

**CITY OF ALBANY, OREGON**

**RIVERFRONT INTERCEPTOR  
SEWER LIFT STATION AND FORCE MAIN**

**SPECIFICATIONS**

**APRIL 2019**

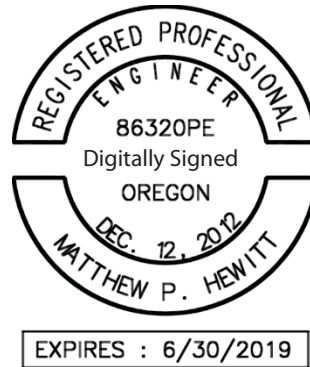


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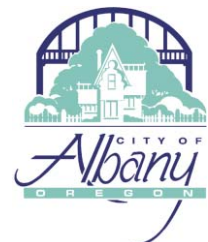
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**CITY OF ALBANY**  
**RIVERFRONT INTERCEPTOR SEWER LIFT STATION AND FORCE MAIN**  
**PROJECT NO. 519-14-18-18**

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**APPENDIX A – (FOR REFERENCE ONLY)**

Shannon & Wilson, *Geotechnical Engineering Report – Riverfront Interceptor Sewer Lift Station and Force Main*, Albany, OR. April 2019

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## SECTION 01110

### SUMMARY OF WORK

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. General description of the Project and the Work to be performed by the Contractor.

##### 1.02 WORK COVERED BY CONTRACT

- A. The Work covered under this Contract will be performed along public right of ways located within the City of Albany and at the City of Albany owned proposed lift station site. The project location is indicated on the Drawings.
- B. The Work to be performed by the Contractor generally includes:
  - 1. Furnishing all labor, superintendence, materials, power, water, tools, equipment and services required by the Contract Documents or required to complete the Work.
  - 2. Coordinate work of all subcontractors and trades.
  - 3. Furnishing and installing miscellaneous items incidental to or necessary for completion of the Work, whether these items are specifically indicated in the Contract Documents or not.
- C. The Work consists of construction of the following items:
  - 1. Schedule A:
    - a. Site clearing and grubbing, tree removal, shoring and excavation for construction of subgrade lift station structure (wet well), vault, and diversion structure, sanitary sewer and manhole, pigging station, and associated site improvements, electrical service, transformer, and electrical building, electrical equipment and conduits, instrumentation and control improvements. The wet well includes installation of three (3) submersible wastewater pumps and associated piping, valves, sump pump and appurtenances. Site improvements include new concrete pedestrian/vehicle concrete path, grass paving surfacing. LSI Networks will be relocating existing fiber optic lines that
  - 2. Schedule B:
    - a. Approximately 7,100 linear feet of 30-inch nominal diameter AWWA C900-16 DR 25 Force Main, five (5) wastewater combination air valves assemblies, force main flushing connection, connection to the existing 54-inch sanitary sewer interceptor in Davidson Street, three (3) railroad crossings with casings, replacement of one (1) storm drain catch basin and lateral, pavement restoration, concrete pavement and concrete paver removal and

reinstallation. Contractor may choose to furnish and install HDPE pipe and fittings in lieu of PVC pipe. Contractor shall submit a plan outlining all HDPE pipe and fittings for Engineer review prior to acceptance.

D. Owner-Furnished Equipment:

1. Owner will furnish the following products to Contractor for installation:

- a. Concrete Pavers. The contractor is responsible to remove the existing concrete pavers to replace after trenching. If any are damaged during the course of the work, the City will provide replacements. Coordinate with Owner to determine number of concrete pavers available and to obtain if required.

E. Work under this Contract includes all provisions necessary to fully incorporate Owner-furnished products, including piping, fasteners, supports, conduit and conductors, coatings and other provisions necessary for a complete and operational installation.

### 1.03 OTHER CONTRACTS

- A. Construction of portions of the force main may coincide with construction activities by other contractors and agencies. Coordination with the contractors undertaking related work or un-related work within the project work areas is the responsibility of the Contractor.

### 1.04 SPECIFICATION LANGUAGE

- A. Specifications may be written in the imperative mood and streamlined form in accordance with practices and principals of the Construction Specifications Institute.
- B. Imperative language is directed to the Contractor unless specifically noted otherwise.
- C. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

### 1.05 REGULATORY REQUIREMENTS

- A. Comply with all Federal, State, and local laws, regulations, codes, and ordinance applicable to the work.
- B. Obtain a City of Albany Erosion Prevention & Sediment Control Permit and City of Albany 1200-CN Permit.
- C. Building permits.
- D. Refer to the Division 1 General Requirements for information on compliance with the requirements set forth by the Oregon Department of Environmental Quality (DEQ) Clean Water State Revolving Fund (CWSRF) Loan Program.
- E. Other standards and codes that apply to the work are designated in the Specifications.

1.06 ACCESS BY GOVERNMENT OFFICIALS

- A. Authorized representatives of governmental agencies shall have access to the work area at all times. Provide proper facilities for access and inspection.

1.07 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- A. Pipeline construction will encounter numerous existing features of various types, such as fences, drain culverts, irrigation facilities, roadside drainage facilities, mailboxes, signs, private and public driveways, curbs, asphalt pavement, buildings, utility poles, guy wires and other surface structures. Protect existing features of this nature and restore features affected by construction operations to their original condition.
- B. To the greatest extent possible, remove existing features without damaging the materials and re-use the material to place back in the original condition. When existing features are damaged during removal, install new materials of similar type, appearance and function, at no additional cost to the Owner.
- C. Contractor shall be responsible for all damage to streets, roads, driveways, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, that may be caused by transporting equipment, materials, or workers to or from the work or any part or site thereof, whether by Contractor or Contractor's subcontractors or suppliers.
- D. Make satisfactory and acceptable arrangements with the Owner of, or the agency or authority having jurisdiction over, any damaged property concerning its repair, replacement, or payment of costs incurred in connection with the damage.
- E. Keep fire hydrants and water control valves free from obstruction and available for use at all times.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

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## SECTION 01140

### WORK SEQUENCE AND CONSTRAINTS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Schedule requirements, construction constraints, and a suggested Work sequence for specific elements of the Project.

##### 1.02 GENERAL SEQUENCING REQUIREMENTS

- A. The sequencing requirements and construction constraints described are critical elements of the Work and are presented to underscore the importance of proper management, planning, scheduling, coordination, and execution of the Work.
- B. Sequencing requirements and construction constraints have been defined in this Section for only certain structures, facilities, and elements of the Work. All work, whether or not addressed in this Section, shall be governed by applicable specified requirements. If additional shutdown constraints are necessary to allow implementation of Contractor's construction procedures and schedule, the Engineer will establish such constraints.
- C. Contractor's Construction Schedule:
  - 1. Clearly illustrate the proposed sequence of construction.
  - 2. Conform to the sequencing requirements and limitations specified in this Section where specified.
  - 3. Modify or adapt the suggested sequencing as necessary to complete the project provided all environmental and service continuity requirements are met.

##### 1.03 OPERATIONAL CONTINUITY

- A. The City of Albany owns and operates wastewater facilities. The Work under this project will interface with these existing facilities.
- B. The existing wastewater collection system continuously receives and conveys wastewater. Do not interrupt functions necessary to maintain operation of these facilities except as approved by the Engineer and as specified herein.
- C. Coordinate the Work to minimize interference and interruption of the normal operation of the Owner's existing facilities through proper planning and by making temporary connections.
- D. Except for allowable out-of-service periods as specified, maintain operation of sanitary and storm sewers, service laterals, catch basins, manholes, and similar facilities.

1. Provide temporary pumps, piping, power, bulkheads, plugs, and other devices that are required to keep such facilities in operation when these must be temporarily taken out of service in order to conduct the Work.
2. Notify the Engineer in writing 3 days in advance of the time it is necessary to take utilities out of service.
3. Notify public agencies and utility companies when service to customers will be temporarily interrupted to perform the Work and coordinate shutdowns with these agencies.

#### 1.04 RAILROAD COORDINATION

- A. This Project is in close proximity to railroad tracks owned by (Burlington Northern Santa Fe (BNSF) Railway and operated by the Portland & Western Railroad (PNWR). However, these railroad tracks are located within the Water Avenue right-of-way which is under the jurisdiction of the City of Albany. No railroad permits are required for the Project. Nonetheless, the Contractor shall provide a minimum of four calendar weeks' notice to the Portland & Western Railroad prior to the start of work and additional notice as noted on the Drawings. Contact the PNWR Rail Master, Davin Helms at (503) 816-8010.
- B. This Project includes three (3) locations where a casing and carrier pipe will be installed under the tracks. Submit a casing installation work plan for each casing installation showing how the work will be completed as noted on the drawings. The Plan shall also include the following information as agreed upon by PNWR and the Contractor:
  1. Date the work will occur
  2. Time work will start
  3. Time work must be completed for normal rail operations
  4. Plan of action in the event Item 3 is not achieved
  5. Plan of action to repair the railroad if, as a result of construction activities, any deviations occur with the track that exceed the current track standards for the Class of track as established by the relevant federal authority.
  6. Contact numbers for the Contractor and PNWR representative who will be the main points of contact the day the work occurs

#### 1.05 WORK AROUND FIBER OPTIC LINES

- A. Give MCI and AT&T 48 hours' notice of each instance where construction will occur in the vicinity of the fiber optic lines. Give AT&T two weeks' notice where construction will occur near the vault buried in the intersection of Water Avenue and Main Street.
- B. It shall be the Contractor's responsibility to comply with all MCI and AT&T-imposed requirements and to protect the fiber optic lines and structures during construction operations. MCI and AT&T may require their lines be excavated by hand to minimize the risk of damage. MCI and AT&T may want their own inspector

on-site during construction of the Project. Contact Thomas Normoyle at (503) 931-1229.

#### 1.06 WORK AROUND UTILITIES

A. Notify the following utilities prior to the start of the work:

Utility	Contact	Telephone	Email
Pacific Power	Eddie Steiner	541-967-6146	<a href="mailto:Eddie.Steiner@PacifiCorp.com">Eddie.Steiner@PacifiCorp.com</a>
NW Natural	Dave Bellinger	541-926-4253 x8238	<a href="mailto:D6b@nwnatural.com">D6b@nwnatural.com</a>
CenturyLink	Travis Vaughn	503-365-5555	<a href="mailto:Travis.vaughn@centurylink.com">Travis.vaughn@centurylink.com</a>
Comcast	Ryan Hansen	541-230-0079	<a href="mailto:Ryan_Hansen@comcast.com">Ryan_Hansen@comcast.com</a>
LS Networks	Craig McPherson	971-291-7873	<a href="mailto:cmcpherson@LSNetworks.net">cmcpherson@LSNetworks.net</a>
AT&T	Thomas Normoyle	503-931-1229	

#### 1.07 PERMIT VIOLATIONS

- A. The wastewater treatment facilities must continuously comply with the Owner’s National Pollutant Discharge Elimination System (NPDES) permit.
- B. Construction of the Work under this Contract must be undertaken in compliance with the terms and conditions of various permits that the Owner has obtained for this project. Contractor to coordinate with Owner to ensure this requirement is met.
- C. In the event NPDES permit violations or spills are caused or, in the Owner’s opinion, will be caused by the Contractor’s operations, the Owner shall be entitled to immediately employ others to stop the violations or potential spills without giving written notice to the Contractor. All costs incurred by the Owner to stop or prevent permit violations shall be paid by the Contractor.
- D. Under no circumstances shall wastewater be discharged, bypassed or spilled to creeks, drainage ditches, or other waterways; storm drain systems; or the ground surface. In the event accidental discharge or bypassing is caused by the Contractor’s operations, the Owner shall immediately be entitled to employ others to stop the bypassing without giving written notice to the Contractor. All costs incurred by the Owner to stop or prevent the bypass shall be paid by the Contractor. The Contractor must notify the owner immediately in the event of a spill.
- E. Penalties imposed on and costs incurred by the Owner as a result of violations caused by the actions of the Contractor, his employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to the Owner resulting directly or indirectly from Contractor’s actions.
  - 1. Under the terms of the NPDES permit issued to the Owner, the Owner is liable for violation penalties. Refer to the Owner’s NPDES Permit for the violation penalty amounts.

#### 1.08 ACCESS

- A. Provide all necessary access to the Owner’s personnel as required to safely and efficiently operate/maintain existing facilities.

- B. Contractor shall maintain access to the Albany Wheelhouse, located at 421 Water Avenue. NE, Albany, Oregon, during business hours.

#### 1.09 WORK AFFECTING PRIVATE PROPERTY

- A. It is essential that the Contractor carefully coordinate the work with private landowners who will be affected by the construction.
- B. Prior to beginning work that is within public right-of-way, but which will temporarily affect owners of private driveways, mailboxes, and other items of private ownership, notify the property owner of the impending construction and provide a written description of the extent of the work that will affect that property owner, the projected impacts and the schedule for completing the work and removing the temporary impact.
  - 1. Notification may consist of fliers that are hung from door handles and shall identify the Contractor's contact person and phone number.
- C. Prior to beginning work in areas that will block access to private driveways and other points of ingress/egress for the general public, prepare an Outage Plan that describes the measures that will be implemented to provide access to private driveways and other points of ingress/egress and how the work will be undertaken to minimize obstructions and inconvenience to private parties and the general public. The Outage Plan shall be submitted to the Engineer for review and work in these areas shall not be started until the Engineer has approved the Outage Plan.

#### 1.10 REMOVING EXISTING FACILITIES FROM SERVICE

- A. Existing systems or individual equipment items shall be isolated, decommissioned, de-energized, or depressurized only by the Owner's operations personnel. This work will be done in accordance with the schedule prepared by the Contractor.
- B. Design and provide all necessary bulkheads, cofferdams, and support structures to allow isolation of work areas from tanks, pipes, and/or channels that are in service. Bulkheads, cofferdams, and support structures shall conform to applicable OSHA requirements.
- C. Provide all necessary temporary pumps, piping, power, electrical wiring, controls, and labor during and subsequent to all shutdown activities as required. Maintain adequate access to the plant facilities, utilities, and equipment during construction to allow continued operation and maintenance by Owner's personnel to take place.
- D. Prior to any shutdown or flow diversion, all materials, bypass pumps, fittings, supports, equipment and tools shall be on the site and all necessary skilled labor scheduled prior to starting any connection work.
- E. If valves or gates need to be opened or closed, or mechanical equipment turned off or turned on, or similar operations performed to allow construction to proceed, this is to be performed by the Owner's operations staff working in coordination with Contractor personnel. Valves and gates that may be used to isolate lines and facilities may not completely seal. Allow for leakage in planning the Work. Clean the work areas as required to perform the work.



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

## **PART 3 - EXECUTION**

### **3.01 WORK COORDINATION**

- A. Schedule and coordinate the overall Work and construction operations, including the work of subcontractors and the timely provision of products and supplies.
- B. Perform Work in an orderly and logical sequence. Individual specification Sections may identify specific requirements that are related to Work sequence. These types of constraints are not repeated in this Section but shall be followed by the Contractor.
- C. Coordinate work near the railroad as indicated on the drawings. Provide for normal, scheduled train operations.
- D. Coordinate with all businesses and leases of the Albany Wheelhouse, located at 421 Water Avenue. NE, Albany, Oregon. Access to the Wheelhouse property must be maintained during business hours.

### **3.02 WORK CONSTRAINTS**

- A. Work Hours
  - 1. Except as otherwise required for the safety or protection of persons and except as otherwise stated in the Contract Documents, Work may only be performed Monday through Friday during the hours of 7:00 am and 6:00 pm. Contractor will not perform of Work on a Sunday or any legal holiday defined by the City of Albany without written consent from the Owner.
  - 2. Legal holidays are defined as:
    - a. New Year's Day on January 1.
    - b. Memorial Day on the last Monday in May.
    - c. Independence Day on July 4.
    - d. Labor Day on the first Monday in September.
    - e. Thanksgiving Day on the fourth Thursday in November.
    - f. The Friday after Thanksgiving Day in November.
    - g. Christmas Day on December 25.
    - h. When a holiday falls on Sunday, the following Monday is recognized as the legal holiday. When a holiday falls on a Saturday, the preceding Friday is recognized as the legal holiday.

### **3.03 SUGGESTED WORK SEQUENCE**

- A. The following work sequence is one suggested means of constructing the project and shall be followed in general unless another suitable method of completing the work is developed by the Contractor and approved by the Owner. This suggested work sequence is general in nature and does not include all work activities required by this Contract for completion of the work. The suggested work sequence shall be

coordinated with the requirements of other specification Sections and the Drawings in order to complete the Work in a timely and satisfactory manner. Forcemain and lift station construction can take place concurrently.

B. Forcemain: Provide submittal information as required.

1. Mobilize on site and obtain all materials and equipment necessary to conduct the work according to the Construction schedule.
2. Confirm the location of existing utilities and coordinate with Engineer if conflicts are found that will result in a change to the alignment or profile. Coordinate with Portland & Western Railroad and BNSF where paralleling the railroad or tunneling below tracks.
3. Install force main piping and appurtenances and structures within the right of way starting on NE Montgomery Street near the proposed lift station and working towards NE Davidson Street.
4. Cover the ends of all piping that will require a future connection and mark their location.
5. Perform force main pressure testing.
6. Perform pavement restoration.
7. Participate in walk through for final completion and address any punch list items.

C. Lift Station:

1. Provide submittal information as required.
2. Mobilize on site and obtain all materials and equipment necessary to conduct the work according to the construction schedule.
3. Create suitable construction access across railroad into site work area. Coordinate with City and railroad for approval of railroad crossing.
4. Perform site demolition, clearing and grubbing as necessary.
5. Clear the site and remove trees where indicated.
6. Coordinate relocation of utilities as shown on the Drawings.
7. Commence shoring installation and excavation for construction of diversion structure.
8. Monitor settlement of railroad tracks throughout shoring and excavation activities.
9. Install the diversion structure of the existing Riverfront Interceptor pipeline
10. Commence shoring installation and excavation for construction of lift station wetwell
11. Construct lift station wetwell, pigging station, electrical building, three (3) submersible wastewater pumps and associated piping and appurtenances.

12. Install piping within the site footprint during completion of earthwork. Connect piping within the site to the force main.
13. Install electrical service and equipment and perform any required testing.
14. Clean all new piping, valves and appurtenances.
15. Pressure test pipe not previously tested.
16. Reconstruct concrete path and grass paving area as shown on plans.
17. Furnish and install topsoil and seeding and complete any remaining restoration activities.
18. Participate in walk through for final completion and address any punch list items.

**END OF SECTION**

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## SECTION 01200

### MEASUREMENT AND PAYMENT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Methods of measurement and payment for specific items of Work under this Contract. Refer also to General Conditions for administrative aspects of payments by the Owner to the Contractor.

##### 1.02 BID COMPONENTS AND PAYMENT

- A. The Bid Form is comprised of the following components:
  - 1. Lump Sum Work
  - 2. Unit Price Work
- B. Contractor's cost for "Lump Sum Work" shall cover all Work indicated by the Contract Documents with the exception of cash allowances and specific items of work that are to be paid on a Unit Price basis as indicated on the Bid Form. Lump Sum Work will be paid for on a progress payment basis in accordance with the provisions of the General Conditions.
- C. "Unit Price Work" is Work indicated on the Drawings or specified. The price of each unit of Work is to be defined by the Bidder in the Unit Price Bid Schedule in the Bid Form and shall include all materials, labor, equipment, and incidentals required to complete each Work Item. When actual Work differs from the basis of the Work Item, costs shall be adjusted on a pro-rata basis or other method suited for the particular condition.

##### 1.03 Description of Bid Item

- A. The Bid Amounts for each Bid Item will be used for comparative bid analysis. The Bid amounts will also form the basis of monthly progress payments. Each Lump Sum bid amount will undergo further breakdown as described later in this section. Unit prices for any unit price bid items will be the basis for monthly progress payment determinations and for any changes related to that Work item. Bid items are not intended to be exclusive descriptions of work categories and the Contractor shall determine and include in its pricing all materials, labor, and equipment necessary to complete each Bid Item (work phase) as shown and specified
- B. Bid Item 1: Schedule A
  - 1. Bid Item 1 includes payment for all work, equipment, and materials necessary for completion of all Schedule A work in accordance with the drawings and specifications and as defined in Section 01110.

2. No measurement will be made. Payment shall be “Lump Sum” and shall be full compensation for all work and incidentals required to complete Schedule A as defined in Section 01110.
- C. Bid Item 2: Schedule B
1. Bid Item 2 includes payment for all work, equipment, and materials necessary for completion of all Schedule B work in accordance with the drawings and specifications and as defined in Section 01110.
  2. No measurement will be made. Payment shall be “Lump Sum” and shall be full compensation for all work and incidentals required to complete Schedule B as defined in Section 01110.
- D. Additional cost for boulder excavation: Payment for boulder excavation will be made at the unit price per cubic yard of boulder excavated. Payment for boulder excavation will only be considered as approved by the Engineer. Prior to proposed boulder excavation, the Contractor must receive approval by Engineer to receive payment. Boulder excavation will be paid for in addition to the lump sum cost per lineal foot for pipe installation and/or lump sum cost for excavation for structures. Boulder excavation is defined in Section 02321.

