (starting) and minimum breakdown torques specified in NEMA Standards for Design B for the ratings specified. Motors shall be of the NEMA Design required to meet the torque requirements of the driven load to which it is to be attached.
  - 2) Currents - Locked rotor (starting) currents shall not exceed NEMA Design B maximum values for the specified rating. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to the motor components.
  - 3) Efficiency - Motors shall have a minimum and nominal full load efficiency which will meet or exceed the values listed in the motor efficiency tables 3(a) and 3(b); tested in accordance with NEMA Test Standard MG1.12.53a, IEEE Test Procedure 112, Method B, using accuracy improvement by segregated loss determination including stray load loss measurements. The minimum efficiency shall be guaranteed. Motors 250 HP and larger shall have a full load nominal efficiency of not less than 95% with a guaranteed minimum of 94%.
  - 4) Power Factor - The power factor for 3,600 and 1,800 rpm, 3 through 250 HP ratings at full load, at full voltage shall be a minimum of 83%. Six-pole ratings will be excluded from this requirement.
- c. Service Factor and Ambient - Standard motors will be rated for a 1.15 service factor in 40degC ambient.
- d. Insulation
  - 1) Standard motors shall have a full Class B insulation system.
  - 2) Standard motors shall be dipped and baked in polyester varnish to consolidate the winding.

3. Motor Efficiency Tables (At Full Load)

a. Open Drip Proof

SYNCHRONOUS SPEED PERCENT EFFICIENCY 3,600 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1		
1/2	81.5	84
2	84	86.5
3	84	86.5
5	86.5	88.5
7	86.5	88.5
10	88.5	90.2
15	88.5	90.2
20	91.7	91.7
25	90.2	91.7
30	91	92.4
40	91	92.4
50	91.7	93
60	92.4	92.6
75	93	94.1
100	93	94.1
125	93	94.1
150	93	94.1
200	94.1	95

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,800 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1	81.5	84
1/2	81.5	84
2	81.5	84
3	86.5	88.5
5	86.5	88.5
7-1/2	89.5	91
10	89.5	91
15	90.2	91.7
20	91.7	93
25	91.7	93
30	91.7	93
40	93	94.1
50	93	94.1
60	93	94.1

75	94.1	95
100	94.1	95
125	94.1	95
150	94.5	95.4
200	94.5	95.4

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,200 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4	77	80
1	81.5	84
1/2	84	86.5
2	85.5	87.5
3	87.5	89.5
5	87.5	89.5
7-1/2	88.5	90.2
10	88.5	91
15	89.5	91
20	90.2	91.7
25	90.2	91.7
30	91	92.4
40	91.7	93
50	91.7	93
60	92.4	93.6
75	93	94.1
100	93	94.1
125	93	94.1
150	94.1	95
200	94.1	95

b. TENV - TEFC Severe Environment and Explosion Proof

SYNCHRONOUS SPEED PERCENT EFFICIENCY 3,600 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1		
1/2	81.5	84
2	82.5	85.5
3	84	86.5
5	85.5	87.5
7-1/2	87.5	89.5
10	88.5	90.2
15	89.5	91
20	91.7	91.7
25	90.2	91.7
30	91	92.4
40	91	92.4

50	91.7	93
60	92.4	93.6
75	93	94.1
100	93	94.1
125	93.6	94.5
150	93.6	94.5
200	94.1	95

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,800 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1	81.5	84
1/2	81.5	84
2	81.5	84
3	86.5	88.5
5	86.5	88.5
7-1/2	88.5	90.2
10	88.5	90.2
15	90.2	91.7
20	91.7	93
25	91.7	93
30	91.7	93
40	92.4	93.6
50	93	94.1
60	93.6	94.5
75	94.1	95
100	94.1	95
125	94.5	95.4
150	95	95.8
200	95	95.8

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,200 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4	77	80
1	78.5	81.5
1/2	84	86.5
2	84	86.5
3	87.5	89.5
5	87.5	89.5
7-1/2	87.5	89.5
10	89.5	91
15	89.5	91
20	90.2	91.7
25	90.2	91.7

30	91	92.4
40	91.7	93
50	91.7	93
60	91.7	93
75	93	94.1
100	93	94.1
125	94.1	95
150	95	95.8
200	94.5	95.4

4. Mechanical Requirements

a. Frame Size - Horsepower/frame relationship shall conform to the latest NEMA Standard for T frame motors.

b. Enclosure

- 1) Motors shall be open drip-proof, TEFC, explosion-proof, or other types of construction as called for in other sections of these Specifications.
- 2) Motor frame and end shields shall be of cast iron or cast aluminum construction using alloys with low copper content. Conduct box may be either steel or aluminum.

c. Bearings

- 1) All motors shall have anti-friction bearings, sized for a L-10 life of at least 25,000 hours under minimum V belt sheave sizes for maximum loading conditions (see NEMA Standard MG1-14-42) or 125,000 hours L-10 life for a direct connected load.
- 2) Aluminum end shields shall have a cast-in steel or cast iron bearing insert.
- 3) Bearing housings shall be regreasable with provisions for purging old grease.
- 4) Bearings shall be preloaded with a bearing loading spring to minimize noise and increase bearing life.

d. Miscellaneous

- 1) Conduit box shall be diagonally split and rotatable in 90 degree increments.
- 2) External hardware shall be plated to resist corrosion.
- 3) External paint shall withstand industrial environments or shall be as called for in other Sections of these Specifications.
- 4) Nameplates shall be of stainless steel and stamped per NEMA Standard MG1-10-37. Nameplate information shall include the nominal efficiency value per Standard MG1-12.53b and the manufacturer's minimum guaranteed efficiency value.

e. Motor Vibration - Motor vibration, when factory tested by manufacturer, shall not exceed the values of NEMA MG-1 12.05; that is, 0.0010 inches for 3,600 rpm motors, 0.0015 inches for 1,800 rpm motors, and 0.0020 inches for 1,200 rpm motors.

f. Ventilating Fans - TEFC, explosion-proof, chemical duty motors, etc., will be equipped with ventilating fans of corrosion resistant, nonsparking material.