#### 1.04 SCHEDULE OF VALUES

- A. Format: Identify each line item in the Schedule of Values with number and title of the major Specification sections. Submit typed schedule on 8½ x 11-inch paper; Contractor's standard form or media-driven printout will be considered on request.
- B. At the pre-construction meeting, submit a preliminary Schedule of Values to the Owner’s Representative for review. The Contractor shall incorporate any review comments from the Owner’s Representative, and submit a final Schedule of Values at least 21 days prior to submitting the first Application for Payment.
- C. The Schedule of Values shall assign a fair, reasonable and equitable dollar value for each activity on the Contractor's construction schedule. The Schedule of Values shall include anticipated progress payments for each item in the bid schedule through the final payment. In addition, a detailed breakdown of lump sum prices shall be included in the Schedule of Values.
- D. The Schedule of Values shall specifically indicate installed cost for materials and equipment for each bid and sub-bid item.
- E. Each activity's assigned value shall consist of labor, equipment and materials cost and a prorata contribution to overhead and profit. Breakdown shall be so organized as to facilitate assessment of work and payment of subcontractors.
- F. The sum of the assigned values shall equal the lump sum price of the activity.
- G. If, in the opinion of the Owner’s Representative or Owner, the Schedule of Values is not balanced, the Contractor shall provide documentation substantiating the cost allocations of those activities believed to be unbalanced. Cost allocation will be considered unbalanced if an activity on the construction schedule has been assigned a disproportionate allocation of labor, direct, or overhead and profit costs which

result in progress payment request(s) which would create a condition where insufficient funds are available to complete the unfinished work. Upon request by Owner, support values shall be given with data that will substantiate their accuracy. Upon Owner's request, the Contractor shall submit additional detailed cost information.

- H. Upon acceptance of the Schedule of Values, it shall be used as a basis for processing all progress payment requests.

#### 1.05 PROGRESS PAYMENT REQUESTS

- A. Submit Progress Payment Requests during the course of the project in conformance with the General Condition.
- B. Submittal of progress record drawings of the project will be required at 50%, and completion of the project. These submittals shall accompany the progress payment request and will be a condition of processing payment requests.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION



## SECTION 01330

### SUBMITTALS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for the submittal of information that will enable determination of whether the Contractor's proposed materials, equipment or methods of work are in general conformance to the design concept and in compliance with the Contract Documents.
- B. Furnish drawings, specifications, descriptive data, certificates, samples, test results, methods, schedules, manufacturer's installation instructions and other information as indicated.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01999 – Reference Forms

##### 1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the materials and equipment incorporated into the Work, or the methods of performing the Work shall be as described in the accepted submittals.
- B. Verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. Extraneous materials shall be crossed out or otherwise obliterated.
- C. Coordinate submittals among subcontractors and suppliers. Ensure that there is no conflict with other submittals and notify the Engineer in each case where a submittal may affect the work of another contractor or the Owner, including those submittals complying with unit responsibility requirements specified in applicable technical sections.
- D. Coordinate submittals with the Work so that work will not be delayed. Coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals.
- E. Do not proceed with work related to a submittal until the submittal process is complete and the submittal has received a response "No Exceptions Taken" or "Make Corrections Noted."

- F. Certify on each submittal document that the Contractor has reviewed the submittal, verified field conditions, and complied with the contract documents.
  - 1. Include a copy of the specification section with addendum updates, all referenced and applicable sections, and each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
    - a. Use check marks (✓) to denote full compliance with a paragraph as a whole.
    - b. If deviations from the specifications are indicated and, therefore requested by the Contractor, underline each deviation and denote by a number in the margin to the right of the identified paragraph.
    - c. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
    - d. Include a detailed, written justification for each deviation.
  - 2. Failure to comply with this paragraph is sufficient cause to reject the entire submittal.

#### 1.04 REVIEW COSTS

- A. The Owner's cost for review of submittals for the same proposed materials, equipment or work will be apportioned as follows:
  - 1. The cost of review of the initial submittal and the first revised submittal will be borne by the Owner.
  - 2. The cost to review all additional revised submittals after the first revised submittal will be charged to the Contractor. The cost of review shall include, without limitation, administrative, design and engineering activities directly related to review of submittals.

#### 1.05 SUBMITTAL INDEX

- A. Within 30 days of the Notice to proceed, submit a list, by specification section, of all submittals to be submitted.
- B. Update and resubmit the submittal index on a monthly basis where additional submittals are identified, or as necessary

#### 1.06 CATEGORIES OF SUBMITTALS

- A. General
  - 1. Submittals fall into two general categories;
    - a. Submittals for review and comment require action by the Engineer.
    - b. Submittals that are primarily for information only do not require Engineer's approval.

- B. Submittals for Review and Comment
  - 1. Transmit submittals for review and comment to the Engineer. The Engineer will review the submittal for compliance with the Contract requirements and will provide written comments regarding acceptability.
- C. Submittals for Information Only
  - 1. Where specified, furnish submittals to the Engineer for information only. The Engineer may, at the Engineer's option, review and comment on any product data.
  - 2. Incomplete or inadequate product data will be returned to the Contractor for resubmittal.

## 1.07 TRANSMITTAL PROCEDURE

- A. General
  - 1. Transmit submittals regarding material and equipment under cover of a Shop Drawing/Transmittal Form (See Section 01999).
  - 2. Use a separate form for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required.
  - 3. Identify submittal documents common to more than one piece of equipment with all the appropriate equipment numbers.
  - 4. Make submittals for various items with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
  - 5. Assign a unique sequential number on the transmittal form accompanying each item submitted.
    - a. Use the following format for original submittal numbers: "XXX"; where "XXX" is the sequential number assigned by the Contractor.
    - b. Use the following format for resubmittals: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.
- B. Electronic Submittals
  - 1. Electronic submittals are preferred except as otherwise indicated.
  - 2. Prepare electronic submittals and Shop Drawings in electronic (\*.pdf) format including half-sized and full-sized drawings, catalog information and other required submittal information.
  - 3. Break down submittals that are larger than 10 megabytes into smaller sections, using logical division points to create sections.

4. Electronically bookmark electronic submittals greater than 30 pages in length by major submittal section to facilitate ease of navigation.
- C. Paper copy submittals are an acceptable alternative to electronic submittals if the Contractor demonstrates, to the satisfaction of the Engineer, that electronic submittals presents a hardship.
- D. Electrical Submittals:
  1. See applicable Electrical Sections for submittal requirements. Reference Part I of Sections found in Divisions 13 & 16 for special submittal requirements related to those disciplines.
- E. Deviation from Contract
  1. If the Contractor proposes to provide material, equipment, or method of work that deviates from the project manual, so indicate under "Proposed Deviations" on the transmittal form accompanying the submittal copies.
- F. Submittal Completeness
  1. Submittals that do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

#### 1.08 SUBMITTAL CONTENT

- A. Prepare submittals in compliance with individual Specification Sections and as indicated herein.
- B. Shop Drawings:
  1. Develop project-specific, scaled drawings to fully identify materials and products that will be provided and their relationship to other products that will be furnished and installed.
  2. Do not utilize reproductions of the Contract Documents as the basis for the submittal.
  3. Identify products, assemblies, equipment and systems.
  4. Provide equipment identification numbers or tag numbers, wiring diagrams, and setting diagrams.
  5. Identify critical dimensions.
- C. Product Data:
  1. Provide information necessary to demonstrate conformance with the specified requirements. Include performance curves, specifications, and wiring diagrams.
  2. Product data may consist of manufacturer's standard catalog information and data sheets, marked to indicate the specific products that will be provided.

3. Provide supplemental information as necessary to fully demonstrate how products will be modified from the manufacture's standard products to meet the specification requirements.
- D. Manufacturer's Instructions: Written or published information that establishes the manufacturer's recommendations, guidelines and procedures for handling and installation of products, equipment and assemblies.
- E. Samples: Mount, display or package samples in a manner that will facilitate review and establish workmanship and quality of materials.

#### 1.09 SUBMITTAL REQUIREMENTS

- A. When the Contract Documents require a submittal, submit the specified information as follows:
  1. Submittals for Review and Comment:
    - a. Electronic Submittal: Submit one electronic (\*.pdf) submittal.
    - b. Paper Copy Submittal: If paper copy submittals are acceptable to the Engineer, submit four (4) copies of all submitted information plus one reproducible original for review unless otherwise specified.
  2. Submittals for Information Only:
    - a. Electronic Submittal: Submit one electronic (\*.pdf) submittal.
    - b. Paper Copy Submittal: If paper copy submittals are acceptable to the Engineer, submit four (4) copies of all submittal information for review, unless otherwise specified.

#### 1.10 REVIEW PROCEDURE

- A. General
  1. The Engineer will review submittals within the processing time identified in paragraph "Processing Time" and return:
    - a. Electronic Submittal – a signed submittal response document, in (\*.pdf) format.
    - b. Paper Copy Submittal – Two marked up copies of the submitted copies. The reproducible original will be retained by the Engineer.
- B. Submittals for Review and Comment
  1. The returned submittal will indicate one of the following actions:
    - a. "NO EXCEPTIONS TAKEN" – The material, equipment or work method complies with the project manual.
    - b. "MAKE CORRECTIONS NOTED" – Limited corrections are required.
      - 1) Provide a corrected copy where:
        - a) The information is to be included in the O&M data.
        - b) If requested by the Engineer.

- c. "AMEND AND RESUBMIT" – The submittal is insufficient or contains incorrect data.
    - d. "REJECTED – SEE REMARKS" – The material, equipment, or work method does not comply with the project manual. Submittals with deviations that have not been identified clearly may be rejected.
  - 2. For submittals marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
    - a. The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with any noted corrections.
  - 3. For submittals marked "AMEND AND RESUBMIT" or "REJECTED – SEE REMARKS"
    - a. Contractor shall provide a typed letter responding to each of the Engineer's review comments with each resubmittal.
    - b. Except at its own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is submitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
- C. Submittals for Information Only
  - 1. The returned submittal will indicate "ACCEPTED FOR RECORD" if the submittal is complete and adequate.
  - 2. Engineer may return comments on information submittals to identify concerns with what was submitted, in such case, Contractor shall address concerns in writing and return a revised submittal.

#### 1.11 PROCESSING TIME

- A. Prepare submittals and transmit to Engineer for review in sufficient time to allow Engineer's review; manufacture, fabrication or assembly of materials and systems; and shipping of material to the site in time for installation in accordance with the Contractor's schedule.
- B. Engineer's time for review will begin upon receipt of a complete and comprehensive submittal containing all required information.
- C. Engineer will review submitted information and transmit a response to Contractor within 30 days after receipt, subject to the following:
  - 1. In some instances, review times for specific submittals may be modified by the individual specification Section.
  - 2. Resubmittals will be subject to the same review time.
- D. No adjustment of Contract Time or Contract Price will be allowed due to delays in the progress of the Work that are caused by rejected submittals and subsequent resubmittals.

## 1.12 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

- A. The purpose of submittals is to demonstrate how Contractor intends to conform to the Contract Documents and design concepts. Engineer is entitled to rely upon the accuracy and completeness of designs, calculations, or certifications made by licensed professionals whether or not a stamp or seal is required by the Contract Documents.
- B. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform to the contract documents.
- C. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, does not relieve the Contractor of its responsibility for
  - 1. Fulfilling the requirements of the Contract,
  - 2. Proper operation of the equipment,
  - 3. Correction of defective work
- D. Reviews shall not be regarded as an assumption of risk or liability by the Engineer or the Owner.
- E. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" means that the Owner has no objection to the Contractor, upon its own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.
- F. The Engineer's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents. The Engineer's review does not extend to:
  - 1. Accuracy of dimensions, quantities, or performance of equipment and systems designed by Contractor.
  - 2. Contractor's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
  - 3. Safety precautions or programs related to safety which shall remain the sole responsibility of the Contractor.
- G. Review of a separate item does not indicate approval of the assembly in which the item functions.

## 1.13 SUBSTITUTIONS OR "OR EQUAL" ITEMS

- A. Named or Sole Source Items
  - 1. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required.

2. Unless the name designated a “sole source” and/or is followed by words indicating that no substitution is permitted, materials, or equipment of other Suppliers may be accepted by Engineer if sufficient information is submitted by Contractor to allow Engineer to determine that the material or equipment proposed is equivalent or equal to that named.

B. Initiating Substitution Request

1. To propose to furnish or use a substitute item of material or equipment, Contractor shall use the Proposed “Or Equal” Substitution Submittal Transmittal Form found in Section 01999.
2. Submit the Substitution Submittal form to Engineer for acceptance, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified.
3. State that the evaluation and acceptance of the proposed substitute will not prejudice Contractor’s achievement of Substantial Completion on time, whether acceptance of the substitute for use in the Work will require:
  - a. A change in any of 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.
  - b. Incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.
4. Identify all variations of the proposed substitution from that specified
5. Identify available maintenance, repair, and replacement service
6. Provide an itemized estimate of all costs 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
7. The Owner or Engineer may require Contractor to furnish at Contractor’s expense additional data about the proposed substitute.
8. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, Contractor may propose to furnish or utilize a substitute means, method, sequence, technique or procedure of construction. Submit sufficient information to allow Engineer to determine that the proposed substitution is equivalent to that indicated or required by the Contract Documents.

C. Review Procedure

1. The procedure for review of substitutions by Engineer will be similar to that provided in this Section.
2. Requests for substitutions may only be submitted by the Contractor.



3. All requests for substitution shall be submitted within thirty (30) calendar days after the date of Notice to Proceed unless the Owner has agreed in writing to a later submittal date and the Contractor agrees to comply with all conditions of the Owner for the late submittal.
4. The Owner's agreement to a later submittal date shall not be construed as favorable review or acceptance of the proposed "or equal" substitution.
5. The Engineer will respond to all requests for substitutions within thirty (30) days following receipt of an acceptable substitution submittal, unless the Engineer notifies the Contractor within fourteen (14) days after receipt of the proposed "or equal" substitution submittal that more time is needed to complete a thorough review.
6. The Engineer and Owner will be the sole judge of acceptability, and no proposed "or equal" substitution item or service will be ordered, installed or utilized without Engineer's prior written acceptance that will be evidenced by either a Change Order or an accepted Shop Drawing.
7. As a condition of acceptance, the Owner may require Contractor to furnish, at Contractor's expense, a special performance guarantee or other surety with respect to a proposed "or equal" substitution item or service.

D. Modification due to Substitutions

1. All costs for redesign required by the implementation of the proposed substitute shall be borne by the Contractor.
2. All costs associated with incorporating a substitution into the project shall be borne by the Contractor.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

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## SECTION 01340

### REQUESTS FOR INFORMATION AND CLARIFICATIONS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Procedures for submitting requests for information and clarifications when Contractor discovers apparent conflicts, omissions, or errors in the Contract Documents, or upon having any questions concerning interpretation of the Contract Documents.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01999 – Reference Forms

##### 1.03 PROCEDURES

- A. Notification:
  - 1. Notify the Engineer in writing and request interpretation, clarification, or additional detailed instructions concerning the Work.
  - 2. Ask for clarification or request information immediately upon discovery, but no less than seven working days prior to the start date of the activities related to the clarification, based on the latest updated version of the official contract schedule.
- B. Form:
  - 1. Submit requests for clarification and/or additional information in writing to the Engineer using the Request for Information (RFI) form provided in Section 01999.
  - 2. Provide a detailed statement indicating the nature of the information requested. Reference specific Drawings and Specifications as appropriate.
  - 3. Limit each written request to one topic.
  - 4. Electronic (\*.pdf) format RFIs are preferred. Prepare RFIs and any attachments in electronic format. Transmit electronic RFIs via email to the Engineer. Break down RFIs that are larger than 4 megabytes into smaller sections, using logical division points to create sections.
  - 5. Hard copy RFIs are an acceptable alternative to electronic RFIs if the Contractor demonstrates, to the satisfaction of the Engineer, that electronic format presents a hardship. If hard copies are used, furnish six (6) copies of each RFI.

C. Numbering:

1. Use consecutive numbers for each new form submitted. When RFI's are re-submitted to request additional information on the same topic, add a letter A, B, C, etc. to the numbering system for each subsequent RFI until the subject is resolved.

1.04 REASONS FOR SUBMITTAL

A. Submit an RFI if one of the following conditions occur:

1. An unforeseen condition or other circumstance that is not described in the Contract Documents.
2. An apparent conflict or discrepancy between portions of the Contract Documents.
3. An apparent omission from the Contract Documents.
4. Information presented in the Contract Documents is unclear or additional details are needed to undertake the Work.

1.05 RESPONSE TIME

- A. The Engineer will resolve the RFI and issue instruction to the Contractor within 15 calendar days.
- B. Response time may need to be lengthened; or shortened for emergency situations as mutually agreed upon by all parties.
- C. Do not proceed with the affected work before receipt of a response from the Engineer. Should the Contractor elect to proceed with the Work affected by the RFI, any portion of the Work that is not done in accordance with the Engineer's interpretation, clarifications, instructions or decisions will be subject to removal or replacement at the Contractor's expense.

1.06 REJECTIONS

- A. RFI's submitted by the Contractor may be rejected by the Engineer for the following reasons:
  1. The RFI is submitted as a substitute for a submittal.
  2. Under the pretense of a Contract Documents discrepancy or omission without thoroughly reviewing the documents.
  3. In a manner that suggests that specific portions of the Contract Documents are assumed to be excluded, or be taken as an isolated portion of the Contract Documents in part rather than whole.
  4. In an untimely manner without proper coordination and scheduling of work or related trades.

1.07 ADDITIONAL DETAILED INSTRUCTIONS (CLARIFICATIONS)

- A. The Owner may furnish additional detailed written instructions to further explain the Work and these instructions shall become part of the Contract Documents. Clarifications will be issued using the above RFI system.
- B. When, in the opinion of the Contractor, the Engineer's response in the RFI constitutes additional work beyond the scope of the Contract, the Contractor shall notify the Engineer in writing following receipt of the RFI and prior to initiating the Work affected by the RFI. The process for submitting claims of additional Work shall be followed as defined in the General Conditions. Lack of compliance with this notification requirement will cause Contractor to forfeit any claim for additional compensation or extension of the schedule.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

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## SECTION 01400

### CONSTRUCTION STAKING

#### PART 1 - GENERAL

##### 1.01 DATUM

- A. Vertical and horizontal datum are based on the coordinates and benchmarks shown on the Drawings or as provided by Owner prior to the start of construction. Locate and protect Owner furnished control points prior to starting the Work and preserve control points during construction. Re-establish control points disturbed by operations at no cost to Owner.
- B. Establish other vertical and horizontal control from these reference points as required to properly layout and construct the Work. Connections shall be installed based on actual elevations of existing structures to which connections are made.

##### 1.02 ACCURACY OF INFORMATION

- A. Dimensions for existing structures, piping, paving, and other nonstructural items are taken from the available information provided by the Owner. Field verify dimensions and conditions in advance of any construction in the area. Any discrepancy between the field survey by the Contractor and the information indicated in the Contract Documents shall be immediately brought to Engineer's attention by written notification.

##### 1.03 CONSTRUCTION STAKING

- A. Construction staking shall be provided by the Contractor to establish the vertical and horizontal controls necessary to lay out the Work.
- B. Construction staking shall include line and grade and location of manholes. Easement boundaries shall not be staked.
- C. Contractor shall bear the cost of replacement staking if the initial staking is damaged and must be replaced.

##### 1.04 LAYOUT AND MEASUREMENT TO BE PERFORMED BY CONTRACTOR

- A. Contractor is responsible for conducting field surveys required to lay out components of the Work at the proper alignment, elevation, grades, dimensions, and distances indicated on the Drawings.
- B. Contractor shall lay out the Work from the lines and grades provided by the Owner and from the dimensions and elevations provided on the Drawings and shall be responsible for measurements required for the execution of the Work.
- C. The Contractor shall furnish stakes, equipment, tools, materials, and all labor as required for layout work.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**



## SECTION 01455

### SPECIAL TESTS AND STRUCTURAL OBSERVATIONS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for providing special tests and structural observations required by the Oregon Structural Specialty Code which is based on the International Building Code.
- B. The Contractor shall cooperate with the Owner and Engineer in performing Special Inspections of the Work.
- C. Special Inspections shall be performed by an agent under contract or employment by the Owner.

##### 1.02 SCHEDULE OF INSPECTIONS/OBSERVATIONS

- A. Special inspections and structural observations will be performed in accordance with Oregon Structural Specialty Code. The most recent version of the Code shall be utilized.
- B. Special inspections and tests are listed in Appendix A - Schedule of Special Inspections following this specification. Certain individual specification Sections may contain Special Inspections and tests specific to those sections.
- C. Structural Observations are described in Appendix B - Schedule of Structural Observations following this specification.

##### 1.03 DEFINITIONS

- A. **Approved Agency:** An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the Building Official.
- B. **Approved Fabricator:** An established and qualified person, firm, or corporation identified as such by AISC or the Building Official. Approval is based on written procedural and quality control manuals and periodic auditing of fabrication practices by an Approved Agency.
- C. **Building Official:** Owner's representative.
- D. **Continuous Special Inspection:** The full-time observation of Work by a Special Inspector who is present in the area where the Work is being performed as it is performed.
- E. **Fabricated Item:** Structural, load-bearing, or lateral load-resisting assemblies consisting of materials assembled prior to installation in a building or structure, or subjected to operations such as heat treatment, thermal cutting, cold working, or reforming after manufacture and prior to installation in the building or structure.