5. Noise Level - All noise levels shall be less than the maximum requirements of OSHA, NEMA, and IEEE Standards.

6. Tests - Tests shall be performed on each design to assure compliance with the design criteria of this Specification.



## Part 3 Execution

### 3.01 Installation

#### A. Equipment

##### 1. General

- a. The CONTRACTOR's attention is directed to the fact that certain equipment, (fans, drives, and other machinery), must be installed before housing and/or enclosures are installed or completed. Doors and other access openings in some cases are not large enough to permit passage of the equipment completely assembled. The CONTRACTOR shall thoroughly investigate these conditions prior to fabrication or shipment.
- b. Component parts furnished as part of a packaged equipment system shall be installed with the mechanical Work, ready for connection as specified in Division 26, Electrical/I&C. Electrical connection between component mechanical parts shall be inclusive to mechanical Work.
- c. Components such as remote operation controls, pilot lights, overloads or others not furnished as integral packaged pieces of equipment shall conform to and be installed as specified in Division 26, Electrical/I&C.

##### 2. Supports and Anchors

- a. Provide bases, pads, platforms, hangers, clamps, or embedded inserts necessary for proper support and/or anchoring of mechanical and process Work. The CONTRACTOR shall be responsible for the proper sizes, locations, and quantities of these bases and pads where same are to be on concrete floor slabs, and shall provide all anchor bolts, sleeves, and setting templates for the mechanical equipment and machinery. Bases and/or pads are to be provided for each piece of mechanical equipment and machinery whether shown or not shown on the drawings. Inserts to be embedded in concrete shall conform to and be installed as specified in Sections 03 1500, Concrete Accessories. Detailed specifications for anchoring are included in other Sections of these Specifications.
- b. All necessary anchor bolts, nuts, washers, and sleeves shall be furnished as per the manufacturer's recommendations and shall be made of ample size and strength for the purpose intended. All anchor bolts, bolt sleeves, washers and nuts supplied shall be stainless steel unless otherwise specified. Setting templates and working drawings for installation shall be furnished.
- c. Unless otherwise indicated on the Plans or specified elsewhere, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Unless otherwise noted, all equipment baseplates shall be furnished complete with openings for grout.
- d. Mechanical equipment resting on concrete foundations, bases or pads shall rest on a level and uniform bearing surface with grout when vibration isolation is not required or specified. Grout shall be nonshrink, nonstaining Type V as specified in Section 04 0511, Mortaring and Grouting.

##### 3. Electrical Service

- a. The CONTRACTOR shall furnish all motors required in connection with his Work and he shall mount or install all his motors in their finished locations.
- b. Electrical components required and furnished for mechanical or process equipment systems provided as complete system by the manufacturer or Subcontractor, and automatic temperature control systems together with

any power and control interface wiring shall be the responsibility of the CONTRACTOR. He shall perform this Work in accordance with all requirements of the electrical Specifications. The CONTRACTOR shall be responsible for the proper operation of his equipment and shall furnish all wiring and control diagrams to ensure proper operation of same.

- B. Painting - Shop priming and finish coats including preparation shall be as specified in Section 09 9100 Painting and Coating. All iron and steel surfaces shall be protected by suitable paint or coatings applied in the shop or point of fabrication. Surfaces which will be inaccessible after assembly or installation shall be finish coated to provide protection for the life of the equipment. Surfaces which have been inadequately coated or require touch up in the field shall be repainted. The repainting shall be the responsibility of the CONTRACTOR and performed to the satisfaction of the ENGINEER.
- C. Sleeves - Provide sleeves where pipes or ducts pass through walls or floors necessary for installation and as specified elsewhere for process or mechanical Work. Sleeves for covered pipe or ducts shall be of proper size to allow the covering to pass through unless otherwise directed or specified elsewhere.
- D. Plates - Ceiling, floor or wall plates shall be installed at all points where exposed pipes pass through walls, ceiling, or floors. Plates shall be nickel-plated sectional, pressed steel plates with positive catches.
- E. Lubrication of Equipment - After installation of any equipment is complete such as motors, pumps, compressors, etc., which depends on lubrication for efficient operation, they shall be lubricated in accordance with the manufacturer's recommendations. The CONTRACTOR shall furnish all oil and grease required to place all of the equipment in initial operation. Oil and grease shall be in accordance with the equipment manufacturer's recommendations. Lubrication points on equipment shall be easily accessible with all points of application provided with one standard fitting throughout the entire job for greases or placing oil. Where equipment is furnished by the manufacturer with different fittings, the CONTRACTOR, at his own expense, shall provide and install standard fittings. All fittings shall be installed in a readily accessible location or provided with extension lines for ease in lubrication. Lubrication shall be done before any test runs will be permitted or equipment placed in final operation.
- F. Identification - All mechanical equipment including pumps, air handling units and each and every valve and regulator shall be identified in accordance with other Sections of these Specifications and in accordance with OWNERS method of equipment identification. Nameplates shall be provided on a new panels and equipment.
- G. Welding
  - 1. Blower air supply lines shall be welded.
  - 2. All natural gas lines 1-1/2 inches and larger shall be welded. If desired, piping less than 1-1/2 inches may be welded; however, sample welds shall be submitted for ENGINEER's approval.
  - 3. Material shall be clean either by wire brushing or by sandblasting, if needed, prior to welding, depending upon the condition of the material. If grease, or other foreign materials of the same nature are present, cleaning shall be done by a suitable solvent.
  - 4. Black steel pipe and fittings may be welded by either oxyacetylene or electric arc method.

5. All welding shall be done by first class pipe welders meeting qualifications covered by the American Standard Code for Pressure Piping (ASA B31.1). Welding shall conform to the standards and requirements of this code and all applicable state and local codes. The OWNER reserves the right to require qualifying demonstrations of any welder assigned to the job by this CONTRACTOR.
6. Branch connections shall be made with welding tees. Welding ells shall be used for changing pipe directions. Scarf welding of branch pipe connections and use of mitered joints shall not be permitted.
7. All slag, dirt, and loose pieces of metal shall be removed from the interior of the vessels, jackets, nozzles and piping. All welds are to be thoroughly cleaned and wire brushed and weld spatter removed. Grinding of finished welds is not desired except where specified.

H. Safety Guards

1. Provide and install safety guards for all belts, gears, shafts or other reciprocating, rotating or moving parts of equipment whether shown on the Plans or required by ANSI B15.1, Safety Standard for Mechanical Power-Transmission Apparatus. Paint all guards safety yellow unless otherwise directed by ENGINEER or specified elsewhere.
2. Guards shall be fabricated from galvanized or aluminum-clad sheet steel no thinner than 16 gage or galvanized 1/2-inch mesh expanded metal. Each guard shall allow for easy installation and removal. All necessary supports and accessories shall be included with guards. Supports and accessories, including bolts, shall be hot dip galvanized.
3. Safety guards in outdoor locations shall prevent the entrance of rain and dripping water.

- I. Nameplates - Provide nameplates on each component of equipment, unless otherwise specified. Plates shall clearly identify manufacturer catalog or model number, serial number and other data pertinent to operation. Securely attach plates to components or have data stamped or cast into the body. Plates or stampings shall be located in a position to be easily and fully visible after components are installed without removing any parts from the component. Only rigid metal plates riveted or screwed to components will be acceptable.

**3.02 Field Quality Control**

A. Testing

1. During and after installation, those tests required by the local, county and state inspection bureaus, the OWNER or the ENGINEER, shall be performed in strict accordance with the department concerned and at the full expense of the CONTRACTOR.
2. The CONTRACTOR shall furnish all equipment, water, compressed air, apparatus, and labor necessary for the test. All defects disclosed by the tests shall be rectified by the CONTRACTOR without cost to the OWNER. Test shall be made under the direction of and subject to the approval of the OWNER or the ENGINEER. Tests required after installation are outlined herein and shall endure for not less than 48 hours.
3. All equipment shall be tested as in normal operating service unless specific rating tests are required as results of questionable performance.
4. Gages and equipment, etc., which may be damaged by the tests shall be valved off or removed before testing.

5. Special tests required for certain apparatus are specified under the specific headings for that apparatus.
6. In general, all visible or audible leaks shall be fixed regardless of previous testing results.

B. Final Inspection

1. Upon completion of the Work, the CONTRACTOR shall conduct a complete inspection of all items of Work instituted by the Contract obligations; and make whatever corrections and adjustments deemed necessary to a well functioning system, same to meet the satisfaction of the ENGINEER and the OWNER.
2. The CONTRACTOR shall signify his readiness for final inspection in writing to the ENGINEER. The time of inspection may occur at the time of "Operating and Instructions." The inspection shall be made in the presence of the OWNER and ENGINEER.

**3.03 Equipment Startup**

- A. After completion of the installation, all systems and equipment shall be tested by the CONTRACTOR in the presence of the ENGINEER under actual operating conditions. Tests shall be performed according to manufacturer's recommendations.
- B. Installed equipment shall be operated under full working load conditions before being accepted by the ENGINEER as ready for satisfactory operation. Each piece of equipment shall be certified by the representative that installation is correct and ready for satisfactory operation.
- C. The manufacturer or supplier of each piece of equipment shall provide the services of a representative to field review installation procedures with the CONTRACTOR, inspect installed equipment and adjust for satisfactory operation. The CONTRACTOR shall include with his bid the services of all required equipment manufacturer's field service technician for a period necessary to complete the work to the satisfaction of the ENGINEER and OWNER. The representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment. A written report covering the technician's findings and installation approval shall be submitted to the ENGINEER covering all inspections and outlining in detail any deficiencies noted.
- D. Specific requirements, if any, for a particular system or piece of equipment are contained in the particular specification sections. The CONTRACTOR's responsibility relative to coordinating these services are contained in Section 01 7700, Closeout Procedures.

**3.04 Adjustment and Cleaning**

- A. Before turning the project over to the OWNER, clean all fixtures, piping, covering, exposed metal surfaces and leave all in clean condition at the end of the Work and remove from the premises all refuse, dirt and rubbish which are a result of the mechanical Work or workmen. Also, remove from the premises all cartons, scrap, and major debris at least once a week during progress of the Work.
- B. All instruments used in the checking, adjusting, and balancing shall be accurately calibrated and maintained. Accuracy tests on instruments shall be performed in the presence of and whenever requested by the OWNER or the ENGINEERS.
- C. Air and water balance and checking shall not begin until systems have been completed and are in full working order. The CONTRACTOR shall put all heating, ventilating, and air

conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

**3.05 Spare Parts and Special Tools**

- A. Spare parts shall be provided for each piece of equipment as specified in various Sections of this Division and shall be delivered to the Project site in boxes with labels identifying contents. Special tools necessary for maintenance by OWNER shall be furnished with each particular piece of equipment. These tools shall be included whether or not specified in various Sections of this Division.
- B. Delivery of all parts and/or special tools shall be made prior to Contract Closeout as specified in Section 01 7700, Closeout Procedures. Storage shall be where determined by ENGINEER.