Materials produced in accordance with standard specifications referenced in the Contract Documents or the Code, such as rolled structural steel shapes, steel-reinforcing bars, masonry units, and plywood sheets are not Fabricated Items.

- F. **Periodic Special Inspection:** The part-time or intermittent observation of Work by a Special Inspector who is present in the area where the Work has been or is being performed and at the completion of the Work.
- G. **Special Inspection:** Inspection as herein required of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the Contract Documents and referenced standards. Special Inspection does not include, waive, or otherwise affect the Contractor's responsibility for inspections required by the Contract Documents.
- H. **Special Inspector:** An individual employed by an Approved Agency who is regularly engaged in conducting tests and furnishing Special Inspection services. The Special Inspector will be approved by the Building Official.
- I. **Structural Observer:** Registered design professional and agent of the Engineer, who provides Structural Observation services during construction.
- J. **Structural Observation:** Visual observation by a Structural Observer of the structural system for general conformance to the Contract Documents at significant construction stages and at completion of the structural system. Structural observation does not include, waive, or otherwise affect the Contractor's responsibility for inspections required by the Contract Documents.

#### 1.04 SUBMITTALS

- A. When fabrication of assemblies that would otherwise require Special Inspection is done on an Approved Fabricator's premises, the following shall be submitted:
  - 1. At completion of fabrication, the Approved Fabricator shall submit to the Engineer and the Building Official a certificate of compliance stating that the Work was performed in accordance with the Contract Documents.

#### 1.05 CONTRACTOR RESPONSIBILITIES

- A. In performing the Work, the Contractor shall cooperate with the Special Inspector and the Structural Observer, so that the Special Inspections and Structural Observations may be performed without hindrance.
- B. The Contractor shall review the Schedule of Special Inspections in Appendix A, the Schedule of Structural Observations in Appendix B, and individual specification sections and shall be responsible for coordinating and scheduling inspections and observations. The Contractor shall notify the Engineer at least 48 hours in advance of a required Special Inspection or Structural Observation.
- C. If any Work that is to receive any Special Inspection or Structural Observation is covered without concurrence in writing from the Engineer, it shall be uncovered at the Contractor's expense unless the Contractor has given the notice required above and the Special Inspector or Structural Observer has not acted with reasonable

promptness to such notice. Removal and replacement of any finished Work damaged by the uncovering process or as required for corrective action shall be at the Contractor's expense.

- D. The Contractor shall furnish incidental labor and facilities for access to the Work to be inspected or observed, and shall facilitate observations and inspections.
- E. The Contractor shall keep at the Site the latest set of Contract Drawings, field sketches, change orders, approved submittals, and specifications for use by the Special Inspector and Structural Observer.
- F. The Special Inspection and observation program shall in no way relieve the Contractor of this obligation to perform Work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.
- G. Contractor's quality control personnel shall first review all Work that is to be subjected to Special Inspection or Structural Observation.
- H. Prior to the beginning of construction, the Contractor shall have a pre-construction meeting with the Engineer, Owner, Special Inspector, and Structural Observer, to review the Special Inspection and Structural Observation requirements.
- I. Contractor shall be responsible for the Special Inspection cost of any replacement and re-testing or re-inspection of Work that is determined to be Defective Work.

#### 1.06 INSPECTION OF FABRICATIONS

- A. When Work is performed on the premises of an Approved Fabricator, no Special Inspection is required.

#### 1.07 RECORDS AND REPORTS

- A. The Special Inspector will prepare detailed daily reports of each Special Inspection. Reports shall be submitted daily to the Owner and Engineer.
- B. The Structural Observer will prepare detailed reports of each structural observation. Reports shall be submitted daily to the Owner and Engineer.
- C. Any deviations from the Contract Documents found during a Special Inspection or Structural Observation will be immediately reported to the Contractor. If the discrepancies are not corrected promptly, the Special Inspector or Structural Observer will notify the Engineer and Building Official. Daily reports will identify all discrepancies and the corrective actions taken.

#### 1.08 FINAL REPORTS OF SPECIAL INSPECTIONS AND STRUCTURAL OBSERVATIONS

- A. The Final Report of Special Inspections, completed by the Special Inspector, will be submitted to the Engineer and Building Official prior to issuance of a Certificate of Use and Occupancy.
- B. The Final Report of Special Inspections will certify that required inspections have been performed and will itemize any deviations that were not corrected or resolved.

- C. The Final Structural Observation Report will certify that Site visits have been made and identify any deviations, which, to the best of the Structural Observer's knowledge, have not been corrected or resolved.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

## APPENDIX A

### SCHEDULE OF SPECIAL INSPECTIONS

Required inspections and tests are described in the following "Schedule of Special Inspections" and in the individual Specification Sections for the items to be inspected or tested.

#### 1.01 FABRICATORS

- A. Where fabrication of structural load-bearing members and assemblies is performed at a fabricator's shop, no Special Inspection is required if the fabricator is an Approved Fabricator. If the fabricator is not, then Special Inspection will be required.

#### 1.02 STEEL CONSTRUCTION

- A. Welding inspection will be in compliance with AWS D1.1.
- B. The Special Inspector will inspect the steel to verify compliance with the details on the Contract Drawings, such as bracing, stiffening, member locations and proper application of joint details at each connection.
- C. Installation of high strength bolts will be inspected periodically in accordance with American Institute of Steel Construction specifications and Oregon Structural Specialty Code.
- D. While the Work is in progress, the Special Inspector will determine that the requirements for bolts, nuts, washers, bolted parts, painting, and installation and tightening in such standards are met.
- E. For bolts requiring pretensioning, the Special Inspector will observe the pre-installation testing and calibration procedures when such procedures are required by the installation method or by the Contract Documents; determine that all plies of connected materials have been drawn together and properly snugged; and monitor the installation of bolts to verify that the procedure for tightening is proper. For joints required only to the snug tight condition, the Special Inspector will only verify that the connected materials have been drawn together and properly snugged.
- F. Monitoring of bolt installation for pretensioning will be performed on a periodic basis when the Contractor uses the turn-of-nut method with matchmarking techniques, the direct tension indicator method, or the alternate design fastener (twist-off bolt) method. Joints designed as snug tight will be inspected only on a periodic basis.
- G. Monitoring of bolt installation for pretensioning using the calibrated wrench method or the turn-of-nut method without matchmarking will be performed on a continuous basis.

#### 1.03 COLD-FORMED STEEL FRAMING

- A. Cold-formed steel framing will have the following special inspections:

1. Periodic Special Inspection during welding of elements of the seismic force-resisting system.
2. Periodic Special Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system, including struts, braces, and hold-downs.

**REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION**

Verification And Inspection	Inspection		Referenced Standards
	Continuous	Periodic	
Material verification of high-strength bolts, nuts, and washers:		X	Applicable ASTM material Specifications; AISC ASD, Section A3.4; AISC LRFD, Section A3.3
<ul style="list-style-type: none"> <li>• Identification markings conforming to ASTM standards indicated in the Contract Documents.</li> </ul>			
<ul style="list-style-type: none"> <li>• Manufacturer's certificate of compliance required.</li> </ul>			
Inspection of high-strength bolting:			AISC LRFD Section M 2.5
<ul style="list-style-type: none"> <li>• Bearing-type constructions</li> </ul>		X	
<ul style="list-style-type: none"> <li>• Slip-critical connections</li> </ul>	X		
Material verification of structural steel:		X	ASTM A 6 or ASTM A568
<ul style="list-style-type: none"> <li>• Identification markings conforming to ASTM standards indicated in the Contract Documents.</li> </ul>			
<ul style="list-style-type: none"> <li>• Manufacturer's certified mill test reports required.</li> </ul>			
<ul style="list-style-type: none"> <li>• Material verification of weld filler materials:</li> </ul>		X	AISC, ASD, Section A3.6; AISC LRFD, Section A3.5
<ul style="list-style-type: none"> <li>• Identification markings conforming to AWS specification indicated in the Contract Documents.</li> </ul>			
<ul style="list-style-type: none"> <li>• Manufacturer's certificate of compliance required.</li> </ul>			
Inspection of welding – Structural steel:			AWS D1.1 AISC Seismic AWS D1.3
<ul style="list-style-type: none"> <li>• Complete and partial penetration groove welds.</li> </ul>	X		
<ul style="list-style-type: none"> <li>• Multi-pass fillet welds.</li> </ul>	X		
<ul style="list-style-type: none"> <li>• Single-pass fillet welds <math>\geq</math> 5/16-in (7.9 mm).</li> </ul>	X		
<ul style="list-style-type: none"> <li>• Single-pass fillet welds <math>&lt;</math> 5/16-in (7.9 mm).</li> </ul>		X	
<ul style="list-style-type: none"> <li>• Welded studs when used for structural diaphragms or composite systems.</li> </ul>			
Inspection of welding – Reinforcing steel:	X		AWS D1.4 ACI 318 - 3.5.2
<ul style="list-style-type: none"> <li>• Verification of weldability of reinforcing steel other than ASTM A 706</li> </ul>	X		
<ul style="list-style-type: none"> <li>• Shear reinforcement.</li> </ul>	X		
<ul style="list-style-type: none"> <li>• Other reinforcing steel.</li> </ul>		X	

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Verification And Inspection	Inspection		Referenced Standards
	Continuous	Periodic	
Inspection of steel frame joint details for compliance with the Contract Documents		X	OSSC 1705.2.1
<ul style="list-style-type: none"> <li>• Details such as bracing and stiffening.</li> </ul>			
<ul style="list-style-type: none"> <li>• Member locations.</li> </ul>			
<ul style="list-style-type: none"> <li>• Application of joint details at each connection.</li> </ul>			
<ul style="list-style-type: none"> <li>• Welded sheet steel for cold- formed steel framing members such as studs and joists.</li> </ul>		X	
<ul style="list-style-type: none"> <li>• Welding of stairs and railing systems.</li> </ul>		X	
<ul style="list-style-type: none"> <li>• Floor and deck welds.</li> </ul>		X	Floor and deck welds.

#### 1.04 CONCRETE CONSTRUCTION

- A. No Special Inspection will be required for minor sitework concrete and non-structural slabs on grade as approved by the Engineer.

#### REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION

Verification And Inspection	Inspection		Referenced Standards
	Continuous	Periodic	
Inspection of reinforcing steel, including prestressing tendons, and placement.		X	ACI 318 - 3.5, 7.1-7.7
Inspection of reinforcing steel welding in accordance with inspection of steel table above.	X		AWS D1.4 ACI 318 - 3.5.2
Inspect bolts to be installed in concrete prior to and during placement of concrete.	X		
Verifying use of required design mix.		X	ACI 318 - Ch. 4 & 5.2-5.4
Sampling fresh concrete and performing slump, air content and determining the temperature of fresh concrete at the time of making specimens for strength tests.	X		ASTM C172 ASTM C31 ACI 318 - 5.6, 5.8
Inspection of concrete placement for proper application techniques.	X		ACI 318 - 5.9 & 5.10
Inspection for maintenance of specified curing temperature and techniques.		X	ACI 318 - 5.11-5.13
Post installed anchor installation.	X		Per ICC-ES Reports

1.05 MASONRY CONSTRUCTION

**REQUIRED VERIFICATION AND INSPECTION OF MASONRY CONSTRUCTION**

Verification And Inspection	Inspection		Referenced Standards
	Continuous	Periodic	
From the beginning of masonry construction, the following shall be verified to ensure compliance:			ACI 530 Sec. 1.12.3 ACI 530.1 Art. 2.6A, 3.2D, 3.3B, 3.4 & 3.5
<ul style="list-style-type: none"> <li>Proportions of site-mixed mortar and grout</li> </ul>		X	
<ul style="list-style-type: none"> <li>Placement of masonry units and construction of mortar joints.</li> </ul>		X	
<ul style="list-style-type: none"> <li>Placement of reinforcement and connectors.</li> </ul>		X	
<ul style="list-style-type: none"> <li>Grout space prior to grouting.</li> </ul>	X		
<ul style="list-style-type: none"> <li>Placement of grout.</li> </ul>	X		
<ul style="list-style-type: none"> <li>The inspection program shall verify:</li> </ul>			ACI 530 Sec. 1.15.4, 2.1.2, 1.12, 2.1.8.6 & 2.1.8.6.2 ACI 530.1 Art. 3.3G, 2.4, 3.4 & 1.8
<ul style="list-style-type: none"> <li>Size and location of structural elements.</li> </ul>		X	
<ul style="list-style-type: none"> <li>Type, size, and location of anchors, including other details of anchorage of masonry to structural members frames or other construction.</li> </ul>	X		
<ul style="list-style-type: none"> <li>Specified size, grades, and types of reinforcement.</li> </ul>		X	
<ul style="list-style-type: none"> <li>Welding of reinforcing bars</li> </ul>	X		
Protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperatures above 90 degrees F)		X	ACI 530 Sec. 1.15.4, 2.1.2, 1.12, 2.1.8.6 & 2.1.8.6.2 ACI 530.1 Art. 3.3G, 2.4, 3.4 & 1.8
Preparation of any required grout specimens, mortar specimens, and/or prisms shall be observed.	X		ACI 530.1 Art. 1.4
Compliance with required inspection provisions of the Contract Documents and the approved submittals shall be verified.		X	ACI 530.1 Art. 1.5
Post installed anchor installation	X		Per ICC-ESReports

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## APPENDIX B - SCHEDULE OF STRUCTURAL OBSERVATIONS

Required observations are described in the following "Schedule of Structural Observations".

WHEN TO OBSERVE	WHAT TO OBSERVE
<b>FOUNDATIONS – GENERAL</b>	
Prior to the first concrete pour, but after placement of reinforcing is well under way.	Review areas of particular concern such as highly congested areas or any mechanically-coupled splices and check that approved placing plans are being used.
	Review anchor bolt placement and placement of hold-down bolts or steel embeds.
<b>FOUNDATIONS BRACED FRAMES AND MOMENT FRAMES</b>	
Prior to pouring each foundation, but after placement of reinforcing steel and placement of embedded anchor bolts.	Review reinforcement and anchor bolt size and placement.
<b>STEEL FRAMING – GENERAL</b>	
During and after the steel framing and / or trusses have been erected, and bolt tightening and joint welding is under way, but prior to placement of the steel decking.	Observe the Work in progress and meet with the Special Inspectors for the welding and bolt tightening operations. Pay particular attention to the details associated with transferring the diaphragm forces into the frames.
<b>CONCRETE CONSTRUCTION</b>	
Prior to close-up of the column or wall forms. During placement of slab/beam/joist reinforcement.	Reinforcement placement and placement of embedded items. The Engineer may elect to personally observe concrete placement for critical structural elements.
<b>MASONRY CONSTRUCTION</b>	
During lay-up of the first section of wall with special reinforcement requirements, such as boundary elements	Special inspection may not include full time inspection of lay-up or reinforcement placement, so it may be important to verify that reinforcement is placed with the appropriate positioners.
Prior to grouting of the first lift.	Verify that the Special Inspector is performing the required special inspections and that elements for connection of other framing are in place.
Prior to pouring the concrete cap, but after reinforcement and embedded anchors are in place.	Observe the Work in progress. Pay particular attention to the details associated with transferring the diaphragm forces into the walls.

**END OF SECTION**

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## SECTION 01500

### CONSTRUCTION FACILITIES AND UTILITIES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for Contractor's temporary facilities at the job site and for the prosecution of the Work.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section.
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Provide the following information in accordance with Section 01330.
  - 1. Proposed plan and layout for all temporary offices, designated parking areas, sanitary facilities, storage yards, temporary water service and distribution, temporary sewer connection, temporary phone service, temporary power service and distribution, and temporary fire equipment access roads.
  - 2. Proposed layout (site and floor plan) of Contractor's and Construction Manager's office trailers, if required. Include manufacturer's name and product literature.
  - 3. Proposed equipment list. Include manufacture's name and product literature.
  - 4. Proposed service and maintenance contracts for offices, alarm, and cleaning service.
  - 5. Proposed layout of parking area, staging area, field office trailers, storage buildings and workshops.

##### 1.04 CONTRACTOR'S CONSTRUCTION OFFICE

- A. Maintain a suitable office at the site.
- B. Temporary office will be considered as the headquarters of the Contractor's representative whom is authorized to receive drawings, instructions, or other communication or articles. Any communication given to the representative or delivered at Contractor's temporary office at the site in his absence is deemed to have been delivered to the Contractor.
- C. Maintain copies of the Drawings, Specifications, and other Contract documents at Contractor's temporary office at the site and make these available for use at all times.

## 1.05 STAGING AND WORK AREAS

- A. Before starting the work, submit a proposed plan and layout for all temporary offices, sanitary facilities, storage areas, temporary water service and distribution, and temporary power service and distribution.
- B. Confine equipment, materials storage and all construction activities within the staging area (s) shown on the Drawings and within City property. Procure agreements with private property owners prior to mobilization. Coordinate with the City for use of City property.
- C. Erect temporary security fence as appropriate. Contractor is responsible for the security of the staging area. Owner and Engineer do not take any responsibility for missing or damaged equipment, tools or personal belongings.
- D. Store only those materials and equipment that are related to the construction within the staging area.

## 1.06 FENCES

- A. Erect temporary fences at the boundary of construction easements and in locations indicated on the Drawings to protect existing wetlands and other environmentally sensitive areas.
- B. When existing fences require temporary removal, and these fences are required to restrain animals and stock, erect fences to prevent animals from escaping. Contractor shall be responsible for loss, injury or damage that results from failure to restrain animals and stock.
- C. When working in open areas where animals and stock are maintained, provide adequate temporary fencing around open excavations to prevent injury to animals and stock.

## 1.07 TEMPORARY ACCESS ROADS

- A. Construct temporary access roads where access to various portions of the site is otherwise unavailable.
  - 1. Construct a point of access that will allow Contractor to gain access onto the property.
  - 2. Install temporary ditches and culverts as necessary to direct rainfall runoff away from construction areas, access road, equipment laydown areas, and temporary stockpile areas. Contractor to determine appropriate size of culvert. Backfill the culvert with gravel and compact to provide a stable and durable access point.
  - 3. Temporarily remove a section of the existing fence and install a security gate with lock.
  - 4. At the conclusion of the work, remove all temporary facilities, re-grade drainage ditches and return the area to its original condition.

5. Contractor is responsible for securing the property until fencing is returned to original conditions and all temporary fences, culverts and backfill material has been removed and the area returned to its original condition.

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

## **PART 3 - EXECUTION**

### 3.01 GENERAL:

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 105.08.00.

### 3.02 TEMPORARY ELECTRIC POWER

- A. Contractor shall make provisions to obtain temporary electric power for use during construction. The Contractor shall be responsible for obtaining a source of electric power for construction.
- B. Cost of electric power shall be borne by the Contractor.
- C. The temporary electric power installation shall meet the construction safety requirements of OSHA, state, and other governing agencies.

### 3.03 TEMPORARY TELEPHONE SERVICE

- A. Provide telephone service at the construction site office. Cellular telephone service is acceptable.
- B. The Contractor is not permitted to use the Owner's telephone service.

### 3.04 TEMPORARY SANITARY FACILITIES

- A. Provide toilet and wash-up facilities for the construction work force at the site of work.
- B. Facilities shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of construction field offices, dwellings, and camps.

### 3.05 TEMPORARY WATER SUPPLY

- A. Use City of Albany potable water for soil moisture conditioning, pipeline pressure testing and other construction uses.
- B. Obtain approvals and authorizations from the City prior to use of potable water and pay all fees associated with consumption of the potable water.
- C. The City will supply the water required for the Project from approved hydrant locations with a hydrant meter. Coordinate with the City.

## **END OF SECTION**

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## SECTION 01505

### MOBILIZATION AND DEMOBILIZATION

#### PART 1 - GENERAL

##### 1.01 MOBILIZATION

- A. Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the site; for the establishment of all facilities necessary for work on the project; and for all other work and operations which must be performed, or costs incurred prior to beginning work, on the various items on the project site.
- B. Mobilization shall also include the construction of temporary access ways; temporary fencing; and the necessary preparatory work required to allow for the safe and stable movement of all vehicles that are required to construct the improvements as shown.

##### 1.02 DEMOBILIZATION

- A. Demobilization shall consist of work and operations necessary to disband all mobilized items and clean up the site. The removal of all temporary access ways, signs, temporary fencing, and temporary facilities or works and the restoration of surfaces to an equal or better than existing condition shall also be included as part of demobilization.