End of Section

Not To Be Used For Bidding Purposes

PUMP RECORD CARD

NAME \_\_\_\_\_ MAKE \_\_\_\_\_ MODEL \_\_\_\_\_  
TYPE \_\_\_\_\_ SIZE \_\_\_\_\_ SERIAL # \_\_\_\_\_  
ORDER NUMBER \_\_\_\_\_ SUPPLIER \_\_\_\_\_ DATE PURCHASED \_\_\_\_\_  
DATE INSTALLED \_\_\_\_\_ APPLICATION \_\_\_\_\_ PLANT # \_\_\_\_\_

Nameplate Data and Pump Info

Stuffing Box Data

Motor Data

GPM \_\_\_\_\_ Diameter \_\_\_\_\_ Depth \_\_\_\_\_ Name \_\_\_\_\_ Serial # \_\_\_\_\_  
TDH \_\_\_\_\_ Pack. Size \_\_\_\_\_ Type \_\_\_\_\_ H.P. \_\_\_\_\_ Speed \_\_\_\_\_  
RPM \_\_\_\_\_ Length \_\_\_\_\_ No. Rings \_\_\_\_\_ Ambient° \_\_\_\_\_  
Gage Press Disc \_\_\_\_\_ Lantern Ring \_\_\_\_\_ Flushed \_\_\_\_\_ RPM \_\_\_\_\_ Frame \_\_\_\_\_  
Gage Press Suc \_\_\_\_\_ Mech. Seal Name \_\_\_\_\_ Size \_\_\_\_\_ Volts \_\_\_\_\_ Amps \_\_\_\_\_  
Shut Off Press \_\_\_\_\_ Type \_\_\_\_\_ Phase \_\_\_\_\_ Cycle \_\_\_\_\_  
Suction Head \_\_\_\_\_ Shaft Size \_\_\_\_\_ Key \_\_\_\_\_

Pump Materials

Rotation \_\_\_\_\_ Casing \_\_\_\_\_ Bearing Front \_\_\_\_\_  
Impeller Type \_\_\_\_\_ Shaft \_\_\_\_\_ Rear \_\_\_\_\_  
Impeller Dia. \_\_\_\_\_ Wearing Rings Casing \_\_\_\_\_ Code \_\_\_\_\_ Type \_\_\_\_\_  
Impeller Clear \_\_\_\_\_ Wearing Rings Impeller \_\_\_\_\_ Amps @ Max Speed \_\_\_\_\_  
Coupl Type & Size \_\_\_\_\_ Shaft Sleeve \_\_\_\_\_ Amps @ Shut Off \_\_\_\_\_  
Front Brg # \_\_\_\_\_ Slinger \_\_\_\_\_ Control Data Info \_\_\_\_\_  
Rear Brg # \_\_\_\_\_ Shims \_\_\_\_\_ Starter \_\_\_\_\_  
Lub Interval \_\_\_\_\_ Gaskets \_\_\_\_\_ NEMA Size \_\_\_\_\_  
Lubricant \_\_\_\_\_ "O" Rings \_\_\_\_\_ Cat. # \_\_\_\_\_  
Wearing Rings \_\_\_\_\_ Brg. Seals Front \_\_\_\_\_ Heater Size \_\_\_\_\_  
Shaft Sleeve Size \_\_\_\_\_ Rear \_\_\_\_\_ Rated @ \_\_\_\_\_  
Pump Shaft Size \_\_\_\_\_ Casing Wear Ring Size ID \_\_\_\_\_ Control Voltage \_\_\_\_\_  
Pump Keyway \_\_\_\_\_ OD \_\_\_\_\_ Variable Speed Type \_\_\_\_\_  
\_\_\_\_\_ Width \_\_\_\_\_ Speed Max \_\_\_\_\_  
Other Related Info  
Impeller Wear Ring ID \_\_\_\_\_ Speed Mix \_\_\_\_\_  
OD \_\_\_\_\_ Width \_\_\_\_\_

## Section 40 0507 Pipe Support Systems

### Part 1 General

#### 1.01 Summary

- A. Section Includes:
  - 1. Pipe support and anchor systems.
- B. Related Sections include but are not necessarily limited to:
  - 1. Division 00 – Procurement and Contracting Requirements.
  - 2. Division 01 - General Requirements.
  - 3. Section 09 9100 - Painting and Coatings.
  - 4. Section 40 1500 - Process Piping.

#### 1.02 Quality Assurance

- A. Referenced Standards:
  - 1. ANVIL International (ANVIL).
  - 2. American Society of Mechanical Engineers (ASME):
    - a. B31.1, Power Piping.
    - b. B31.3, Process Piping.
  - 3. ASTM International (ASTM):
    - a. A36, Standard Specification for Carbon Structural Steel.
    - b. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
    - c. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
  - 4. American Welding Society (AWS):
    - a. D1.1, Structural Welding Code - Steel.
  - 5. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
    - a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
    - b. SP-69, Pipe Hangers and Supports - Selection and Application.

#### 1.03 Submittals

- A. Shop Drawings:
  - 1. See Section 01 3300 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.
    - c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
    - d. Scale drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

## Part 2 Products

### 2.01 Acceptable Manufacturers

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 2513.
- C. For pipe supports for large diameter piping, refer to Contract Drawings for pipe support details, locations, and spacing.

### 2.02 Manufactured units

- A. Hanger Rods:
  - 1. Material:
    - a. ASTM A36.
    - b. ASTM A575, Grade M1020.
    - c. ASTM A576, Grade 1020.
    - d. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
  - 2. Continuously threaded.
  - 3. Electro-galvanized or cadmium plated after threads are cut.
  - 4. Load limit:

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD, (LBS)
3/8 IN DIA (min)	610
1/2 IN DIA	1,130
5/8 IN DIA	1,810
3/4 IN DIA	2,710
7/8 IN DIA	3,770
1 IN DIA	4,960

- B. Hangers:
  - 1. Hangers for use directly on copper pipe: Copper or cadmium plated.
  - 2. Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.
  - 3. Hanger type schedule:

APPLICATION	PIPE SIZE	HANGER TYPE
All except noted	4 IN and less	ANVIL Figure 108 with Figure 114
All except noted	Over 4 IN	ANVIL Figure 590
Steam, condensate and hot water	All	ANVIL Figure 181, Figure 82

- C. Concrete Inserts for Hanger Rods:
  - 1. Continuous slots: Unistrut #P1000.
  - 2. Individual inserts: ANVIL Figure 281.
  - 3. Self-drilling expansion anchors: Phillips flush-end or snap-off end type.



- D. Beam Clamps for Hanger Rods:
1. Heavy duty.
  2. ANVIL Figure 133 or 134.
- E. Trapeze Hangers for Suspended Piping:
1. Material: Steel.
  2. Galvanized.
  3. Angles, channels, or other structural shapes.
  4. Curved roller surfaces at support point corresponding with type of hanger required.
- F. Vertical Pipe Supports:
1. At base of riser.
  2. Lateral movement:
    - a. Clamps or brackets:
      - 1) ANVIL
- G. Expanding Pipe Supports:
1. Spring hanger type.
  2. MSS SP-58.
- H. Pipe Support Saddle:
1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
  2. ANVIL Figure 264.
- I. Pipe Support Risers:
1. Schedule 40 pipe.
  2. Galvanized.
  3. As recommended by saddle manufacturer.
- J. Pipe Support Base Plate:
1. 4 IN larger than support.
  2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
  3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
  4. Collar welded to floor plate.
  5. Edges ground smooth.
  6. Assembly hot dipped galvanized after fabrication.
- K. Pipe Covering Protection Saddle:
1. For insulated pipe at point of support.
  2. ANVIL Figure 167, Type B.
- L. Wall Brackets:
1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated on the Drawings.

2. ANVIL Figure 199.
- M. Pipe Anchors:
1. For locations shown on the Drawings.
  2. 1/4 IN steel plate construction.
  3. Hot dipped galvanized after fabrication.
  4. Designed to prevent movement of pipe at point of attachment.
- N. Pipe Guides:
1. For locations on both sides on each expansion joint or loop.
  2. To ensure proper alignment of expanding or contracting pipe.
  3. ANVIL Figure 256.

### 2.03 Design Requirements

- A. For pipe supports for large diameter piping, refer to Contract Drawings for pipe support details, locations, and spacing.
- B. Supports capable of supporting the pipe for all service and testing conditions.
1. Provide 5 to 1 safety factor.
- C. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.
- D. Design supports and hangers to allow for proper pitch of pipes.
- E. For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
1. ASME B31.3.
  2. MSS SP-58 and MSS SP-69.
  3. Except where modified by this Specification.
- F. For steam and hot and cold water piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
1. ASME B31.1.
  2. MSS SP-58 and MSS SP-69.
- G. Check all physical clearances between piping, support system and structure.
1. Provide for vertical adjustment after erection.
- H. Support vertical pipe runs in pipe chases at base of riser.
1. Support pipes for lateral movement with clamps or brackets.
- I. Place hangers on outside of pipe insulation.
1. Use a pipe covering protection saddle for insulated pipe at support point.

2. Insulated piping 1-1/2 IN and less: Provide a 9 IN length of 9 LB density fiberglass insulation at saddle.
  3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of 9 LB density fiberglass insulation on saddle.
- J. Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure minimum contact width of 4 IN.

K. Pipe Support Spacing:

1. General:
  - a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.
  - b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.
  - c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.

2. Steel, stainless steel, ductile-iron pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

3. Copper pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
2-1/2 and less	5
3 thru 6	10
8 and greater	15

4. PVC pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/4 and less	3
1-1/2 thru 3	4
4 and greater	5

\* Maximum fluid temperature of 120 DegF.

5. Support each length and every fitting:
  - a. Bell and spigot piping:
    - 1) At least one (1) hanger.
    - 2) Applied at bell.
  - b. Mechanical coupling joints:
    - 1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.
6. Space supports for soil and waste pipe and other piping systems not included above every 5 FT.
7. Provide continuous support for nylon tubing.

## Part 3 Execution

### 3.01 Installation

- A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
1. Included in this requirement are movements from:
    - a. Trap discharge.
    - b. Water hammer.
    - c. Similar internal forces.
- B. Weld Supports:
1. AWS D1.1.
  2. Weld anchors to pipe in accordance with ASME B31.3.
- C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.
- D. Inspect hangers for:
1. Design offset.
  2. Adequacy of clearance for piping and supports in the hot and cold positions.
  3. Guides to permit movement without binding.
  4. Adequacy of anchors.
- E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.
- F. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
1. Install concrete inserts as concrete forms are installed.
- G. Welding:
1. Welding rods: ASTM and AWS standards.
  2. Integral attachments:
    - a. Include welded-on ears, shoes, plates and angle clips.
    - b. Ensure material for integral attachments is of good weldable quality.
  3. Preheating, welding and postheat treating: ASME B31.3, Chapter V.
- H. Field Painting:
1. Comply with Section 09 9100 – Painting and Coatings.

End of Section

# Section 40 1500 Process Piping

## Part 1 General

### 1.01 Scope of Work

- A. CONTRACTOR shall provide labor, materials, equipment, tools and services required for the furnishing and installation of process piping, complete with pipe, fittings, valves, connections, and accessories such as hangers, supports and operators as indicated on the Plans or as required for a complete and functioning system.
- B. Piping shall be furnished and installed of the materials and sizes and at elevations and locations shown, indicated, or specified elsewhere in the Contract Documents and/or in this specification.

### 1.02 Related Work Specified Elsewhere

- A. Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
  - 1. Section 01 3300: Submittal Procedures
  - 2. Section 09 9100: Painting and Coating
  - 3. Section 11 1000: Mechanically Cleaned Bar Screen
  - 4. Section 11 2000: Washer Compactor
  - 5. Section 40 0507: Pipe Support Systems

### 1.02 Reference Standards

- A. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:
  - 1. ANSI - American National Standards Institute
  - 2. ASME - American Society of Mechanical Engineers
  - 3. ASTM - American Society for Testing and Materials
  - 4. AWWA - American Water Works Association
  - 5. NCPWB - National Certified Pipe Welding Bureau
  - 6. NEMA - National Electrical Manufacturers' Association
  - 7. UL - Underwriters Laboratories

### 1.03 System Description

- A. General:
  - 1. Drawings show general arrangement, direction, and sizes of pipes. Drawings are not intended to show every offset and fitting, or every structural difficulty that may be encountered. CONTRACTOR shall install the piping and appurtenances to suit, and to avoid interference with installation, operation, and maintenance of fixtures, equipment, or other piping. CONTRACTOR shall verify dimensions and measurements prior to furnishing and installing the Work specified herein.
  - 2. CONTRACTOR shall provide piping with necessary hangers, anchors, and supports as specified herein and as indicated. Piping supported by equipment to which it is connected is not acceptable.