#### PART 2 - (NOT USED)

#### PART 3 - (NOT USED)

**END OF SECTION**

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## SECTION 01550

### TRAFFIC CONTROL

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Contractor furnished labor, materials, equipment, tools, and services necessary to provide access to the motoring and pedestrian public; and adequately safeguard the workers and public from construction hazards with a minimum of inconvenience.
- B. Work includes but is not limited to the following:
  - 1. Preparation of Traffic Control Plans (detailed drawings) and obtaining approval of Traffic Control Plans from the Owner's Representative.
  - 2. Masking and restoring permanent signs and striping.
  - 3. Erection and removal of temporary construction signs.
  - 4. Installation and removal of temporary traffic control devices, including barriers and barricades, street closure and detour implementation.
  - 5. Coordinating work with all agencies having jurisdiction.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 PROJECT SPECIFIC REQUIREMENTS

- A. Lane closures during peak hours shall be limited to the extent possible.
- B. At least one lane shall be open to traffic at all times.
- C. Road closures shall be restricted to block by block segments as approved by the Owner's Representative.
- D. Allow local traffic only during working hours.

##### 1.04 REFERENCE STANDARDS

- 1. Comply with the latest editions of the following reference standards:
- 2. Oregon Department of Transportation's (DOT) "Sign Policy and Guidelines for the State Highway System.
- 3. The Federal Highway Administration "Manual on Uniform Control Devices (MUTCD) and the Oregon Supplement to the Manual on Uniform Traffic Control Devices.
- 4. FHWA "Standard Highway Sign" manual.

5. Oregon DOT “Oregon Temporary Traffic Control Handbook for Operations of 3 Days or Less” when directed by the Owner’s Representative only for mobile pavement marking operations or surveying work.
  6. Oregon Department of Transportation Standard Specifications, most recent edition.
  7. OSHA, Code of Federal Regulations.
    - a. Title 19, Part 1926, Construction Safety and Health Regulations.
    - b. Title 29, Part 1910, Occupational Safety and Health Standards.
- B. In case of conflict between the above reference standards and the specifications contained herein, these specifications shall take precedence and be used in lieu of such conflicting portions.

#### 1.05 SUBMITTALS

- A. Traffic Control Plans: According to the requirements of Section 01330, submit, at least three (3) weeks prior to work, Traffic Control Plan drawings which conform to all requirements of these specifications, approved by the Owner’s Representative. Traffic Control Plans shall be provided for roadways and intersections affected by construction.
- B. A traffic control plan shall include systems of closing traffic lanes in accordance with the details shown on Oregon Standard Drawing TM840, the provisions of Section 00225, "Work Zone Traffic Control," of the State Standard Specifications, the MUTCD, and the Oregon Supplement to the Manual on Uniform Traffic Control Devices.
- C. Traffic control plans shall be site specific. Standard plans may be referenced, but details shall be depicted on maps, images, or figures of actual road configurations at specific locations along the project. Photo copies of typical traffic control lane closure samples from the MUTCD, State Standard Drawings or any other manuals will not be accepted.
- D. All signs, signals, pedestrian and vehicle ramps, and barricades shall conform to the requirements of OSHA Construction Safety and Health Regulations. A Traffic Control Plan shall be submitted to the Engineer and agencies having jurisdiction for review and approval. Traffic Control Plan shall contain, but not be limited to the following:
  1. Circulation and detour plans to minimize impacts on local street circulation during road closures.
  2. Show the existing intersection lane configuration and the appropriate traffic control application for each approach. Location, placement, monitoring schedule and movement of all traffic control devices to be used to guide vehicles through and/or around the construction zone including, but not limited to, proper lane tapers, signs, flashing arrow boards, portable changeable message signs, “work ahead” and other advance warning signs, signals, pedestrian and vehicle ramps, barricades and flaggers.

3. For work within all other intersections, use a flagger to control the intersection in addition to the mobile operation. There shall be at least one (1) flagger assigned to each intersection approach.
  4. Identification of truck routes that minimize truck traffic on local roadways and residential streets will be utilized to the extent possible.
  5. Identification of detours for bicycles, where applicable, in all areas affected by project construction.
  6. Provisions for pedestrian access through the work zone during construction. If the work impacts any pedestrian pathway such as sidewalks, curb ramps, and crosswalks, the traffic control plan shall include a pedestrian handling plan to direct pedestrians safely through the construction work zone. The pedestrian handling plan shall conform to the most current MUTCD, Oregon Supplement to the MUTCD, and State Standard drawings and may include pedestrian detours, signs, temporary pedestrian path and ramps.
  7. Sufficient staging areas for trucks accessing construction zones to minimize disruption of access to adjacent land uses, particularly at entries to onsite pipeline construction within residential neighborhoods.
  8. Control and monitoring of construction vehicle movement through the enforcement of standard construction specifications by onsite inspectors.
  9. Scheduling of truck trips outside the peak morning and evening commute hours to the extent possible.
- E. The traffic control plans shall be submitted for all streets in the agency having jurisdiction as one package for review by the agency having jurisdiction; partial submittals may be rejected.
  - F. The contractor shall be responsible for coordinating development of the Traffic Control Plan with the City of Albany.
  - G. No work will be allowed on city streets until the Contractor obtains written approval of the proposed Traffic Control Plan from agencies having jurisdiction.
  - H. The temporary closure of a signalized intersection, when necessary, shall be done in accordance with a traffic control plan approved by the agency having jurisdiction prior to the start of work. Inform the Transportation Engineering Division of the agency having jurisdiction of the anticipated signal shutdown at least five (5) working days in advance of the work.

#### 1.06 QUALITY ASSURANCE

- A. Traffic Control Plans shall be prepared by a qualified traffic management/traffic control firm or Oregon Licensed Civil or Traffic Engineer. Plans shall be stamped by an Oregon Licensed Civil or Traffic Engineer if a third submittal is required to gain approval from the agency having jurisdiction.

- B. The Traffic Engineer who prepared the Traffic Control Detail shall be available at any time during the life of the contract to modify the Traffic Control Detail if and as required by the agency having jurisdiction.
- C. No changes or deviations from the approved Traffic Control Detail shall be made, except temporary changes in emergency situations, with prior approval of the Traffic Engineer, the Construction Manager, and all agencies having jurisdiction.
- D. Any revisions to the traffic control plans shall be submitted by agency having jurisdiction 10 days in advance of the work.

#### 1.07 REQUIRED NOTIFICATION

- A. Notify the Owner’s representative and Engineer at least 48 hours prior to lane, roadway or ramp closures, reopenings, or partial obstruction of roadways.
- B. Coordinate construction with the Owner’s representative. The Owner’s representative will notify law enforcement, fire and other emergency services. Facility owners or operators shall be notified in advance of the timing, location, and duration of construction activities and the locations of detours and lane closures.

### PART 2 - MATERIALS

#### 2.01 TRAFFIC CONTROL DEVICES

- A. Traffic control devices shall conform to the Oregon DOT Standard Specifications Section 00225 “Work Zone Traffic Control,” and to the MUTCD and the agency having jurisdiction.
- B. Included, but not limited to, are flag units, construction signs, channelizing devices, barricades, delineators, and lighting devices.
- C. All signs which are to convey their messages during darkness shall be reflectorized or illuminated.
- D. No signs or supports shall bear any commercial advertising.

### PART 3 - EXECUTION

#### 3.01 PLACEMENT OF TRAFFIC CONTROL DEVICES

- A. Install, inspect, move, and operate traffic control devices according to the traffic control plan, these specifications, and reference standards.
- B. Install, maintain, and move all traffic control devices by working with the direction of traffic.
- C. Provide additional traffic control measures according to these specifications and referenced standards, when necessary or directed.
- D. Store all equipment and materials in designated contractor staging areas or adjacent to the worksite, such that traffic obstruction is minimized.

- E. Implement all roadside safety protocols. Advance “Road Work Ahead” warning and speed control signs (including those informing drivers of state legislated double fines for speed infractions in a construction zone) shall be posted to reduce speeds and provide safe traffic flow through the work zone. All excess and unsuitable material resulting from the Contractor’s operation shall be removed as it develops and before the end of each workday.

### 3.02 MAINTENANCE OF TRAFFIC CONTROL DEVICES

- A. If any component of the traffic control system is displaced or ceases to operate or function as specified from any cause, during the progress of the work, immediately repair the component to its original condition or replace the component, and restore the component to its original location.

### 3.03 REMOVAL OF TRAFFIC CONTROL DEVICES

- A. Remove the existing TCD as directed when they are not necessary or conflict with temporary devices. Remove and obliterate, without damaging the wearing surface, all evidence of all temporary TCD when the Contract is complete.
- B. Remove TCD in the reverse sequence of the installation.
- C. When lane closures are made for work periods only, at the end of each work period, all components of the traffic control system, except portable delineators placed along open trenches or excavations adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations, approved by the agency having jurisdiction.

### 3.04 ACCESS TO ADJACENT PROPERTIES

- A. Provide and maintain access to adjacent properties at all times. Notify homeowners/occupants along the proposed construction route. Provide a minimum of two working days’ notice prior to impacting access.
- B. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times.
- C. Temporary provisions shall be made by the Contractor to assure the use of sidewalks and the proper functioning of all gutters, sewer inlets and other drainage facilities.

### 3.05 STREET CLOSURE

- A. No streets may be closed without first obtaining approval, in writing, from the City of Albany. If permission is granted, it shall be the Permittee’s responsibility to notify the agencies/departments in Paragraph 1.07 prior to closing the street.
- B. Request for street closure shall include detour and signage plans.

### 3.06 TRAFFIC COORDINATION WITH OTHER CONTRACTORS

- A. Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the work hereunder, and the Contractor shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas.
- B. Coordinate the traffic routing work with that of other forces working in the same or adjacent areas.

### 3.07 CONSTRUCTION PARKING CONTROL

- A. Curb parking shall be removed in accordance with the Traffic Control Plan. Removal of curb parking shall be minimized.
- B. Make arrangements directly with local authorities to keep the working area clear of parked vehicles.
- C. The Contractor may prohibit stopping in parking lanes where and when necessary in order to gain access to the work to provide the required traffic lanes in city streets and parking areas.
- D. Coordinate with local authorities for the location of “No Stopping” and “No Parking” signs.
- E. At least one (1) week in advance of construction, furnish and place portable “TOW AWAY – NO STOPPING” signs where approved by local authorities and the Owner’s Representative. The dates and times of parking removal shall be posted on the signs.
- F. Contractor is responsible for ensuring signs stay posted. “No Parking” signs shall be posted at a minimum spacing of 100 feet on portable barricades, delineators or similar devices furnished by the Contractor. In addition, a minimum of one (1) “No Parking” sign shall be posted between all driveways where on-street parking is normally allowed. Posting of “No Parking” signs will not be allowed on trees, sign posts, fences, etc.
- G. All “No Parking” signs shall list the anticipated dates of work. Dates posted on all “No Parking” signs shall be limited to provide a maximum two-day construction window unless otherwise authorized by the Engineer. If the work is not performed during the timeframe indicated on the “No Parking” signs, the work shall be rescheduled with at least five (5) working days advance notice. Leave the streets open to traffic until just prior to starting the work, and provide all barricades, signs and traffic control measures necessary to protect the work. The Contractor, at his expense, will perform all re-posting of “No Parking” signs and re-notification of business and residents as a result of his failure to meet the posted schedule.
- H. Any delays caused by failure of the Contractor to adhere to the approved schedule will be at the Contractor’s sole expense. No additional compensation will be allowed for costs resulting from said delays.

- I. Notify local authorities of all parking violators who require tow away from construction areas.
- J. Construction equipment not actively engaged in the work and employee vehicles shall not be parked in the vicinity of the work in such a manner as to further restrict or obstruct traffic flow.
- K. Vehicles and equipment in continuous or frequent use may be operated or parked in the same traffic lane as the work obstruction.

### 3.08 CONSTRUCTION SIGNING

- A. All construction area signs and sign spacing shall conform to the MUTCD and Oregon Supplement to the MUTCD.
- B. Signs normally shall be installed immediately before work is to commence and must be removed immediately after work is complete. If at any time a sign is not required, it shall be covered or removed.
- C. The Contractor shall be responsible for the placement of advisory signs to inform the public of any street closure, detour, or construction affecting traffic at least 7 days before the closure or other significant disruption of normal traffic flow.
- D. Existing roadside signs conflicting with the construction area signs shall be either removed and reset upon completion of work or securely covered.
- E. After the application of crack seal material, “Fresh Oil” (W21-2) signs shall be placed at the limits of work.

### 3.09 ILLUMINATION

- A. Provide sufficient visibility on a 24-hour basis to approaching traffic whenever a street is closed partially or completely. Ensure that sufficient illumination is provided by means of portable flashing beacons, floodlights, or other similar devices. Mount all lighting fixtures in a manner which precludes glare to approaching traffic.
- B. All barricades and obstructions shall be illuminated at night, and all lights shall be turned on from sunset until sunrise.
- C. Arrow boards or other traffic control devices and lighting which will operate outside of the normal working hours shall be battery-operated. The use of gas-fired generators during nonworking hours will not be allowed.

### 3.10 FLAGGING

- A. Flaggers shall be required:
  - 1. Where workers or equipment intermittently block a traffic lane.
  - 2. When trucks or equipment enter or leave the work site from an adjacent traffic lane
  - 3. Where plans or permit allow the use of one lane for two directions of traffic.

- 4. Wherever the safety of the public and/or workers determine there is a need.
- B. Locate flaggers far enough in advance of the work area to permit adequate time for the motorist to respond to the flagger's instructions. All flaggers, including advance flaggers, shall use a STOP/SLOW paddle. Do not use the rollup STOP/SLOW paddle for non-emergency flagging operations.
- C. Flagging shall be carried out in accordance with the approved Traffic Control Plan.
- D. Flagging costs shall be considered as included in pay items for traffic control.

### 3.11 PEDESTRIAN SAFETY AND BICYCLE ACCESS

- A. Maintain safe and adequate pedestrian zones and public transportation stops as well as provide pedestrian crossings at intervals not to exceed 300 feet within the work zone.
- B. When the construction area crosses a crosswalk, the crosswalk shall be barricaded and sign "No Ped Crossing Use Crosswalk" posted.
- C. Maintain pedestrian and bicycle access and circulation during project construction where safe to do so. If construction activities encroach on a bicycle lane, advance warning signs (e.g., "Bicyclists Allowed Use of Full Lane" and/or "Share the Road") will be posted that indicate bicycles and vehicles are sharing the lane. If construction activities encroach on a sidewalk, safe crossings and appropriate signage will be provided for pedestrians.

### 3.12 NIGHT WORK

- A. No night work shall be permitted unless requested in writing by the Contractor and approved in writing by the agency having jurisdiction. In addition to schedule information traffic control and detour plans for specific locations shall be part of the Contractor's request for night work.
- B. For all night work locations approved in writing, provide advanced special message signs placed at least seven (7) days prior to closing the intersection, but not more than fourteen (14) days in advance of the intersection closure. The advanced special message sign shall state the anticipated closure dates and times as shown on the plans. Notify the agency having jurisdiction not less than fourteen (14) calendar days prior to installing the advance intersection closure warning signs.
- C. The Contractor shall be responsible for maintaining accurate and timely information on the advanced special message signs. The signs, when no longer required or when the information becomes outdated, shall be immediately covered or removed, or the sign message shall be updated.

**END OF SECTION**



## SECTION 01560

### ENVIRONMENTAL CONTROLS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Environmental controls to be maintained during construction.

##### 1.02 APPLICABLE LAWS AND REGULATIONS

- A. Comply with applicable Federal, State and local environmental, health and safety laws and regulations.

##### 1.03 SUBMITTALS

- A. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
- B. Plan for disposal of waste materials and intended haul routes.
- C. Dust control plan.
- D. Erosion and Sediment Control Plan meeting the requirements of the latest edition of the City of Albany Erosion Prevention and Sediment Control Manual.

##### 1.04 SITE CLEANLINESS

- A. Maintain work sites, staging areas, public roadways and private property clean and free of rubbish and debris. Remove materials and equipment from the site when they are no longer necessary for the Work.
- B. Keep buildings that are occupied by the Contractor clear of refuse and debris and in a reasonably neat condition.
- C. Upon completion of the work and before final acceptance, clear work areas of equipment, unused materials, and rubbish to present a clean and neat appearance.

##### 1.05 HAZARDOUS MATERIALS

- A. Handle paints, solvents, and other construction materials with care to prevent contaminants from entering into sewers, storm drains, surface waters, or soils.
- B. Develop an emergency response plan for spills of sewage, paint, oil, and other hazardous materials.
- C. In the event of a spill, immediately notify the Engineer, Owner and jurisdictional agencies. Take proper measures to clean up spills of hazardous materials in accordance with the emergency response plan, State, Federal, and local regulations and manufacturer's recommendations.

## 1.06 AIR POLLUTION CONTROL

- A. Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the air pollution regulations for the area.
- B. Do not idle internal combustion engines for prolonged periods of time.
- C. Minimize dust nuisance by cleaning, sweeping and sprinkling work areas, exposed soil, and haul roads with water or by powered brushing.

## 1.07 NOISE CONTROL

- A. Comply with local controls and noise level rules, regulations, and ordinances which apply to any work performed pursuant to the Contract. If the requirements of this Section are more restrictive than those of the local regulations, the requirements of this Section shall govern.
- B. Minimize noise from construction equipment.
  - 1. Whenever possible, utilize construction equipment powered by electric motors rather than diesel or gas driven engines.
  - 2. Locate construction equipment such as compressors and generators as far from sensitive receptors as feasibly possible. Erect temporary sound blankets around noisy equipment to mitigate noise propagation.
  - 3. Equip internal combustion engines with a muffler and provide a noise enclosure around stationary equipment such as engine-driven generators, welders, compressors, and pumps. Use “quiet package” and “hush” equipment.
  - 4. Do not start-up machines or equipment prior to or after the specified construction work hours.
- C. Noise Complaints: Should a specific noise impact complaint occur, Engineer has the prerogative to direct Contractor to implement one of the following noise mitigation measures at Contractor’s expense:
  - 1. Relocate stationary construction equipment away from the affected property.
  - 2. Shut off idling equipment.
  - 3. Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
  - 4. Install temporary or portable acoustic barriers around stationary construction noise sources.
  - 5. Operate electric powered equipment using utility power.
- D. Amplified sounds such as telephone, loudspeakers, and other forms of loud communication that constitute a nuisance and potential disturbance shall not be used.

## 1.08 DIRT AND MUD CONTROL

- A. Contractor is responsible for preventing dirt, mud, and debris from accumulating on streets, sidewalks, parking areas, or other paved surfaces and for maintaining the cleanliness of these areas.
  - 1. Track Out: Clean vehicle tires of mud and dirt before exiting the site.
  - 2. Cover all dump truck loads and other loads that may result in debris falling from the vehicle.
  - 3. Sweeping Paved Areas:
    - a. Maintain cleanliness of paved areas used by the Contractor for the duration of the project.
    - b. Sweep paved areas that have been used since the previous cleaning on at least a weekly basis, or more frequently when directed by the Engineer. Utilize regenerative air or vacuum pickup sweepers together with proper dust control methods to remove sediment, dust, dirt, and other matter from paved areas. Do not use excessive water resulting in mud on public streets.

## 1.09 TREE AND PLANT PROTECTION

- A. Temporary tree protection
  - 1. Carefully protect existing trees from damage by construction activities. Additional requirements for specific trees may be shown on the Plans or designated in the Contract Documents.
  - 2. Every reasonable effort shall be made to avoid creating conditions adverse to the tree's health.
    - a. The natural ground within the dripline of protected trees shall remain undisturbed.
    - b. The dripline area of protected trees shall be identified on the ground by a circle with a radius measurement from the trunk of the tree to the tip of its longest limb.
    - c. No limb shall be cut back in order to change the dripline measurement.
    - d. The area within the dripline is a critical area of the tree's root zone and defines the minimum protected area of each tree.
    - e. No vehicles, construction equipment, temporary buildings, supplies, materials or facilities shall be driven, parked, stockpiled or located within the dripline of protected trees.
    - f. No trees outside the construction limits shall be removed or damaged, unless authorized by the Engineer .
  - 3. If a tree is damaged or destroyed by construction (other than those designated for removal), the Contractor shall replace it in species, size and grade with a healthy tree as directed by the Engineer . Where it is necessary

to replace a tree damaged by construction, the Contractor shall bear all expenses required to establish the replacement tree and pay any tree removal fees.

- B. Cultivated areas and other surface improvements:
  - 1. Landscaped areas and other surface improvements which are damaged by actions of the Contractor shall be restored.
  - 2. Minimize vegetation removal.
  - 3. Areas shall not be cleared until construction activities require the work.
  - 4. Erosion controls shall be in place prior to clearing and grading activities.
- C. Other areas to be protected:
  - 1. Environmentally sensitive areas are indicated on the Drawings.
  - 2. Erect a protective fence around the area to be protected.
    - a. The protective fence shall be 4 feet tall, international orange high density polyethylene resin (Visi-Barrier or equal).
    - b. Posts shall be heavy duty steel T-posts with corrosion resistant coating spaced at 5 feet on centers.

#### 1.10 OIL SPILL PREVENTION AND CONTROL

- A. Store fuel and oil in accordance with requirements of the Uniform Fire Code and applicable National Fire Protection Association standards.
- B. Assume responsibility for the prevention, containment, and cleanup of spilled oil, fuel, and other petroleum products used in the Contractor's operations. Prevention, containment and cleanup costs shall be borne by the Contractor.
- C. Periodically inspect fuel hoses, lubricating equipment, hydraulically operated equipment, oil drums, and other devices for drips, leaks or signs of damage. Maintain and properly store to prevent spills and vandalism.
- D. Construct dikes around storage tanks, or locate tanks to prevent spills from escaping to surface waters or drainage ditches.
- E. Remove oils on land using sand, clay, sawdust or other absorbent material and dispose in an acceptable manner. Store waste materials in drums or other leak proof containers after cleanup and during transport to disposal.