## 1.04 Submittals

### A. Shop Drawings and Product Data:

#### 1. Shop Drawings:

- a. Submit shop drawings as required in Sections 01 3300, Submittal Procedures and 40 0500, Process Equipment General Requirements, showing the layout of the piping systems complete with piping, supports, and structural dimensions.
- b. Shop drawings shall identify all joints, valves, fittings, component parts, pipe material, insulation where required, and valve identification codes. Supports and anchors shall be shown in the layout and detailed.
- c. CONTRACTOR shall verify in the field, the location, position, and size of existing piping (including buried pipes), as indicated on the Contract Drawings and Specification to be reused, forming a part of the new process piping layout.
- d. Process piping Shop Drawings submitted to ENGINEER for review shall clearly indicate the location, position (elevation), and size of existing piping to be reused.

### B. Product Data:

1. Submit product data as required in Section 01 3300, Submittal Procedures. Include manufacturer's recommendations for installation, connection to automatic operators, and instructions for proper operation and maintenance.
  - a. Valve operator data shall also include information necessary for any external controls, wiring or hydraulics to be furnished, installed or connected by other Work.

### C. Welders Certification:

1. Submit certification of welders and/or welding process for fabrication and/or field assembly.

### D. Record Drawings:

1. Submit record drawings as required in Section 40 1000, Process Equipment General Requirements.

## 1.05 Quality Assurance

### A. Welding, Brazing or Soldering:

1. Qualify welding/brazing processes and welder/brazer performance in accordance with AWS B2.2, Standard for Brazing Procedure and Performance Qualification, or ASME Boiler and Pressure Vessel Code, Section IX. Certify that each welder/brazer has satisfactorily passed AWS or ASME qualification tests for welding/brazing processes involved and, if pertinent, have undergone re-certification.
2. Welding and brazing procedures shall address cleaning, joint clearance, overlaps, internal purge gas, purge gas flow rate, and filler metal.
3. Certification of procedures and operators applies for both shop and job site welding

- and brazing of pipe work.
4. If required, apply for and obtain a "Hot Work Permit" from OWNER.
  5. Performance qualification of welders/brazers shall remain in effect indefinitely unless the welder/brazer does not weld or braze with the qualified procedure for a period exceeding 12 months, or there is a specific reason to question the ability of the welder/brazer.
  6. Soldering: Conform to ASME B31.3, Process Piping and Copper Development Association recommended practices.
- B. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. All castings used for coupling housings, fittings, valve bodies, etc. shall be dated stamped for quality assurance.

### **1.06 Delivery, Storage, and Handling**

- A. Handling:
1. Pipe and special castings shall be handled in such a manner as to avoid any damage to pipe or specials.
    - a. In the event pipe coating is damaged, especially on the inside of the pipe, the damaged area shall be cleaned by wire brushing and then recoated with an approved coating similar to that specified for the pipe.
- B. Storage:
1. Store materials in enclosures or under protective coverings. Keep inside of pipe fittings and valves free of dirt and debris. Store in a manner for easy identification of all materials.

### **1.07 Spare Parts**

- A. Furnish spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than delivery of equipment specified herein.
- B. Pack in containers bearing labels clearly designating contents and pieces of equipment for which the part is intended. Each part shall be identified with a tag bearing its part number and a part description.

## **Part 2 Products**

### **2.01 Pipe System**

- A. General:
1. Pipe systems shall conform to the materials or component performance as specified herein and the pipe schedule as shown on the drawings.
- B. Design Requirements:
1. Provide piping, valves and related products for a 1/2" potable water feed to the Washer Compactor. The supply piping shall be copper, and the pipe system shall be designed for a working pressure of 80 psi.

2. Providing piping, valves, and related products for a 3" drain line to collect drainage from the Washer Compactor and convey it to the influent channel by gravity flow. The drain piping shall be PVC, and the pipe system shall be open to the atmosphere.
- C. Copper Pipe:
1. Material:
    - a. Copper pipe shall be Type L and shall meet the specifications of ASTM Standard B-88 for all inside service. The minimum diameter of a service shall be 1/2-inch.
  2. Fittings:
    - a. Fittings used with this pipe above grade (interior) shall be soldered joint type fittings.
    - b. Grooved end fittings shall be manufactured to copper-tube dimensions of cast bronze per ASME B16.18 or wrought copper per ASME B16.22.
    - c. Connection of copper piping to the Washer Compactor water supply shall be 1/2-inch male NPT.
  3. Joints:
    - a. Copper joints shall be thoroughly cleaned and the end of pipe uniformly flared or cut by a suitable tool to the bevel of the fitting used. Wrenches shall be applied to the bodies of the fittings where the joint is being made and in no case to a joint previously made.
    - b. Grooved joint couplings shall consist of two ductile iron housing segments cast with offsetting angle-pattern bolt pads, pressure responsive gasket, and ASTM A449 electroplated steel bolts and nuts. Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 607H. Installation-Ready gaskets shall be grade EHP suitable for water or dry air to +250 deg F, or Nitrile grade T suitable for air with oil vapors to +180 deg F.
- D. Polyvinyl Chloride Pipe (PVC):
1. PVC Solid Wall Pipe in sizes 1/2-inch through 3-inch shall be ASTM D1785, schedule 80, 6-inch through 15-inch shall be ASTM D3034, SDR 35, and in sizes 18-inch through 27-inch shall be ASTM F679 SDR35, polyvinyl chloride pipe (PVC).
  2. Joints for polyvinyl chloride pipe (PVC) shall be ASTM D2855, solvent cemented or ASTM D3212, push-on type. A joint in which an elastomeric ring gasket is compressed in the annular space between a bell end or socket and a spigot end of pipe.
  3. Wyes or tees shall be a molded wye or tee fitting per ASTM D2680, with gasketed joints on each end suitable for directly inserting in the mainline pipe. Wye and tee fittings shall be furnished with the spurs securely fastened by the manufacturer to the barrel of the pipe. There shall be no projection on the inner surface of the pipe. Branch connection fitting shall be a gasketed joint suitable for the house lead pipe specified. Saddle connections are not allowed.
  4. Connection of PVC piping to the Washer Compactor drain shall be 3-inch female NPT.