#### 1.11 WATER POLLUTION CONTROL

- A. Divert sanitary sewage and nonstorm waste flow interfering with construction and requiring diversion to sanitary sewers. Do not cause or permit action to occur which would cause an overflow to existing waterway.
- B. Prior to commencing excavation and construction, obtain Project Manager's agreement with detailed plans showing procedures intended to handle and dispose of sewage, groundwater, and stormwater flow, including dewatering pump discharges.

- C. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

1.12 EROSION, SEDIMENT, AND FLOOD CONTROL:

- A. Provide, maintain, and operate temporary facilities to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period.
- B. Comply with state and local City of Albany requirements including but not limited to the City of Albany Erosion Prevention and Sediment Control Manual, latest edition.
- C. Apply for a City of Albany Erosion Prevention and Sediment Control Permit.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

## SECTION 01600

### MATERIALS AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Materials, equipment and products incorporated into the work.

##### 1.02 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Specified in individual specification Sections in Divisions 2 through 16.
- B. Specifications are minimum requirements and manufacturers' standard products may require modifications to meet the specified requirements.
- C. Provide products and equipment with all accessories, trim, finish, safety guards and other devices needed for a complete and operational installation.
- D. Products to be supplied in quantity shall be the same product from a single source to provide standardization and interchangeability.

##### 1.03 DEFINITIONS

- A. Named Products: Items identified by manufacturer's product name and model number as indicated in the manufacturer's published product data.
- B. Materials: Products that are shaped, cut, worked, finished or otherwise fabricated or installed to form a part of the Work.
- C. Equipment: A product with working parts, whether motorized or manually operated, that requires connections such as wiring or piping.

##### 1.04 PACKAGING AND MARKING

- A. Equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.
- B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or subassembled units where possible.
- C. Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by dust and dirt.

##### 1.05 SHIPPING AND DELIVERY

- A. Plan, order, coordinate and deliver materials and equipment in accordance with the construction schedule to avoid delays and conflicts with the Work.

- B. Deliver anchor bolts and bolt templates sufficiently early to permit setting and placement in structural concrete.
- C. Unload products in accordance with the manufacturer's handling instructions. Promptly inspect for completeness and evidence of damage during shipment.

#### 1.06 HANDLING AND STORAGE

- A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.
- B. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.
- C. Fabricated products, pipe and pipe appurtenances shall be handled, stored off the ground on blocking or skids. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.
- D. Store loose granular products in well-drained area on a solid surface to prevent mixing with foreign matter. Cover products that are subject to erosion or deterioration with plastic sheeting.
- E. Store electrical, instrumentation and control products in a water-tight enclosure to protect against damage from moisture, dust and corrosion.

#### 1.07 PROTECTION OF EQUIPMENT AFTER INSTALLATION

- A. After installation, protect equipment from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and painting of new or existing piping and equipment.
- B. As a minimum, vacuum cleaning, blowers with filters, protective shielding, and other dust suppression methods will be required at all times to adequately protect all equipment.
- C. When sandblasting or when finishing concrete, all equipment that may be affected by cement dust shall be completely covered. Electrical switchgear, substations and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.



- D. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint.

**PART 2 - (NOT USED)**

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. Prior to installation, inspect materials and equipment for signs of corrosion and other effects of storage. Do not install material or equipment showing such effects.
- B. Remove damaged material from the site and expedite delivery of replacement material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays that are within the Contractor's control.

**3.02 INSTALLATION**

- A. Handle, install, connect, clean and adjust products in accordance with the manufacturer's instructions.
- B. Fill lubricant reservoirs and grease bearings prior to starting equipment. Use lubricants recommended by the manufacturer of the equipment.
- C. Recoat painted surfaces that are damaged prior to final acceptance of the Work.

**END OF SECTION**

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## SECTION 01610

### SEISMIC ANCHORAGE AND BRACING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for seismic anchorage and bracing for equipment, tanks and nonstructural components.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  1. Section 01330 – Submittals
  2. Section 01611 – Seismic Design Requirements
  3. Section 05501 – Anchor Bolts and Anchoring Devices
  4. Section 11000 – General Requirements for Equipment
  5. Section 11002 – Equipment Mounting

##### 1.03 AREAS OF DESIGN RESPONSIBILITY

- A. The Contractor shall be responsible for designing all seismic attachments, braces, and anchors to the structure for tanks, mechanical equipment and electrical equipment included in the Work that weigh more than 20 pounds.
- B. Equipment manufacturers may provide standard design calculations and details for their specific pieces of equipment as part of the submittal for that equipment. Project-specific design calculations and details need not be produced unless the manufacture does not already have standard designs already prepared.
- C. Design of seismic anchorage and bracing for piping systems and ventilation ducting is also included in the Contractor's responsibility for seismic design.

##### 1.04 REFERENCES

- A. The following is a list of standards which may be referenced in this section.
  1. International Code Council (ICC)
    - a. International Building Code (IBC)
    - b. Evaluation Service (ICC-ES) Reports and Legacy Reports
  2. American Society of Civil Engineers (ASCE)
    - a. ASCE 7, Minimum Design Loads for Building and Other Structures.

##### 1.05 SUBMITTALS

- A. Comply with Section 01330.

- B. Seismic Anchorage and Bracing Calculations
  - 1. Submit manufacturer’s engineered seismic hardware data and installation requirements.
  - 2. Provide calculations for seismic attachments, braces and anchorages clearly showing the criteria used for the design. Calculations for anchorage of components shall be signed and sealed by a registered Professional Engineer.
- C. Shop Drawings: Show details of seismic attachment assemblies including connection hardware, bracing, and anchor bolts.

1.06 DESIGN AND PERFORMANCE REQUIREMENTS

- A. In accordance with Oregon Structural Specialty Code, tanks, mechanical and electrical components, and other elements of the Work that are permanently attached to structures shall be designed and constructed to transfer the component seismic forces specified in ASCE 7, Chapter 13 to the structure.
- B. Seismic attachments, braces, and anchorages shall be designed in accordance with the provisions of the Oregon Structural Specialty Code and the site-specific seismic criteria in Section 01611
- C. Comply with Sections 11000 and 11002.
  - 1. Do not use more than 60 percent of the weight of tanks and mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
  - 2. Do not use friction to resist sliding due to seismic forces.
- D. In accordance with ASCE 7, the following are exempt from the requirements of this Section:
  - 1. Mechanical and electrical components with a Component Importance Factor of = 1.0 that weigh 400 pounds or less, are mounted 4 feet or less above the adjacent finished floor elevation, and are provided with flexible connections between the components and any associated ductwork, piping, or conduit.
  - 2. Mechanical and electrical components with a Component Importance Factor of = 1.0 that weigh 20 pounds or less, are mounted at any height, and are provided with flexible connections to attached ductwork, piping, and conduit.

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Attachments and supports transferring seismic loads to the structure shall be constructed of materials and products suitable for the application and designed and constructed in accordance with the design criteria shown on the Drawings and nationally recognized standards.

- B. Do not use powder driven fasteners and sleeve anchors for seismic attachments and anchorages where resistance to tension loads is required.
- C. Anchor Bolts: In accordance with Section 05501.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Design seismic anchorage systems to provide restraint in all directions, for each component or system so anchored.
- B. Anchor tall and narrow equipment such as motor control centers and electrical control panels at the base and within 12 inches from the top of the equipment.
- C. Mechanical and electrical components shall not be attached to more than one element of a building structure at a single restraint location where such elements may respond differently during a seismic event. Such attachments shall also not be made across building expansion and contraction joints.
- D. Provide and install seismic attachments and braces in accordance with the size and number of braces determined by the design calculations prepared by the Contractor.
- E. Provide and install anchor bolts and concrete and masonry anchors for the anchorage of equipment in accordance with the bolt sizing, minimum embedment, and spacing requirements determined by the calculations prepared by the Contractor.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

## SECTION 01611

### SEISMIC DESIGN REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. The following primary and secondary structural system elements, non-structural components, and/or equipment supported by structures.
  - 1. Mechanical, electrical, and plumbing equipment and appurtenances.
  - 2. Un-buried Conduit, piping, cable trays, raceways, ducts and similar systems.
  - 3. Un-buried tanks and vessels (include contents), including support systems.
  - 4. Storage racks, suspended ceilings, light fixtures, raised floors, partitions, store-fronts, windows, louvers, architectural features and other non-structural components.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 05501 – Anchor Bolts and Anchoring Devices

##### 1.03 REFERENCES

- A. 2014 Oregon Structural Specialty Code (OSSC)

##### 1.04 DEFINITIONS

- A. Engineer of Record: The Engineer responsible for the preparation of Contract Documents.
- B. Specialty Engineer: Structural or Civil Engineer provided by the Contractor licensed in the State where the project is being built responsible for specific elements of the primary structural system, the secondary structural system, non-structural elements and/or equipment supported by structures.

##### 1.05 GENERAL DESIGN REQUIREMENTS

- A. The Contractor is responsible for producing designs that resist the total seismic forces in accordance with the seismic design criteria.
- B. The Contractor is responsible for coordinating between the Engineer of Record and the Specialty Engineer.
- C. The seismic design for non-structural components and equipment shall be in accordance with the OSSC Chapter 16, and the required coefficients and factors for

determining the total design seismic forces are provided in the Seismic Design Criteria in Paragraph D below.

- D. Coordinate the layout so that adequate space is provided between items for relative motion. Provide additional supports and restraints between items of different systems when necessary to prevent seismic impacts or interaction.
- E. Seismic forces shall be determined in accordance with the following seismic design criteria:
  - 1. Site-Specific Spectral Response Coefficients
    - a. Short Period Mapped Maximum Considered Earthquake, 5 Percent Damped:  $S_s=0.807g$
    - b. Short Period Mapped Maximum Considered Earthquake, 5 Percent Damped:  $S_1=0.423g$
    - c. Short Period Design Spectral Response Acceleration, 5 percent Damped:  $SDS = 0.633$
    - d. 1 Second Period Design Spectral Response Acceleration, 5 percent Damped:  $SD_1 = 0.529$
  - 2. Site Class: D
  - 3. Seismic Design Category: D, unless noted otherwise
  - 4. Risk Category: IV, unless noted otherwise
  - 5. Component Importance Factor,  $I_p$ :
    - a. Mechanical and Electrical Equipment: Use 1.5.
    - b. Tanks and Tank Anchorage: Use 1.5.
    - c. Components that contain hazardous materials: Use 1.5.
    - d. Components that are required for life safety: Use 1.5.
    - e. Components that must remain functional after an earthquake, such as fire protection sprinkler systems: Use 1.5.
  - 6. Do not use more than 60 percent of the weight of tanks and mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
  - 7. Do not use friction to resist sliding due to seismic forces.

#### 1.06 DESIGN REQUIREMENTS FOR PIPING, CONDUIT, AND DUCTS

- A. The Contractor is responsible for producing designs for support of piping, conduit, duct or other systems to resist total seismic forces based on the seismic design criteria coefficients specified above, unless shown on the Contract Documents. Except where the technical specifications give specific exemption from resistance of seismic forces, all supports shall be designed to meet seismic criteria.
- B. Where possible, pipes, conduit, and their connections shall be constructed of ductile materials (e.g., copper, ductile iron, steel or aluminum and brazed, welded or screwed connections). Pipes, conduits and their connections, constructed of



nonductile materials (e.g., cast iron, no-hub pipe and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for ductile material.

- C. Seismic restraints may be omitted for the following conditions, where flexible connections are provided between components and the associated ductwork, piping and conduit:
  - 1. Where the nominal pipe size is 1 in. or less.
  - 2. Piping, conduit or ducts suspended by individual hangers 12 inches or less in length from the top of the component to the bottom of the structural support. Where rod hangers are used, they shall be equipped with swivels.
  - 3. Air-handling ducts less than 6 square feet in cross-sectional area.
  - 4. See the CBC for additional requirements related to the omitting of seismic bracing.
- D. All trapeze assemblies supporting pipes, ducts and conduit shall be braced to resist the total seismic forces considering the weight of the elements on the trapeze. Pipes, ducts and conduit supported by a trapeze where none of those elements would individually be braced need not be braced if connections to the pipe/conduit/ductwork or directional changes do not restrict the movement of the trapeze. If this flexibility is not provided, bracing will be required when the aggregate weight of the pipes and conduit exceed 10 pounds/foot. The weight shall be determined assuming all pipes and conduit are filled with water.
- E. As an alternative to designing the supports and anchorage, where an approved national standard provides a basis for the earthquake-resistant design, submit standard, data, and details for piping, conduit, duct or other systems:
  - 1. For ductwork, mechanical piping, process piping and electrical conduits, follow Guidelines for Seismic Restraints of Mechanical Systems by SMACNA modified as follows:
    - a. Seismically brace piping regardless of size or location. Provide transverse braces at all changes in direction and at the end of all pipe runs. Space transverse braces not more than 20 feet apart. Provide longitudinal braces at 40-foot centers.
    - b. Seismically brace all ductwork regardless of size or location. Provide transverse braces at all changes in direction and at each end of run. Space braces not over 20 feet apart. Provide longitudinal braces at 40-foot centers.
  - 2. For fire protection systems, follow NFPA 13 modified as in Paragraph 1.b above. Ensure that no seismic interaction occurs with items of other systems.

## 1.07 DESIGN REQUIREMENTS FOR UNDERWATER ITEMS

- A. To allow for water sloshing, design rigid items such as piping or equipment supports for twice the lateral force, computed as if the item were above water. Alternatively, include seismic forces due to hydrodynamic forces in the analysis.

- B. Design flexible items to accommodate sloshing motions without damage to rigid machinery.
- C. Provide retainers to hold items from falling and damaging rotating equipment below, if bolted connections will fail because of ground motion displacing the supports.

#### 1.08 SUBMITTALS

- A. Comply with Section 01330.
- B. Shop Drawings: Submit signed and sealed structural calculations and detailed drawings for the following listed elements and where required in Divisions 2 through 16 of the primary structural system and their attachments, the secondary structural system and their attachments, permanent non-structural components and their attachments, and the attachments and anchorage for all permanent equipment supported by the structures.
  - 1. Slide Gates
  - 2. Electrical Equipment
  - 3. Submersible Wastewater Pumps
  - 4. Pipe Supports
- C. Structural calculations and detailed drawings shall be prepared by a Specialty Engineer licensed in the State where the project is being built.
- D. Structural calculations and detailed drawings shall clearly show the total design seismic forces which will be transferred from the elements of the structural system, non-structural components, and/or equipment and their attachments to the primary structure.
- E. The Engineer's review of items within a Specification Section cannot be completed until all related items have been coordinated and submitted for review.
- F. Quality Assurance Submittals
  - 1. Test Reports: Submit test reports for tension testing of anchors.
  - 2. Where required in the equipment specifications in Divisions 2 through 16 submit certification that the equipment itself is designed to resist all internal seismic forces based on the seismic design criteria for the project.
  - 3. Where required in the equipment specifications in Divisions 2 through 16, submit signed and sealed structural calculations and detailed drawings from a specialty Structural or Civil Engineer licensed in the State where the project is being built for the attachments and anchorage to the primary structure.
  - 4. Where required in the equipment specifications in Divisions 2 through 16, submit certification that the attachments and anchorage are designed to resist all seismic forces based on the seismic design criteria for the project.

## 1.09 QUALITY ASSURANCE

- A. Qualifications: The Contractor is responsible for submitting signed and sealed structural calculations and detailed drawings from a Specialty Structural or Civil Engineer licensed in the State where the project is being built.
- B. Regulatory Requirements: Comply with amended versions of 2014 Oregon Structural Specialty Code (OSSC) Chapter 16 – Earthquake Design plus clarifications and additions specified in this Section.

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

## **PART 3 - EXECUTION**

### 3.01 FIELD QUALITY CONTROL

- A. Site Tests:
  - 1. Tension testing of expansion or adhesive anchors utilized for anchorage shall be done in the presence of the special inspector and a report of the test results shall be submitted.
  - 2. See Section 05501 for additional requirements.
- B. Inspection:
  - 1. Provide special inspection for high strength bolting or bolts installed in concrete.
  - 2. See Section 05501 for additional requirements.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

## SECTION 01770

### CONTRACT CLOSEOUT PROCEDURES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for contract closeout.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  1. Section 01780 – Record Drawings
  2. Section 01782 – Operation and Maintenance Information

##### 1.03 FINAL CLEANING

- A. Immediately prior to submittal of a request for inspection for Final Completion, clean the project site and make ready for Owner's use and occupancy.
- B. Employ experienced workers or professional cleaners for final cleaning.
- C. Complete the following cleaning operations:
  1. Clean the project site, yard and grounds which were disturbed by construction activities. Remove rubbish, waste material, litter and other foreign material.
  2. Sweep paved areas, remove oil stains, grease, dust and dirt.
  3. Remove tools, construction equipment, machinery, storage sheds, temporary fences and surplus material.
  4. Broom clean sidewalks and concrete floors.
  5. Vacuum carpets, spot clean or if necessary, shampoo to remove visible soil or stains.
  6. Clean glass in doors and windows, remove glazing compounds, replace chipped and broken glass, clean door and window frames.
  7. Patch, touch up and repair marred surfaces and finishes. Replace finishes and surfaces that cannot be satisfactorily repaired or restored.
  8. Wipe surfaces of mechanical and electrical equipment, remove excess lubrication, paint splatter and mortar droppings.
  9. Clean plumbing fixtures and mirrors.
  10. Clean light fixtures, lamps and bulbs. Replace burned-out bulbs and defective or noisy starters in fluorescent and mercury vapor fixtures.

#### 1.04 FINAL COMPLETION

##### A. Final Completion Submittals:

1. Prior to submitting final Application for Payment, complete and submit the following:
  - a. Project Record Drawings. Refer to Section 01780.
  - b. Guaranty and Warranties.
  - c. Operation and Maintenance Information. Refer to Section 01782.
  - d. Punch List with all corrective actions completed and ready for Final Inspection.
  - e. Releases from Agreements with property owners or public agencies.
  - f. Releases or Waivers of Liens and Claims.
  - g. Evidence of final, continuing insurance coverage complying with insurance requirements.
  - h. Consent of Surety to Final Payment.

##### B. Final Inspection:

1. Submit written request for final inspection for Project Acceptance.
2. Engineer will either proceed with the inspection or advise Contractor of unfulfilled requirements.
3. Engineer will prepare a final Certificate of Completion after satisfactory inspection of the Work.

#### 1.05 FINAL APPLICATION FOR PAYMENT

- A. Following a satisfactory Final Inspection and receipt of a final Certificate of Completion from the Engineer, Contractor shall submit the final Application for Payment in accordance with the procedures and requirements specified in Section 109 of the Division 1 General Requirements

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

**SECTION 01780**  
**RECORD DRAWINGS**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. Record Drawings are documents maintained and annotated by the Contractor during construction to illustrate the final location of piping, equipment, electrical conduits, outlet boxes and cables.
- B. Record changes or deviations that vary from the details indicated on the original Contract Documents. Identify buried or concealed construction and utility features that are revealed during the course of construction. Record the horizontal and vertical location of buried utilities that differ from the locations indicated, or which were not indicated on the Contract Documents.
- C. When the configuration and arrangement of the Work is changed from that indicated on the Contract Drawings or specified in the Project Manual, the authorizing document for the change, such as a Request for Information, Change Order, Shop Drawing, or Field Order, shall be clearly referenced on the Record Drawings as a comment.
- D. Supplement the Record Drawings with detailed layout sketches, schedules, installation drawings and fabrication drawings.

**PART 2 - (NOT USED)**

**PART 3 - EXECUTION**

3.01 RECORD DRAWINGS

- A. Record Drawings shall be full size and maintained in a clean and legible condition. Engineer will provide one set of full size Drawings for use as a Record Drawing set.
- B. Do not use the Record Drawing set for construction purposes.
- C. At the completion of the work, but prior to final payment, submit the Record Drawing set to the Engineer.
- D. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed.
- E. Annotations to the Record Drawings shall be legible and shall be made with an erasable colored pencil conforming to the following color code:
  - 1. Additions and Final Dimensions – Red
  - 2. Deletions – Green
  - 3. Comments – Blue

- F. Engineer will review the Contractor's updated Record Drawing mark-ups on a monthly basis during the evaluation of each progress payment.
1. Progress payment approval is contingent upon complete and up-to-date Record Drawing mark-ups.
  2. Payment approval will be delayed if mark-up drawings are not up-to-date.