## 2.02 Sleeve-Type Couplings

- A. Pressure rating at least equal to that of related pipeline.
- B. Manufactured by Dresser Mfg. Div., Bradford, PA; Rockwell International, Municipal & Utility Div., Pittsburgh, PA; R.H. Baker & Co., Inc., Los Angeles, CA; or equal.



- C. Couplings for Exposed Pipe: Steel; Dresser Style 38, 127 or 128 Rockwell Style 411, Baker Series 200, or equal. Couplings provided with type 304 or 316 stainless steel bolts and nuts. Provide tie rods across couplings as shown.
- D. Furnished with pipe stop removed.
- E. Provided with gaskets of composition suitable for exposure to liquid or gas within pipe.

### 2.03 Valves

- A. Brass Ball Valves:
  - 1. Bronze body and trim ASTM B 584
  - 2. Full Port.
  - 3. TFE Seat.
  - 4. Blowout proof stem.
  - 5. 600 PSI WOG/150 PSI S-steam.
  - 6. In-line disassembly design.
  - 7. Acceptable Manufacturers:
    - a. Nibco
    - b. Stockham
    - c. Apollo
- B. PVC Ball Valves:
  - 1. Fabricated of same material as PVC pipe
  - 2. Full Port.
  - 3. Acceptable Manufacturers:
    - a. Hayward
    - b. G. F. Plastics Systems, Inc.
    - c. Chemtrol
    - d. Or Approved Equal

## Part 3 Execution

### 3.01 Contractor's Verification

- A. CONTRACTOR shall field measure dimensions and check possible interferences for the pipe system and accessories.

### 3.02 Preparation

- A. Pipe fittings and accessories shall be free of all foreign matter. Accumulations of dirt, rust, scale, etc., shall be removed prior to installation. Pipe ends shall be reamed and deburred to prevent loose particles from getting into the pipe line.

### 3.03 Installation

- A. General:
  - 1. Piping installation shall be coordinated, with respect to space available, with heating, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment.

2. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted.
3. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers.
4. Aboveground piping shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet.
5. Service pipe, valves, and fittings shall be located a sufficient distance from other work to permit the installation of the finished covering not less than 1/2" from such other work, and not less than 1/2" between the finished covering on the different services.
6. Valves shall be installed at the locations shown on the drawings and where specified. Valves shall be installed with their stems orientated horizontal or vertical and with sufficient clearance to allow for full stem travel and the repair of two-piece or three-piece valves in place.
7. Piping connections to equipment shall be aligned and supported in such manner that no load or thrust will be exerted upon the equipment by the piping at installation or in operating conditions.
8. Cutting of the pipe shall be done in a neat workmanlike manner with the least amount of waste and without damage to existing or new lines. A fine tooth saw, tubing, or pipe cutter, or similar tool shall be used to cut the pipe. Cuts must be square and ragged edges removed with a burring tool and/or file.
9. After cutting bell and spigot or socket pipe a stop mark shall be made with a pencil or crayon using dimensions as shown by the manufacturer's instructions or by using another pipe in the field as a guideline.
10. Cutting of concrete walls, floors or ceilings shall be avoided and requires written approval from ENGINEER. If approved, holes shall be core drilled and patched. Reinforcement steel shall not be cut or disturbed.
11. At the termination of pipe installation any open ends of pipelines shall be closed off by a suitable cover until installation operations are resumed.

B. Pipe Supports:

1. Refer to Section 40 0507 – Pipe Support Systems.
2. Piping shall be rigidly supported from the building structure by means of adjustable ring-type, clevis, or band-type hangers. Where pipes run side by side, they shall be supported using rod and angle iron, or Unistrut trapeze hangers.
3. Polyvinyl chloride pipe, fiber glass reinforced pipe, rubber hose, tubing, etc., shall be supported along the entire length by means of a steel channel or angle iron or approved tray anchored to the floor, wall, or ceiling with supports per above. Where shown, chemical feed lines are installed in containment piping.
4. Valves shall be supported to keep undue strain off of piping and adjacent equipment.
5. Equipment requiring periodic maintenance shall be supported to allow easy removal with a minimum of temporary supporting.
6. Hanger rods shall be connected to beam clamps or concrete inserts. Clamps or inserts shall be Underwriter's Laboratories approved. "C" clamps will not be permitted.
7. Expansion anchors may be used upon written approval by ENGINEER. Holes for expansion anchors shall be made by rotary drilling only, hammering devices will not

be permitted. Explosive studs may be used provided they are driven under safe conditions.

8. Anchors, guides and sway braces shall be provided to allow for forces on the piping system. Sleeves shall be provided on pipe subject to movement. Sleeves shall be no less than four inches wide or have a width equal to  $1/3$  the diameter of the pipe, whichever is larger.
9. Vertical piping shall be supported at each floor or grating level with approved riser clamps except where prohibited by piping flexibility requirements. Lateral movement of exposed vertical piping at building walls shall be restrained by anchor devices attached to walls except where prohibited by piping flexibility requirements. Provide retaining straps when clamps are used.

C. Joints:

1. Flanged Joints: Flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be machined flush. All flange bolt holes shall straddle the horizontal and vertical centerlines unless otherwise noted. Install insulating kits on flanges connecting dissimilar metals such as steel to copper in order to prevent electrolytic action. Bolting shall comply with ASME B31.3, Process Piping. Torque values and tightening sequence for bolts shall be in accordance with flange manufacturer's instructions.
2. Threaded Joints: Threaded pipe joints shall have American Standard Taper Pipe Threads complying with ASME B1.2. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Metal screwed pipe joints shall be made leak tight by the use of Teflon tape, pipe thread lubricant, or Teflon tape and a pipe-lubricating compound. Thermoplastic threaded pipe joints shall be made leak tight per product manufacturer's recommendations. When joining thermoplastic threaded pipe to metal threaded piping attempts should be made to screw the plastic pipe into female metal pipe fittings in order to reduce the likelihood of plastic fitting failure.
3. Solder-Joints: Tubing shall be cut square, reamed, and burrs removed. Both the inside of fittings and the outside of tubing shall be well cleaned with sand cloth or wire brush before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Solders containing lead or cored solders are not permitted. Joints shall conform to ASTM B828. Joints shall comply with ASME B31.3, Process Piping and the Copper Development Association.
  - a. Solder containing antimony shall not be used to join metals containing zinc (e.g., galvanized iron, galvanized steel, and brass).
  - b. Use sand cloth or a stainless steel wire brush to clean surfaces to be joined.
  - c. Solder End Valve:
    - (1) Use a gate, globe, two-piece or three-piece ball valve for solder end valves.
    - (2) When joining a solder end valve, ensure valve is fully open. Apply heat to tube first.
    - (3) Transfer as much heat as possible through the tube to the valve. Avoid prolonged heating of the valve.
    - (4) Use a noncorrosive paste flux and solid wire solder suitable for the service temperatures and pressures expected.
4. Brazed Joints: New copper systems shall be installed with socket type fittings and with an argon or nitrogen purge applied. Flux shall not be used except where joining specialty items and fittings that are not available in copper. Brazing filler metals shall comply with AWS A5.8, Specification for Brazing Filler Metals. Copper-to-copper joints shall be brazed using a copper-phosphorus or copper-phosphorous-silver brazing

filler metal (BCuP) without flux. Copper-to-bronze or copper-to-brass joints shall be brazed using an appropriate flux with 45% silver (Bag-5 series) brazing filler metal. The following procedure shall be followed:

- a. Tube ends shall be cut square using a sharp tubing cutter. The wheel shall be free from grease, oil, or dirt. The cut end of the tubing shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube or pipe.
  - b. The surfaces to be brazed shall be mechanically cleaned. Joints shall be recleaned if they become contaminated prior to brazing. Joints shall be brazed within 1 hour of being cleaned.
  - c. Where dissimilar metal joints, such as copper to bronze or brass are being brazed, flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. Where possible, short sections of copper tube shall be brazed to the non-copper components and the interior of the subassembly shall be cleaned of the flux prior to installation in the piping system. Flux-coated brazing rods may be used in lieu of the application of flux to the surfaces to be joined for tubes  $\frac{3}{4}$ " size and smaller.
  - d. While being brazed, joints shall be continuously purged with oil-free dry nitrogen or argon to prevent the formation of copper oxide on the inside surface of the joint. The flow of the purge gas shall be maintained until the joint is cool to the touch.
  - e. Exception: A final connection to an existing system shall be permitted to be made without the use of a purge gas.
  - f. During and after installation, openings in the piping system shall be kept capped or plugged to avoid unnecessary loss of purge gas and to prevent contamination. Do not begin brazing until piping is fully purged of air. For continuous runs of piping, brazing shall begin at the purge port area and continue through the system. The purge connection shall not be changed. While brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is introduced. During brazing, the purge gas flow rate shall be maintained at a level that will not produce a positive pressure in the piping system. While welding, the minimum purge rate shall be 15 scfh for  $\frac{1}{4}$ " tubing or 25 scfh for all tubing  $\frac{3}{8}$ " and larger. Purge shall continue after completion of braze until the joint is cool.
  - g. After brazing, the outside of all joints shall be cleaned by washing with water and a stainless steel brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.
5. Solvent Cement Joints: CPVC and all thermoplastic pipe solvent cement joints shall follow the manufacturer's installation instructions for assembly of joints with respect to pipe size and ambient conditions. Installations shall comply with ASTM F 402 "Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings".
  6. Expansion Joints: Expansion joints shall be installed where indicated on the Plans and in accordance with the manufacturer's recommendations. Pipe systems shall be properly supported so expansion joints do not carry any loads. Piping on equipment adjacent to expansion joints shall be anchored to prevent excessive elongation of the pipe system when subject to pressure. Restrained expansion joints shall be used when adequate anchoring is not available. Misalignment of installation shall not exceed  $\frac{1}{8}$ " to allow full movement of expansion joints when necessary. Do not cover expansion joints with insulation. Straight, concentric or eccentric tapered joints shall be used as indicated on the Plans.

### 3.04 Field Quality Control

#### A. General:

1. Installed pipe systems shall be tested by hydrostatic or pneumatic means as specified in Section 40 0500, Process Equipment General Requirements, and herein.
2. Hydrostatic testing shall be for any fluid type material to be handled with pneumatic testing for any gas or air pressurized lines.
3. Testing shall be made with the temperatures of surrounding air and test water or air approximately constant within operating temperature ranges.
4. Pipe ends shall be valved or blanked off. Exterior surfaces of pipes, fittings, or valves shall show no cracks or other forms of leakage.

#### B. Hydrostatic Testing:

1. Process piping shall be tested with water.
2. Exposed piping shall be drop tight for a period of two hours under test pressures as detailed in the Contract Drawings.

End of Section

Not To Be Used For Bidding Purposes