**END OF SECTION**



## SECTION 01782

### OPERATION AND MAINTENANCE INFORMATION

#### PART 1 - GENERAL

##### 1.01 GENERAL

- A. Provide Operation and Maintenance (O&M) information for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this Contract.
1. Provide in the form of an instructional manual for use by Owner's personnel.
  2. Provide a separate manual for each piece of equipment (i.e., submersible pumps will have a separate manual from vertical turbine pumps). One exception is that O&M Manuals for valves specified in Division 15 may be combined into one manual.
  3. O&M Manuals and CMMS Data are required for equipment, specialties, electrical, and instruments included in, but not limited to, the following sections:

Section	Title
11288	Fabricated Stainless Steel Slide Gates
11342	Submersible Sump Pumps
11347	Submersible Wastewater Pumps
15110.3	Powered Valve Operators and Operator Appurtenances
15111	Gate Valves
15115.1	Eccentric Plug Valves
15117.1	Wastewater Combination Air Vacuum Release Valve
16010	Operation and Maintenance Data

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
1. Section 01330 - Submittals
  2. Section 01820 – Training
  3. Section 16010 – Operations and Maintenance Data

##### 1.03 SUBMITTALS

- A. Submit in accordance with Section 01330.
- B. Submit preliminary O&M manuals in electronic format.
1. Refer to “Format Requirements – Electronic Copies” below.

2. Include all material in final O&M manual except startup and field testing information.
  3. Engineer and Owner will review manuals. Make additions and revisions in accordance with review comments.
- C. Submit final O&M manuals in hard-copy and in electronic format on CD or DVD.
1. Include startup and field testing information.
  2. Submit two (2) final hard copy O&M Manuals and one (1) electronic copy on CD or DVD for review. Hard copies will be returned to Contractor.
  3. Provide five (5) approved O&M manuals and two (2) copies on CD or DVD to Owner.
- D. O&M Manuals must be submitted and accepted before on-site training, specified in Section 01820, may start.
- E. Submittals that are not fully indexed and tabbed with sequentially numbered pages may be returned without review.
- F. Complete and submit O&M Information Transmittal with each Manual.
- G. Deferred submittal parts, which need not be included with final manuals, but shall be included with approved manuals:
1. Master Volume Index as specified in Paragraph 2.01
  2. Include test reports as specified in Paragraph 2.05 in final O&M manuals.
  3. Include forms required during startup and training in final O&M manuals.
  4. Include completed Equipment Record Forms with equipment serial numbers, as specified in Paragraph 2.02, in final O&M manuals.
- H. Submit data for import in a Computerized Maintenance Management System (CMMS) as specified under Paragraph 2.07 below.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. Each O&M Manual shall provide instructions and procedures for all aspects of equipment installation, operation, and maintenance including: delivery, handling, storage, maintenance during storage, assembly, erection, installation, startup, adjusting, testing, operating, shutdown, troubleshooting, maintenance, and as may otherwise be required.
- B. Organize information in a consistent format under separate headings for each different procedure, with a logical sequence of instructions for each procedure.
- C. Where manufacturers' standard pre-printed manuals are included in O&M Manuals, mark to reflect only the model or series of equipment used on the Project. Neatly cross out non-applicable material.

D. Master Volume Index

1. Provide a neatly typewritten master index of all O&M manuals.
2. List each manual as Volume \_\_\_ of \_\_\_.
3. Include a copy of the index at the front of each manual. Clearly call out the manual in the index.

2.02 FORMAT REQUIREMENTS – GENERAL

A. Cover: Provide a cover page the includes the following information:

1. "OPERATION AND MAINTENANCE MANUAL, VOLUME NO. \_\_\_ OF \_\_\_"
2. Project Name
3. Owner Project Number
4. Specification Number(s)
5. Equipment Name(s)
6. Equipment Tag Numbers

B. Title Page: Provide a title page at the front of each Equipment O&M Manual containing the following information:

1. Owner Name and Project Name
2. Equipment Name
3. Specification Section
4. Equipment Tag Numbers
5. Equipment Model Numbers
6. Equipment Serial Numbers
7. Names, addresses, telephone numbers and individuals to contact for the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts
8. Engineer name, address, and telephone number
9. Contractor, name of responsible principal, address, and telephone number.
10. Date

C. Table of Contents

1. Number each page of O&M Manuals and provide a typed table of contents with page numbers at the front of each O&M Manual.
2. Divide the O&M Manuals into major sections and subsections, to allow easy location of material. At a minimum, list each major section in the table of contents.

3. Provide a fly sheet for each major section listed in the table of contents, with section title printed on fly sheet.
- D. Section 1: Reserve Section 1 of the manual for the following:
1. Maintenance Summary Form (Division 16 – Supplement 16010 – B)
    - a. Fill out by machine. Hand entries will not be allowed.
    - b. Include all required information. The Maintenance Summary Form is intended as an easily accessible quick reference for plant operation and maintenance personnel.
    - c. Maintenance Summary Form for electrical/instrumentation equipment shall be as specified in Division 16. Include a complete list of items supplied, including serial numbers, ranges, options, and other pertinent data necessary for ordering replacement parts.
  2. Startup forms required by individual specification sections. These may include but are not limited to the following:
    - a. Equipment Test Report
    - b. Manufacturer’s Representative Service Report
    - c. Manufacturer’s Installation Certification Form
    - d. Manufacturer’s Instruction Certification Form
- E. Presentation of Data
1. Include only those sheets that are pertinent to the specific product.
  2. Annotate each sheet to:
    - a. Clearly identify the specific project or part installed.
    - b. Clearly identify the data applicable to the installation.
    - c. Cross-out references to inapplicable information.
  3. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
  4. Material shall be suitable for reproduction, with quality equal to original. No scanned or faxed copies of standard published manuals and product data available from manufacturers will be allowed.
- F. Text
1. Manufacturer’s printed data properly edited for project. Cross out all data that does not apply to the equipment to be furnished. Clearly annotate to identify applicable product, part, or data.
  2. Documents shall be machine typed; hand written documents are not acceptable. Documents shall be legible and original size, documents that cannot be read or have been reduced will be returned for correction.

## 2.03 FORMAT REQUIREMENTS – HARD COPIES

- A. Binders
  - 1. Bind Equipment O&M Manuals in heavy duty hard cover three-ring “Slant D” binders with clear vinyl overlay pocket on binder front and spine, Avery Dennison, Heavy Duty, EZD, View Binder or equal.
  - 2. Insert cover page specified above into clear pocket on the front of each binder.
  - 3. Provide with heavy plastic-coated section dividers with numbered plastic index tabs.
  - 4. Include plastic sheet lifters prior to first page and following last page.
- B. Spine Label
  - 1. Provide a spine label to be inserted into the clear pocket on the spine of each binder. Include the following information on the spine label:
    - a. Equipment Name(s)
    - b. Specification Number(s)
    - c. Equipment Tag Numbers.
    - d. Appendix number and/or volume number
- C. Drawings
  - 1. Drawings reduced to 11-inch by 17-inch are acceptable if they are clear and readable, and are neatly and individually double-folded to 8-1/2-inch by 11-inch size. Drawing title shall be visible in lower right hand corner of the original and folded drawing. Reinforce binding edge with clear Mylar strip.
  - 2. Larger drawings or illustrations are acceptable if neatly folded and individually placed in an 8-1/2-inch by 11-inch clear plastic pocket which fits in the binder. Only one drawing or illustration shall be placed in each pocket. Drawing title shall be visible in lower right hand corner of the original and folded drawing.
- D. Additional formatting requirements:
  - 1. Paper Size: 8-1/2 inches by 11 inches, except as noted below.
  - 2. Paper: 20-pound minimum, white for typed pages.
  - 3. Arrange printing so that punched holes do not obliterate data and use hole reinforcements for bound in plan sheets.

## 2.04 FORMAT REQUIREMENTS - ELECTRONIC COPIES

- A. Include all information in the hard-copy Operation and Maintenance Manuals.
- B. Insert fly sheets as specified above at the location of tabbed section dividers.
- C. Provide as a single, searchable PDF file. Generate PDF files from original documents to enable text searches.

- D. The files shall become the property of the Owner for use in training programs and other uses.

## 2.05 CONTENTS OF MANUALS

### A. Product Data

1. Provide manufacturer's catalog data indicating equipment and accessories provided for the Project. Include only those sheets that are pertinent to the products supplied and delete references to inapplicable information.
2. Supplement product data with drawings as necessary to clearly illustrate relations of component parts of equipment and systems.
3. Provide "As Constructed" submittal shop documents, data sheets, and drawings, including all items in the electrical/instrumentation system as specified in Division 16. Contract documents shall not be used as "As Constructed" drawings.

### B. Drawings

1. Supplement product data with drawings as necessary to clearly illustrate:
  - a. Relations of component parts of equipment and systems. Include individual parts list with exploded views for all equipment.
  - b. Control and flow diagrams.
2. Coordinate drawings with information in project contract documents to assure correct illustration of completed installation.

### C. Equipment Description

1. Theory of Operation.
2. Description: Provide description of unit and component parts functions, normal operating characteristics, and limiting conditions.
  - a. Include descriptive bulletins, brochures, or catalog sheets to describe the equipment.
  - b. Include performance curves, engineering data, and test results.

### D. Procedures

1. Safety Procedures: Manufacturer's safety procedures for operating and maintaining all equipment and materials used. List personnel hazards and safety precautions for all operating conditions.
2. Shipping and Installation Procedures
  - a. Receiving and handling.
  - b. Short-term storage, long-term storage and maintenance during storage.
  - c. Complete step-by-step installation instructions for all components.
  - d. Startup, adjusting and testing.

- E. Operating Instructions
1. Provide complete, detailed, written description of the sequence of operations for all operations in all modes. Prepare specifically for this work and reference to control diagrams and system components.
    - a. Recommended step-by-step pre-start, startup, adjustment, calibration, and break-in operating instructions.
    - b. Recommended step-by-step regulation and control instructions for routine operation. Include summer and winter operating instructions as applicable. Include any special operating instructions.
    - c. Recommended step-by-step stopping, shut-down, and post-shutdown instructions.
  2. Staff Service Requirements: Provide instructions for services to be performed by the staff such as lubrication, adjustments, and inspection.
  3. Current and desired control settings.
  4. Emergency Procedures.
    - a. Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment.
    - b. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies.
- F. Preventive Maintenance Information
1. Preventive Maintenance Plan and Schedule
    - a. Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair.
    - b. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis.
  2. Lubrication information
    - a. Lubrication schedule showing service interval frequency
    - b. Table showing recommended lubricants for specific temperature ranges and applications
      - 1) For each required lubricant, provide a list of acceptable equivalents from at least one different major manufacturer whose products are locally available.
    - c. Include a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities
  3. Additional requirements
    - a. Include procedures for disassembly, assembly, alignment, adjusting, and checking.

- b. Provide manufacturer's printed maintenance instructions.
- c. Include illustrations, assembly drawings, and diagrams required for maintenance.

G. Corrective Maintenance Information

1. Corrective maintenance to include disassembly, repair, overhaul and re-assembly.
2. Provide manufacturer's step-by-step trouble shooting and diagnostic procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement
3. Provide manufacturer's step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of text and illustrations
4. Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.
5. Provide manufacturer's instructions and list tools required to restore product or equipment to proper condition or operating standards
6. Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft.

H. Electrical and Instrumentation Information

1. Electrical & Instrumentation Drawings shall include as-built information per Division 16 for the project. As-built drawings shall be signed and stamped by an electrical engineer registered in the State of Oregon.
2. Complete software ladder logic printouts.
3. Record of all settings or parameters for all programmable devices.
4. At the end of the project these manuals shall be updated to show "as-built" or "as-installed" conditions, including any field changes.

I. Parts Identification

1. Provide full identification and listing of all parts of each component, assembly, subassembly, and accessory.
  - a. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification.



- b. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross reference the illustrated part to the listed part.
  - 2. Include schematic diagrams of all electronic devices. Provide a complete parts list with stock numbers for the components that make up the assembly.
  - 3. Include special hardware requirements, such as requirement to use high-strength bolts and nuts.
  - 4. Include control and flow diagrams and panel wiring diagrams.
  - 5. Coordinate drawings to ensure correct illustration of completed installation.
- J. Spare Parts:
  - 1. Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays.
    - a. Manufacturer's recommended spare parts list with manufacturer's current prices.
    - b. Include complete nomenclature and commercial numbers of replaceable parts.
    - c. List spare parts and supplies that have a long lead-time to obtain.
    - d. Provide a table showing the predicted life of parts subject to wear.
- K. Test Data
  - a. Provide copies of factory test reports as specified in the applicable equipment sections.
  - b. After field testing is completed, include field test data.
  - c. Include performance curves and engineering data.
- L. Additional Information
  - 1. Provide any information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Examples include:
    - a. Information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.
    - b. Instances that might affect the validity of Warranties or Bonds

## 2.06 APPENDICES:

- A. Submittals
  - 1. Include a copy of all approved submittals.

- B. Warranty Information
  - 1. List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.
- C. Personnel Training
  - 1. Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.
  - 2. Refer to Section 01820 for additional training information.

## 2.07 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM

- A. Collate and submit information on the new and modified equipment, specialties, electrical, and instrumentation installed during the Project, for potential import into a Computerized Maintenance Management System (CMMS).
- B. Data Format
  - 1. Submit equipment and instrument information in a database file format suitable for direct import to an SQL-based relational database management system, without additional data manipulation.
  - 2. The acceptable format is Microsoft Excel file format.
  - 3. Format data in row (equipment name or tag) and column (equipment, name, tag, description, and various features as noted herein) so that it can be added to the SCADA database.
- C. Data Content
  - 1. Maintenance information to be provided shall include all equipment information relevant to a reliability-centered maintenance program.
  - 2. File and file name of electronic (PDF version) of equipment manual.
  - 3. The spreadsheet information shall include, but is not limited to, the following:
    - a. General information required for all equipment:
      - 1) Equipment or instrument name, model number, serial number
      - 2) Equipment or instrument tag numbers
      - 3) Description
      - 4) Equipment cost
      - 5) Manufacturer and local representative name and contact information
      - 6) Dates of purchase, installation and commissioning
      - 7) List of spare parts, including part number, quantity, name and cost

- 8) Required inspections and frequency
- 9) Required preventive maintenance procedures and frequency
- b. Mechanical equipment information:
  - 1) Lubrication information, including lubrication points, frequency of lubrication, and recommended lubricants
  - 2) Replaceable wear components and recommended replacement intervals
- c. Electric motor information:
  - 1) Frame number
  - 2) Horsepower
  - 3) Amperages
  - 4) Voltage, frequency, number of phases
  - 5) RPM
  - 6) Service factor
  - 7) Duty
  - 8) NEMA design code
  - 9) Insulation class
  - 10) Ambient temperature rating
  - 11) Temperature rise
- d. Instrumentation equipment information:
  - 1) Instrument type
  - 2) NEMA rating
  - 3) Size
  - 4) Range
  - 5) Power requirements
  - 6) Output units
  - 7) Output signal (e.g. millivolts, 4-20 milliamps, pulse)
  - 8) Communications protocol (where applicable)

#### D. Submittal Requirements

- 1. Submit a complete draft electronic copy of the equipment and instrument information database for City review at least three (3) months prior to the project acceptance.
- 2. The City will provide comments on the draft database within then (10) Working Days of receipt. City comments on subsequent drafts of the equipment and instrument information database will be provided within five (5) Working Days of receipt, provided that major revisions requiring additional review time have not occurred.

3. The equipment and instrument information database shall not be considered complete until approved by the City. Approval will not be unreasonably withheld.
4. Following review and approval, the Contractor shall submit one (1) electronic copy of the equipment and instrument information database to the City.

**PART 3 - (NOT USED)**

**END OF SECTION**

## SECTION 01785

### WARRANTIES AND BONDS

#### PART 1 - GENERAL

##### 1.01 GUARANTEE OF WORK

- A. The Contractor hereby agrees to make, at its own expense, all repairs or replacements necessitated by defects in materials or workmanship, supplied under terms of this Contract, and pay for any damage to other works resulting from such defects, which becomes evident within one (1) year after the date of acceptance of the project or the Substantial Completion date whichever is applicable or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents. The Contractor further assumes responsibility for a similar guarantee for all work and materials provided by subcontractors or manufacturers of packaged equipment components. The Contractor also agree to indemnify, defend, and hold the City of Albany harmless from liability of any kind arising from damage due to said defects.
- B. Upon the receipt of notice in writing from the Owner, promptly make all repairs arising out of defective materials, workmanship, or equipment. The Owner is hereby authorized to make such repairs, and the Contractor and its Surety shall be liable for the cost thereof, if ten (10) days after giving of such notice to the Contractor, the Contractor has failed to make or undertake the repairs with due diligence. In case of emergency, where in the opinion of the Owner delay could cause serious loss or damage, repairs may be made without notice being sent to the Contractor, and the expense in connection therewith shall be charged to the Contractor, and its Surety shall be liable for the cost thereof.
- C. Prior to the expiration of the Warranty period, the Owner reserves the right to hold a meeting and require the attendance of the Contractor. The purpose of the meeting is to review warranties, bonds and maintenance requirements and determine required repair or replacement of defective items.
- D. For the purpose of this paragraph, acceptance of the Work or a portion of the Work by the Owner, shall not extinguish any covenant or agreement on the part of the Contractor to be performed or fulfilled under this Contract which has not, in fact, been performed or fulfilled at the time of such acceptance. All covenants and agreements shall continue to be binding on the Contractor until they have been fulfilled.
- E. The Owner and the Contractor agree that warranty on the parts of the work possessed and used by the Owner in accordance with these Specifications, shall commence on the date that the Owner takes possession of such work and so notifies the Contractor in writing. The Owner and the Contractor further agree that such possession, and use of the work shall not be deemed as Substantial Completion or acceptance of any other part of the Work.

- F. If, after installation, the operation or use of the materials or equipment furnished under this Contract proves to be unsatisfactory to the Engineer or Owner, the Owner shall have the right to operate and use such materials or equipment until it can, without damage to the Owner, be taken out of service for correction or replacement. Such period of use of the defective materials or equipment pending correction or replacement shall in no way decrease the guarantee period required for the acceptable corrected or replaced items of materials or equipment.
- G. Nothing in this Section shall be construed to limit, relieve or release the Contractor's, subcontractor's and equipment supplier's liability to the Owner for damages sustained as the result of latent defects in the equipment furnished caused by the negligence of the supplier's agents, employees or subcontractors. Stated in another manner, the warranty contained in this Section shall not amount to nor shall it be deemed to be a waiver by the Owner of any rights or remedies (or time limits in which to enforce such rights or remedies) it may have against the supplier of the equipment to be furnished under these Specifications for defective workmanship or defective materials under the laws of this State pertaining to acts of negligence.
- H. Execute and submit a completed, dated, and signed Warranty Form summarizing the agreement to the warranty requirements of this specification. The Warranty Form shall be submitted prior to the Substantial Completion date or the final acceptance of the project or within five (5) days of the occupancy or use of a portion of the Work, whichever is applicable.

**END OF SECTION**

## SECTION 01810

### FACILITY START-UP AND COMMISSIONING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Project requirements for Start-up and Commissioning

##### 1.02 DEFINITIONS

- A. Start-up: The initial operation of the facility and/or plant, utilizing wastewater and related substances (sludge, methane, scum), or other media which the facility has been designed to process.
- B. Commissioning: A confirmation that equipment, systems and facilities operate in accordance with the design intent and satisfy the detailed requirements of the technical specifications. The duration of the commissioning period shall be not less than 7 consecutive days.

##### 1.03 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  1. Section 01330 – Submittals
  2. Section 01600 – Materials and Equipment
  3. Section 01820 – Training

##### 1.04 SUBMITTALS

- A. Prepare and submit in accordance with Section 01330.
- B. Facility Startup/Operational Testing and Demonstration Plan:
  1. Submit at least 4 week prior to the scheduled start date and the plan must be approved before startup.
  2. Include the following items at a minimum:
    - a. A pre start-up inspection checklist
    - b. A schedule for the Performance Testing, Facility Startup/Operational Testing, and Demonstration Period updated monthly
    - c. A Facility Startup/Operational Testing and Demonstration Plan. An Equipment Testing Plan to be used during Performance Testing
    - d. Calibration and Performance Test results, documented as required by the test program, of equipment or system prior to commencement of the Operational Test
    - e. The original records produced during the Testing Program.

## 1.05 SERVICES OF MANUFACTURER

- A. Manufacturer's services for inspection, physical checkout, field adjustment, field testing, and start-up shall comply with the requirements of this Section, the requirements of the particular equipment or product technical specifications contained in Divisions 2 through 17, and the requirements of Section 01600.
- B. Manufacturer's services for training and instruction of the Owner's personnel shall comply with the requirements of the particular equipment or product technical specifications contained in Divisions 2 through 17 and Section 01820.

## 1.06 ROLES AND RESPONSIBILITIES

- A. Contractor's Responsibilities
  - 1. Submit specific start-up plan(s) per Paragraph 1.04 in order to:
    - a. Schedule and coordinate with the Engineer for start-up of equipment and systems.
    - b. Review procedures for facility start-up.
  - 2. Review preliminary punch list items with the Engineer 15 days prior to the scheduled start-up; and complete, correct, or resolve at the option of the Engineer, any items which impact or interfere with the facility start-up.
  - 3. Attend meetings related to the review of start-up plan(s).
  - 4. Clarify submittals, testing requirements, schedules, or other items related to the start-up of the equipment and facilities specified and indicated in the Contract Documents.
  - 5. Provide all start-up materials and operating supplies for 30 operating days. Supplies include lubricants, chemicals, gases, and specialized fluids to maintain operation for 30 days.
  - 6. Provide Manufacturer's authorized representatives as required to supervise placing equipment or systems in operation and to provide guidance during the start-up period.
  - 7. Provide to the Engineer a list of, "on call" representative supervisory persons who will monitor the facility start-up, and serve as a liaison for the Engineer.
  - 8. Provide the necessary craft or labor assistance full time during the day shift and as required at other times in the event of an emergency requiring immediate attention. An emergency is defined as a failure which precludes the further operation of a critical segment of the Work. The response time shall be not less than four hours from the time of notification.
  - 9. Correct all failures or equipment problems identified during start-up. Repairs deemed the responsibility of the Contractor shall be made at no additional cost to the Owner.



- B. The responsibilities of the Owner's O&M staff during the 7-day facility start-up period include the following:
  - 1. Provide staff to operate equipment, systems, and facilities requiring start-up.
  - 2. Provide all utilities including power, natural gas, and water.
- C. The Engineer's responsibilities for the facility start-up period include the following:
  - 1. Coordinate the Contractor's start-up activities with plant operations staff.
  - 2. Verify the results of performance tests and any retesting.
  - 3. Direct the Contractor to repair defective workmanship, materials, and equipment.

#### 1.07 COMMISSIONING

- A. The Owner's Operations and Maintenance staff will initiate the commissioning period and will operate the facility throughout the duration of the commissioning period. If any item malfunctions during the test, the item shall be repaired and the test restarted at day zero with no credit given for the operating time before the malfunction.
- B. The purpose of this 7-day operational demonstration is to:
  - 1. Provide the environment by which the Owner's O&M staff can place equipment and systems into service as needed.
  - 2. Expose flaws or defects in workmanship, equipment, or materials, not previously discovered that are the responsibility of the Contractor to repair, correct, modify, or replace prior to Final Acceptance.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**

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## SECTION 01820

### TRAINING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for training the Owner's personnel, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this Contract.
- B. Coordinate with the equipment suppliers for all training activities and provide additional labor, services, and materials as required to complete training.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 TRAINING SESSIONS

- A. Where required by the detailed specifications, provide on-the-job training of the Owner's personnel, which will include plant operations personnel, mechanics, electricians, and electronics technicians.
- B. The training sessions shall be conducted by qualified, experienced (2 years minimum), manufacturer's factory-trained representatives (not sales representatives) of the various equipment manufacturers.
- C. Include instruction in both equipment operation and preventive maintenance.
- D. Field training sessions shall take place at the project site. Classroom training facility will be provided at the site by the Owner.

##### 1.04 TIMING OF TRAINING SESSIONS

- A. Conduct training sessions in conjunction with the operational testing and commissioning periods.
- B. Operation and maintenance manuals shall be approved and ready for distribution to the Owner's personnel at least 30 days prior to the date scheduled for the individual training session.

##### 1.05 SUBMITTALS

- A. The following information shall constitute the Contractor's training plan and be submitted to the Engineer in accordance with the provisions of Section 01330.
  - 1. Lesson plans for each training session to be conducted by the Contractor's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.

2. Date, time, and subject of each training session and identity and qualifications of individuals to be conducting the training.
  3. Training schedule. Concurrent classes will not be allowed.
- B. Due to phased testing and start-up activities, Contractor may prepare separate submittals for individual equipment items and systems. The materials shall be reviewed and accepted by the Engineer no later than 3 weeks prior to delivery of the training.

## **PART 2 - PRODUCTS**

### **2.01 LESSON PLANS**

- A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session.
- B. Each lesson plan shall contain a time allocation for each subject.
- C. Furnish ten copies of the training manuals, handouts, and reference materials and one copy of necessary visual aids at least 1 week prior to each training session. These materials shall remain the property of the Owner and shall be suitably bound for proper organization and easy reproduction.

### **2.02 FORMAT AND CONTENT**

- A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system.

### **2.03 VIDEO RECORDING**

- A. The City may record, or retain the services of a commercial video taping service to record, each training session. After taping, the material may be edited and supplemented with professionally produced graphics to provide a permanent record.

## **PART 3 - EXECUTION**

### **3.01 SCHEDULING TRAINING SESSIONS**

- A. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. Consolidate short training sessions into combined sessions so that staff time is more efficiently used. The minimum combined session length should be 1.5 to 2 hours. The maximum single or combined session length shall be 4 hours. The Contractor shall arrange to have the training conducted on consecutive days, with no more than 4 hours of classes scheduled for any one day. Contractor shall provide two training sessions on each system, piece of equipment, or "topic".

- B. No training sessions shall be scheduled for Mondays or Fridays. The Contractor shall coordinate the scheduling of training sessions with the operations superintendent.
- C. The following services shall be provided for each item of equipment or system. Additional services shall be provided, where specifically required in individual specification sections.
  - a. At a minimum, classroom equipment training for operations personnel will include:
  - b. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.
  - c. Purpose and plant function of the equipment.
  - d. A working knowledge of the operating theory of the equipment.
  - e. Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.
  - f. Identify and discuss safety items and procedures.
  - g. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
  - h. Operator detection, without test instruments, of specific equipment trouble symptoms.
  - i. Required equipment exercise procedures and intervals.
  - j. Routine disassembly and assembly of equipment if applicable (as judged by the City on a case-by-case basis) for purposes such as operator inspection of equipment.
- 2. At a minimum, hands-on equipment training for operations personnel will include:
  - a. Identify location of equipment and review the purpose.
  - b. Identifying piping and flow options.
  - c. Identifying valves and their purpose.
  - d. Identifying instrumentation:
    - 1) Location of primary element.
    - 2) Location of instrument readout.
    - 3) Discuss purpose, basic operation, and information interpretation.
  - e. Discuss, demonstrate, and perform standard operating procedures and round checks.
  - f. Discuss and perform the preventative maintenance activities.
  - g. Discuss and perform start-up and shutdown procedures.
  - h. Perform the required equipment exercise procedures.

- i. Perform routine disassembly and assembly of equipment if applicable.
  - j. Identify and review safety items and perform safety procedures, if feasible.
3. Classroom equipment training for the maintenance and repair personnel will include:
  - a. Theory of operation.
  - b. Description and function of equipment.
  - c. Start-up and shutdown procedures.
  - d. Normal and major repair procedures.
  - e. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the “pass” and “no pass” test instrument readings.
  - f. Routine and long-term calibration procedures.
  - g. Safety procedures.
  - h. Preventive maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
4. Hands-on equipment training for maintenance and repair personnel shall include:
  - a. Locate and identify equipment components.
  - b. Review the equipment function and theory of operation.
  - c. Review normal repair procedures.
  - d. Perform start-up and shutdown procedures.
  - e. Review and perform the safety procedures.
  - f. Perform City approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.
  - g. Review and use equipment manufacturers’ manuals in the hands-on training.

**END OF SECTION**

## SECTION 01825

### EQUIPMENT AND SYSTEM TESTING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for the Contractor's testing of mechanical, electrical, and instrumentation equipment and systems provided under this Contract.
- B. The requirements contained in this Section supplement, but do not supersede, specific testing requirements found elsewhere in the Contract Documents.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 01999 – Reference Forms

##### 1.03 COORDINATION

- A. Coordinate with the equipment suppliers for functional and performance testing and facility startup. Minimum levels of on-site installation and testing assistance required of the equipment suppliers is described in separate Sections.
- B. Coordinate the activities of subcontractors and equipment suppliers to implement the requirements of this Section.

##### 1.04 SUBMITTALS

- A. Prepare and submit in accordance with Section 01330.
- B. Independent Testing Labs: When testing by an independent laboratory is specified, provide credentials and certifications to demonstrate capabilities.
- C. Test Instruments Calibration: Certification that test instruments used in the testing procedure have been calibrated to an acceptable and recognized standard.
- D. Testing Schedule: For each piece of equipment or system, provide a testing schedule and updates as appropriate. Submit at least 20 working days prior to the scheduled start of testing. Confirm the test schedule, or provide an updated schedule 4 days prior to the start of testing.
- E. Testing Plan: Describe step by step procedure that will be utilized to systematically test equipment and systems.
- F. Test Results:
  - 1. Factory Test Results: Results of equipment tests performed by the equipment supplier at the point of manufacture and prior to shipping the equipment to the site.

2. Results of the Pre-Operational Test.
  3. Results of the Functional Test.
  4. Results of the Operational and Performance Tests.
- G. Testing Form
1. Section 01999 contains a sample Instrumentation Data and Calibration Test Form showing the format and level of detail required for the documentation forms.
- H. Manufacturer's Field Certification
1. Submit a Manufacturer's Installation Certification Form (Section 01999) after the manufacturer's Field Representative has completed the specified field services and testing. Submit the certification prior to Manufacturer's Representative leaving the plant site.

#### 1.05 DOCUMENTATION REQUIREMENTS

- A. Develop and implement a records keeping system to document compliance with the requirements of this Section.
- B. Document date of test, equipment number or system name, nature of test (performance or operational), test objectives, test results and test instruments used during the test. Provide signature spaces for the Engineer and the Contractor.

#### 1.06 TEST PLANS

- A. Develop test plans in cooperation with the equipment suppliers detailing the coordinated, systematic testing of each item of equipment and system provided under this Contract.
- B. Make test plans specific to the item of equipment or system to be tested. Identify by specific equipment or tag number each device or control station to be manipulated, observed or tested during the test procedure and the specific results to be observed or obtained.
- C. Identify the responsibility of subcontractors and suppliers who will participate in the tests and list the names of manufacturers' representatives to be present during the duration of the test.
- D. Provide step-by-step procedures for testing control and electrical circuits to affirm that the circuit is properly identified and connected to the proper device.
- E. Undertake performance tests in a manner that will duplicate the actual operating conditions that will be encountered.

#### 1.07 TESTING SCHEDULE

- A. Prepare a testing schedule setting forth the sequence contemplated for performing the test work. Identify the contemplated start date, duration of the test and completion of each test.



## 1.08 TEST RESULTS

- A. Test results shall be within the tolerances set forth in the detailed specification sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice.
- B. Retesting: If any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion, together with all other portions of the work as are affected thereby, shall be repeated within reasonable time and in accordance with the specified conditions.

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

## **PART 3 - EXECUTION**

### 3.01 GENERAL

- A. The objective of the testing program is to demonstrate, to the Engineer's complete satisfaction, that the systems and equipment provided under this Contract meet the specified performance requirements.
- B. Testing program also provides a base-line operating condition for the Owner to use in a preventative maintenance program.
- C. Testing sequence consists of Pre-Operational Checkout, Functional Tests, Performance Testing and Operational Testing. These tests are required regardless of whether Factory Tests were conducted on the same piece of equipment or system.
- D. Each item of mechanical, electrical, and instrumentation equipment installed under this Contract shall be tested by the Contractor to demonstrate compliance with the performance requirements of this project.
- E. Provide labor, outside services, materials, test equipment and other items required to complete the specified testing and startup requirements. Unless otherwise specified, furnish power, water chemicals, fuel, oil, grease and other materials needed to conduct the specified tests.
- F. Install temporary valves, gauges, piping and other materials required to conduct the specified tests.

### 3.02 PRE-OPERATIONAL CHECKOUT

- A. Pre-Operational Checkout shall be undertaken by the manufacturer's field representative.
- B. Pre-Operational Checkout includes basic checks of the equipment installation prior to starting the equipment to determine if the equipment and related components have been correctly installed and is ready for starting.
- C. Pre-Operational Checkout includes the following:
  - 1. Alignment of equipment, shafts and shaft couplings, drives, belts and pulleys.

2. Filling and checking lubrication reservoirs.
  3. Checking shaft seals, packing and seal lubrication system.
  4. Manufacturer's recommendations for pre-start preparation.
  5. Proper motor rotation
  6. Circuit continuity testing, electrical testing, and instrumentation and control system testing in accordance with the requirements of Division 16.
  7. Demonstrate operational controls function as intended.
  8. Calibration and adjustment of electrical and instrumentation devices.
- D. Verify tanks, pipes, conduits, vessels and equipment are clean and free of debris that may interfere with the testing or operation of the equipment. Remove debris prior to start of testing.
- E. Following completion of the Pre-Operational Checkout, the manufacturer's field representative shall complete and sign a field certification form and submit to the Engineer.

### 3.03 FUNCTIONAL TESTS

- A. After successful completion of the Pre-Operational Checkout, start individual items of equipment and systems and operate under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications.
- B. Operate the equipment for a sufficient period of time to determine machine operating and characteristics, including noise, temperatures and vibration; to observe and document performance characteristics; and to permit initial adjustment of operating controls.
- C. Obtain baseline operating data on all equipment with motors greater than 10 horsepower to include amperage draw, bearing temperatures, and vibration as required. This baseline data will be collected for the Owner to enter in their preventive maintenance system.
- D. Post-Test Inspection: When Functional Tests have been completed, recheck equipment for proper alignment, unacceptably loose connections, unusual movement, or other indications of improper operating characteristics. Correct any deficiencies to the satisfaction of the Engineer.
- E. Machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Repair any defects found during the course of the inspection and identify and correct the cause of such defect. Replace specific parts, or the entire equipment item, to the complete satisfaction of the Engineer at no cost to the Owner.

### 3.04 OPERATIONAL AND PERFORMANCE TESTS

- A. After successfully completing functional tests, conduct an operational test of each system to verify correct operation. During the operational test, conduct

performance testing to verify that the system complies with the performance requirements contained in the individual equipment specifications.

- B. Owner's operating personnel will fill process units and process systems with water and other process fluids to allow the Contractor to conduct the operational tests.
- C. Upon completion of the filling operations, operate all parts of each system for a continuous, uninterrupted period of not less than 8 hours unless noted otherwise in the detailed Specifications. During this period, the Contractor shall undertake performance testing and shall monitor the characteristics of each machine according to manufacturer information and specifications and report any unusual conditions to the Engineer.
- D. Undertake performance tests of mechanical, electrical, HVAC, and instrumentation equipment and systems to demonstrate and confirm compliance with the performance requirements specified in the individual equipment specifications.
- E. Should the operational testing be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption.
- F. Following successful completion of the Operational Test, commissioning of the system may begin.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

## SECTION 01890

### RESTORATION OF IMPROVEMENTS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Restoration of work areas after installation and construction of new facilities.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 02953 – Pavement Restoration

#### PART 2 - (NOT USED)

#### PART 3 - EXECUTION

##### 3.01 STRUCTURES

- A. Take precautions to protect the integrity and usefulness of existing facilities.
- B. If necessary, remove existing structures including curbs, gutters, pipelines, and utility poles, as necessary for the performance of the work.
  - 1. Repair existing structures that are damaged as a result of the Work under this contract
  - 2. Rebuild or replace the structures in as good a condition as originally found.

##### 3.02 ROADS AND STREETS

- A. Asphalt pavement that has been removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be brought to original grade and section and resurfaced.
- B. Before resurfacing material is placed, sawcut edges of pavement to provide clean solid vertical faces.
- C. Complete pavement repair in accordance with Section 02953 and in accordance with the requirements of the affected agencies and parties.

##### 3.03 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS

- A. Restore cultivated or planted areas and other surface improvements damaged by construction as nearly as possible to their original condition.
- B. Repair existing guard posts, barricades, and fences that are damaged.
- C. Replace damaged plantings with new plantings of the same type or as acceptable to the Owner

### 3.04 PROTECTION OF EXISTING INSTALLATIONS

- A. Immediately repair or replace existing equipment, controls, structures, or facilities which are damaged as part of the Work.
- B. Take measures that are necessary to ensure that construction debris and materials are kept out of the wastewater system.

**END OF SECTION**

## SECTION 01999

### REFERENCE FORMS

The forms listed below and included in this section are referenced from other sections of the project manual. Contractor may submit equivalent forms for Owner's approval prior to use. If Owner does not approve substitute form, Contractor must use forms found in this Section. Owner will provide Contractor electronic files of prescribed forms upon request.

<b>Referenced in Section</b>	<b>Title of Form</b>
07900, 09900, 11347	Extended Warranty Form
07900, 11000, 11347, 15110.3, 15856	Manufacturer's Installation Certification Form
11347, 15110.3	Manufacturer's Instruction Certification Form
11347	Motor Data Form
15996	Pipe Test Record Form
01330	Proposed "Or Equal" Substitution Transmittal
01340	Request for Information (RFI)
01330	Submittal Transmittal
11288, 11347	Unit Responsibility Certificate

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**EXTENDED WARRANTY FORM**  
(For Equipment, Material, Process)

Extended Warranty For: Product Name  
Specification Section No. \_\_\_\_\_  
Product Manufacturer \_\_\_\_\_  
Project: \_\_\_\_\_  
Location: \_\_\_\_\_

We hereby guarantee the Product Name that we have constructed for a period of # of Years (#) year(s), as specified in the Section noted above, from Date, the date of acceptance of the work/substantial completion and the assumption of occupancy and beneficial use by the Name of Owner.

The following are excluded from the provisions of this warranty:

We agree that if any of the equipment, material, or process designated for Product Name should fail due to any reason other than improper maintenance or improper operation, or should any portion of the work fail to fulfill any of the requirements of the Specifications, we will, within ten days after written notice of such defects, commence to repair or replace the same together with any other work which may be damaged or displaced in so doing.

In the event of our failure to comply with the above mentioned conditions within a reasonable time after being notified, or should exigent circumstances require repairs or replacements to be made before we can be notified or respond to notification, we do hereby authorize the Name of Owner to proceed to have the defect repaired and made good at our expense, and we will pay the cost therefor upon demand.

The warranty provided herein shall not be in lieu of, but shall be in addition to any warranties or other obligations otherwise imposed by the Contract Documents and by law.

Manufacturer: _____	Contractor: _____
Signed: _____	Signed: _____
Title: _____	Title: _____
Date: _____	Date: _____
Phone: _____	Phone: _____
E-mail: _____	E-mail: _____

# MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No: \_\_\_\_\_ Specification Section: \_\_\_\_\_

Equipment Name \_\_\_\_\_

Contractor: \_\_\_\_\_

Manufacturer of Equipment Item: \_\_\_\_\_

*The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations and that the trial operation of the equipment item has been satisfactory.*

**Comments:**

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\_\_\_\_\_  
Date

\_\_\_\_\_  
Manufacturer

\_\_\_\_\_  
Signature of  
Authorized Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Signature of  
Authorized Representative

# MANUFACTURER'S INSTRUCTION CERTIFICATION FORM

Contract No: \_\_\_\_\_ Specification Section: \_\_\_\_\_

Equipment Name: \_\_\_\_\_

Contractor: \_\_\_\_\_

Manufacturer of Equipment Item: \_\_\_\_\_

*The undersigned manufacturer certifies that a service engineer has instructed the owner's staff in the proper maintenance and operation of the equipment designated herein.*

## **Operations Check List** (check appropriate spaces)

Start-up procedure reviewed

Shutdown procedure reviewed

Normal operation procedure reviewed

Others: \_\_\_\_\_

\_\_\_\_\_

## **Maintenance Check List** (check appropriate spaces)

Described normal oil changes (frequency)

Described special tools required

Described normal items to be reviewed for wear

Described preventive maintenance instructions

Described greasing frequency

Others \_\_\_\_\_

\_\_\_\_\_

Manufacturer: \_\_\_\_\_

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Authorized Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Owner's Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Contractor's Representative

## MOTOR DATA FORM

Equipment Name: \_\_\_\_\_ Equipment Number: \_\_\_\_\_

Site Location: \_\_\_\_\_

### Nameplate Markings

Mfr \_\_\_\_\_ Mfr Model \_\_\_\_\_ Frame \_\_\_\_\_ HP \_\_\_\_\_

Volts \_\_\_\_\_ Phase \_\_\_\_\_ RPM \_\_\_\_\_ Service Factor \_\_\_\_\_

FLA \_\_\_\_\_ LRA \_\_\_\_\_ Freq \_\_\_\_\_ Amb temp rating \_\_\_\_\_ degrees C

Time rating \_\_\_\_\_ Design letter \_\_\_\_\_

(NEMA MG1-10.35) (NEMA MG-1.16)

KVA code letter \_\_\_\_\_ Insulation class \_\_\_\_\_

The following information is required for explosionproof motors only:

A. Approved by UL for installation in Class \_\_\_\_\_, Div \_\_\_\_\_

B. UL frame temperature code \_\_\_\_\_, Group \_\_\_\_\_ Atmosphere

(NEC Tables 500-2 and 500-2(b))

The following information is required for high efficiency motors only:

A. Guaranteed minimum efficiency at full load or NEMA efficiency index

(NEMA MG1-12.53b)

B. Nameplate or nominal efficiency \_\_\_\_\_

### Data Not Necessarily Marked on Nameplate

Type of enclosure \_\_\_\_\_ Enclosure material \_\_\_\_\_

Temp rise \_\_\_\_\_ degrees C (NEMA MG1-12.41,42)

Space heater included? \_\_\_\_\_ Yes \_\_\_\_\_ No, if Yes \_\_\_\_\_ watts \_\_\_\_\_ volts

Type of motor winding overtemperature protection, if specified:

\_\_\_\_\_

Use the space below to provide additional information on other motor modifications, if specified:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# PIPE TEST RECORD

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

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_

Contractor: \_\_\_\_\_

Pipeline Size & Name	Pipe Type	Pipe Location/Description
(SL), SN, IA, etc.)	(DI, PVC, Steel, Copper, etc.)	(Attach sketch if needed)
<b>Section Tested:</b> From: _____ To: _____	<b>First Test</b> <input type="checkbox"/> <b>Or</b> <b>Re-Test</b> <input type="checkbox"/>	<b>Length of Pipe Tested:</b> _____ Ft.

Test Specifications	Actual Test Results
Type of Test: _____	Start pressure: _____
Type of Test: _____	End Pressure: _____
Duration: _____	Start time      Stop time      Duration _____      _____      _____
Allowable loss: _____	Actual loss: _____

**Comments:**

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<b>Test Passes</b>	<input type="checkbox"/>
<b>Test Fails</b>	<input type="checkbox"/>

**Tested By:** \_\_\_\_\_  
Contractor

**Test Witnessed By:** \_\_\_\_\_  
Construction Inspector

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## PROPOSED "OR EQUAL" SUBSTITUTION SUBMITTAL TRANSMITTAL

**Proposed "Or Equal Substitution Submittal Description**

\_\_\_\_\_

\_\_\_\_\_

Priority Level:  Low     Medium     High     **On Critical Path**

<b>Submittal No.</b>	
<input type="checkbox"/> 1st Submission	<input type="checkbox"/> Re-Submittal
Spec Section	
Dwg/Detail No.	

Owner:	Routing	Date Sent	Date Received
	Contractor/CM		
Project Name:	CM/Design Consultant		
	Design Consultant/CM		
Contractor:	CM/Contractor		

**Proposed "Or Equal" Substitution Item or Service**

- A. When the first specified item is followed by a second maker's name and "or equal," the Contractor may submit Proposed Equivalent items for the Engineer's review. Proposed "Or Equal" Substitution items that are in the Engineer's judgment equal to the first specified item in quality, utility, and appearance, will be Favorably Reviewed. Where a product description and first maker's name is followed by "or equal" with no second maker's name, it means the Engineer knows of no equivalent product and the Contractor may submit Proposed Equivalent products by other makers for review. Where the term "or equal" is omitted, it means that the named item is required to meet the Owner's needs; no products or makers other than those specified will be considered.
  
- B. This request shall include adequate technical information to fully describe the function and quality of the item. Submittals of Proposed "Or Equal" Substitution items that are not made within thirty (30) calendar days of the Notice to Proceed date will be rejected unless the Owner has agreed in writing to a later submittal date and the Contractor agrees to comply with all conditions of the Owner for the late submittal. If the Contractor's second attempt to obtain Favorable Review of a Proposed "Or Equal" Substitution item is unsuccessful, the Contractor shall submit the first specified item.
  
- C. Inclusion of a second maker's name indicates the maker is acceptable but does not necessarily indicate the maker offers a standard product equal to the first specified item. Items by the second named maker are subject to the same conditions of review and compatibility as other Proposed "Or Equal" Substitution items. Inclusion of a maker's name and/or model number after a specification description is not a representation that the maker will furnish an item meeting the Contract requirements at bid time or at time of need. It is the Contractor's sole responsibility to furnish items meeting the Contract requirements.
  
- D. The Engineer's review of Proposed "Or Equal" Substitution items is based solely on information provided by the Contractor and on the Contractor's warranty that the proposed item is equal in quality, utility, function and appearance to the first specified item. Favorable Review of a Proposed "Or Equal" Substitution item has the same meaning and is subject to the same limitations that apply to the Favorable Review of Product Data and Shop Drawings described in the Contract Documents.
  
- E. Submit with proposal:
  - 1. Description of item being proposed including the Manufacturer's model or product number.
  - 2. Manufacturer's representation that the proposed "or equal" substitution item or service is equal to or superior to specified item in all respects.
  - 3. Manufacturer's product data.
  - 4. Information about several recent similar installations, including project name, owner's name, address, telephone number, and name of knowledgeable person to contact for information on performance of the product.

5. Whether a reduction in the Contract Price is being proposed. If so, provide a detailed cost breakdown substantiating the cost reduction. Consideration should be given to all extra costs and expenses necessary to make the proposed "or equal" substitution meet or exceed the all requirements found in the Contract Documents.
6. Whether a reduction in the Contract Time is being proposed. If so, provide schedule analysis substantiating the reduction in contract time and assumptions made in the schedule analysis.
7. Explain all known differences between the product specified and the Proposed "Or Equal" Substitution. Explanation to consider such items as:
  - a) Does the substitution affect dimensions shown on Drawings?
  - b) Are the manufacturer's guarantees and warranties on the proposed substitution items identical to those on the specified items? If there are differences, please specify each and every difference in detail.
  - c) Does the proposed "or equal" substitution impact other contractors, trades or suppliers?
  - d) Is the proposed "or equal" substitution compatible with all other interrelated equipment, materials and products?
  - e) Any differences in Operations and Maintenance costs?
  - f) Any differences in available factory authorized repair centers with regards to response times and geographic location?
  - g) Will use of proposed "or equal" substitution be subject to any license fee or royalty?
  - h) Are there any color or pattern differences? If so, provide color and pattern samples?

The undersigned hereby:

1. Certifies that he/she has thoroughly investigated the Proposed "Or Equal" Substitution item or service and has determined that the function/utility, appearance and quality of the Proposed "Or Equal" Substitution item or service are equivalent or superior to those of the specified item;
2. Certifies that the Proposed "Or Equal" Substitution item or service is compatible with all interrelated equipment, materials, products and services unless otherwise explained in specific detail in this submittal;
3. Agrees to coordinate installation and make all other changes that may be required for Work to be complete in all respects at no additional cost to the Owner;
4. Waives all claims for additional costs and contract time due to late ordering of the specified products or services caused by requests for "Or Equal" Substitutions that are subsequently rejected by the Engineer;
5. Represents and warrants that the Contractor is solely responsible for any extra cost or expense necessary to make the Proposed "Or Equal" Substitution item or service fully equivalent to and compatible with the Contract Documents and will meet or exceed the Engineer's design intent;
6. Agrees to compensate the Owner for all additional redesign costs associated with the Proposed "Or Equal" Substitution item or service and the cost of the Engineer's review of the Proposed "Or Equal" Substitution item or service;
7. Waives all claims for additional costs and contract time which may subsequently become apparent; and
8. Agrees to comply with all additional requirements imposed by the Owner and Engineer should the Proposed "Or Equal" Substitution item or service is approved.

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

Contractor: \_\_\_\_\_

Name: \_\_\_\_\_

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

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



# REQUEST FOR INFORMATION

RFI No.: XXX

Owner: \_\_\_\_\_

Project: \_\_\_\_\_

Contractor: \_\_\_\_\_ Engineer \_\_\_\_\_

RFI Generated by:  Contractor  CM  Other

Priority Level:  Low  High  On Critical Path

Is there a Cost Impact associated with this RFI?  Yes  No  Possibly

Is there a Time Impact associated with this RFI?  Yes  No  Possibly

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**RFI Title:**

Reference: Spec: \_\_\_\_\_ Sheet: \_\_\_\_\_

**Requested Information:**

Signed: \_\_\_\_\_

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

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**Response:**

Signed: \_\_\_\_\_

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

## SUBMITTAL TRANSMITTAL

Submittal Description \_\_\_\_\_

Priority Level:  Low     Medium     High     On Critical Path

<b>Submittal No.</b>	
<input type="checkbox"/> 1st Submission	<input type="checkbox"/> Re-Submittal
Spec Section	
Dwg/Detail No.	

Owner:	<b>Routing</b>	<b>Date Sent</b>	<b>Date Received</b>
Project Name:	Contractor/CM		
	CM/Design Consultant		
Contractor:	Design Consultant/CM		
	CM/Contractor		

We are sending you:     Attached                       Under separate cover via \_\_\_\_\_

Submittals for review and comment

Product Data for information only \_\_\_\_\_

No. Copies	Description	Manufacturer	Reviewer Action	Reviewer Initials

<p>The Action Designated Above is in Accordance with the Following Legend:</p> <p>A – No Exceptions Taken          B – Make Corrections Noted          C – Amend and Resubmit          D – Rejected          E – Review not Required</p>	<p><b>CONTRACTOR:</b> Must certify one of the following statements pertaining to the transmittal or submittal sent for review:</p> <p><input type="checkbox"/> As the General Contractor for this project we certify that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work specified (no exceptions)</p> <p><input type="checkbox"/> As the General Contractor for this project we certify that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.</p>
--	--

Comments:

Certified by: \_\_\_\_\_  
 (Contractor's Signature)

Name of Owner

**CERTIFICATE OF UNIT RESPONSIBILITY  
For Specification Section**

Section Number and Title

***In accordance with the contract documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section Section #. We hereby certify that these components are compatible and comprise a functional unit suitable for the specified performance and design requirements.***

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City, State and Zip Code

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

By: \_\_\_\_\_  
Duly Authorized Official

\_\_\_\_\_  
Commission Expiration Date

\_\_\_\_\_  
Name

\_\_\_\_\_  
Title

Seal:

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

**END OF SECTION**

## SECTION 02085

### PRECAST CONCRETE UTILITY STRUCTURES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Precast concrete manholes and utility vaults.
- B. Manhole and utility vault frames and covers.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 15951 – Testing Gravity Flow Pipelines

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.
- B. Geotechnical Engineering Report: Shannon & Wilson, Inc., *Riverfront Interceptor Sewer Pump Station and Force Main*. April 2019, Project No. 100623 (Appendix A).

##### 1.04 SUBMITTALS

- A. Prepare and submit in accordance with Section 01330.
- B. Product Data:
  - 1. Manhole barrels, bases, cones, grade rings, tops, frames, and covers.
  - 2. Rubber boot-type pipe connectors for connecting piping to manholes.
  - 3. Link seals and weep rings.
  - 4. Utility vault sections, basins, tops, frames, and grates
  - 5. Accessories
- C. Structure Details:
  - 1. Manufacturer's standard shop drawings for each size and type of precast utility structure.
    - a. Provide dimensions of structure.
    - b. Identify location of each type of insert cast into the structure.
  - 2. Illustrate construction details related to joints between precast sections, method of connecting pipe to the structure, size and location of pipe penetrations, reinforcement details and concrete mix design.

- D. Structural Design:
  - 1. Laboratory results verifying compressive strength of concrete mix design used in the manufacture of precast concrete utility structures.
  - 2. Calculations and related sketches prepared, stamped and signed by a civil or structural Professional Engineer licensed to practice in the state of Oregon. Calculations must show adherence to the Design Requirements listed in Paragraph 1.05.

#### 1.05 DESIGN REQUIREMENTS

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 402 except as modified below.
- B. Concrete Mix Design for products covered by this Section:
  - 1. Per Section 205 of the City of Albany Standard Construction Specifications.
- C. Comply with Geotechnical Engineering Report for soil pressures applied to below grade structures including surcharge.
  - 1. Vehicle Loading: HS-20.
  - 2. Railroad Loading: Cooper E80.
- D. Earth Loads: Design for lateral earth pressure and equivalent fluid pressure as required by the project Geotechnical Report.
- E. Seismic Loads: Design in accordance with the requirements of the Oregon Structural Specialty Code and project Geotechnical Report.
- F. Buoyancy: Select wall and slab thicknesses to provide sufficient weight against buoyancy due to groundwater elevations.
  - 1. Consider groundwater elevation at the ground surface.
  - 2. Utilize a safety factor of 1:1.
  - 3. Do not take credit for friction forces that may develop between the soil backfill and concrete walls of the utility vault.
- G. Manholes shall comply with design requirements specified in ASTM C478 and Section 402 of the City of Albany Standard Construction Specifications and this specification. If any conflicts are found between the references and these specifications, these specifications will take precedence. Loading design shall be per Paragraphs 1.05.C (rated for HS-20 and Cooper E80 loading) and 1.05.D and 1.05.E.
- H. Storm Drain Inlets and Catch Basins shall comply with Section 402 of the City of Albany Standard Construction Specifications.
- I. Utility Vaults:
  - 1. Vault Body Loading Criteria per Paragraphs 1.05C (rated for HS-20 and Cooper E80 loading) and 1.05D and 1.05E.
  - 2. Vault Lid Loading Criteria per 1.05C.1 (lid does not require Cooper E80 load rating) and 1.05D and 1.05E.

## 1.06 COORDINATION

- A. Coordinate layout and installation of utility structures with the final arrangement of other utilities, site grading, and surface features as determined in the field.

## PART 2 - PRODUCTS

### 2.01 PRECAST CONCRETE MANHOLES

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 402.
- B. Conform to the requirements of ASTM C478.
- C. Construct precast reinforced concrete manholes in accordance with design, size, shape, form and details indicated on the Drawings and specified.
  - 1. Minimum Diameter: 48 inches.
- D. Accessories:
  - 1. Rubber Boot Pipe Connectors:
    - a. Manufacturers: One of the following or equal:
      - 1) “Cast-A-Seal 603” flexible rubber boot with stainless steel accessories as manufactured by Press-Seal Corporation.
      - 2) “A-LOK” flexible connector as manufactured by A-LOK Products, Inc.
  - 2. Joint Sealing Compound: Preformed cold-applied ready-to-use plastic joint sealing compound.
    - a. Per 402.01.04D of the City of Albany Standard Construction Specifications.
    - b. Manufacturers: One of the following or equal:
      - 1) Quikset Utility Vaults, Quik-Seal.
      - 2) K. T. Snyder Company, Ram-Neck.
  - 3. Manhole Frame and Cover Sets:
    - a. Per Section 402.01.04E of the City of Albany Standard Construction Specifications.
    - b. Cast Iron: ASTM A48, Class 30B.
    - c. Type, size, and features as indicated on the Drawings.
    - d. Grind mating surfaces of cover and frame to ensure flat, true fit and even seating.
  - 4. Step Assemblies:
    - a. Per Section 402.01.04F of the City of Albany Standard Construction Specifications.

## 2.02 PRECAST CONCRETE CATCH BASINS

- A. Provide precast concrete catch basins, drop inlets, curb inlets or other storm drain inlets as indicated on the Drawings.
- B. Comply with Section 402 of the City of Albany Standard Construction Specifications.

## 2.03 PRECAST CONCRETE UTILITY VAULTS

- A. Manufacturers: One of the following or equal:
  - 1. Oldcastle.
  - 2. Christy Concrete Products.
  - 3. Utility Concrete Products, LLC.
  - 4. Utility Vault Company.
- B. Description:
  - 1. Factory-fabricated, reinforced concrete vault with cover and accessories.
  - 2. Open or integral closed bottom as indicated on the Drawings or as scheduled.
  - 3. Monolithically poured walls and bottom, unless open-bottom vaults are indicated on the Drawings or scheduled.
- C. Frame and Cover:
  - 1. Unless access hatches are indicated or specified, fabricate steel frame and cover for utility vault openings.
  - 2. Frame and Cover: Galvanized steel or aluminum. Product as indicated on the Drawings.

## PART 3 - EXECUTION

### 3.01 MANUFACTURE

- A. Utilize a central batching facility to ensure accurate weighing and mixing of materials to consistently obtain a suitable concrete mix.
- B. Concrete Batching: Properly proportion sand, aggregate and cement with sufficient water to produce a concrete mix of uniform quality and slump.
- C. Concrete Compaction: Use either external or internal mechanical vibration during placement of the concrete mix within the forms.
- D. Curing: Steam cure concrete while still in the forms and after an initial set has taken place.
  - 1. Steam temperature: Not to exceed 160 degrees F, nor raised from normal ambient temperature at a rate exceeding 40 degrees F per hour.



2. Terminate steam curing after sufficient time has elapsed to produce adequate strength to withstand any structural strain that may occur during the form stripping operation.
  3. Additional curing may be applied by means of water spraying or membrane curing compound to reach the ultimate strength requirements.
- E. Reinforcing Steel: Position within the forms as required for design loads. Tie reinforcing steel sufficiently to withstand displacement during the pouring operation.

### 3.02 INSTALLATION

#### A. Concrete Manholes:

1. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 402.02.02.
2. Manhole Bases: May be pre-cast or cast-in-place at Contractor's option. If cast-in-place base is used:
  - a. Form that portion of base above invert elevation of sewer pipe to provide smooth channel section as indicated on the Drawings.
  - b. Place base concrete as a monolith.
3. Manhole Invert: Construct with smooth transitions to provide an unobstructed flow path through the manhole. Remove sharp edges and rough sections.
  - a. When a full section of pipe is laid through the manhole, break out the top portion of the pipe. Cover the exposed edge of pipe with mortar and trowel smooth.
4. Manhole Sections:
  - a. Set each manhole section plumb.
  - b. Use sections of various heights and adjustment rings in order to bring top of manhole ring and cover to required elevation.
5. Joints in Manhole Sections:
  - a. Seal joints with joint sealing compound.
  - b. Clean joints with brush, prime and apply sealing compound in accordance with manufacture's printed instructions.
  - c. Remove silicon treated protective paper from one side of preformed rope and lay preformed rope, paper side up, on cleaned joint surface. Press surface firmly end-to-end around entire joint, making minimum 1-inch laps where necessary. Remove protective paper from preformed rope and lower next section into place.
  - d. Seal joints watertight.

#### B. Manhole Frame and Cover Sets:

1. Location and Grade:
  - a. In Paved Areas: Set cover flush with pavement  $\pm 0.25$  inch

- b. In Open Areas: Set cover above surrounding grade in accordance with the details indicated on the Drawings  $\pm$  1 inch
    - c. In existing roadside ditches or unpaved, untraveled right-of-way: Set cover approximately 12 inches above existing ground surface  $\pm$  2 inches
  - 2. Setting Frames:
    - a. Clean bearing surfaces and provide uniform contact.
    - b. Set manhole frames at required grade and securely attach to top of precast manhole shaft unit or on adjustment rings, using cement mortar.
  - 3. Setting Covers: After frames are securely set in place, install covers and perform necessary cleaning and scraping of foreign materials from frames and covers as necessary to assure proper fit. Replace frames and covers that create noise when passed over by traffic.
- C. Inlets and Catch Basins
  - 1. Comply with Section 402 of the City of Albany Standard Construction Specifications.
- D. Utility Vaults:
  - 1. Comply with ASTM C891.
  - 2. When vaults are provided in sections, install vault sections level and plumb and with orientation and depth coordinated with connecting pipes.
  - 3. Support vault on a level bed of aggregate base material, 12 inches deep and compacted to 95 percent of maximum density.
  - 4. Seal joints with joint sealing compound. Clean joints and apply sealing compound in accordance with the manufacturer's requirements.
  - 5. Covers:
    - a. Install covers and perform necessary cleaning and scraping of foreign materials from frames and covers as necessary to assure proper fit. Replace frames and covers that create noise when passed over by traffic.
  - 6. Finish Elevations of Utility Vaults
    - a. Paved Areas, Roadway Shoulders and Other Areas of Vehicular Traffic: Set structure so that cover is flush with finished pavement elevation  $\pm$  0.25 inch
    - b. Other Locations: Set utility vault so that cover is 4 inches above finished grade  $\pm$  1 inch

### 3.03 PIPE CONNECTIONS

- A. Comply with the following Sections of the City of Albany Standard Construction Specifications:
  - 1. Section 402.02.02B for connections to new manholes

2. Section 402.02.03A for inlets and catch basins
  3. Section 403.02.03 for connections to existing structures
- B. Install connecting pipe at the required alignment and grade.
  - C. Set connecting pipes through the full thickness of the manhole wall, flush with the inner face of the wall.
  - D. Use standard flexible pipe connector boots, specifically manufactured for the intended service, to connect pipe to the manhole, where indicated on the Drawings.
  - E. Plugging pipes provided for future connections:
    1. Pipe 18-inches or less in diameter; Plug with concrete, extend minimum 8 inches into pipe.
    2. Pipe greater than 18-inches in diameter: Construct plug using brick, concrete block or concrete, mortar exposed face of plugs constructed of brick and concrete block.

#### 3.04 CLEANING

- A. Upon completion, clean each structure of all silt, debris, and foreign matter.

#### 3.05 TESTING

- A. Test manholes for leakage in accordance with Section 15951.

**END OF SECTION**

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## SECTION 02200

### SITE PREPARATION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Site preparation work, as follows:
  - 1. Locating existing facilities.
  - 2. Installing safety and protective barriers.
  - 3. Constructing temporary access roads, work areas and storage areas, erecting temporary fences and erosion control devices, and other initial work required for earthwork operations.
  - 4. Clearing, grubbing, stripping, top soil removal, and other initial work required for earthwork and trenching operations.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 02210 – Subsurface Investigations
  - 3. Section 02872 – Reinforced Grass Paving

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 DEFINITIONS

- A. Clearing: Consists of removal of natural obstructions and man-made objects and features including foundations, buildings, fences, lumber, stumps, debris, rubbish, brush, trees, boulders, and other items that interfere with construction operations or are specifically designated for removal.
- B. Stripping: Includes the removal and disposal of sod, grass, weeds, roots, and other organic material remaining after clearing has been completed.
- C. Top Soil: The native or cultivated surface-soil layer containing organic matter and typically consisting of a darker shade of brown, grey or red than the underlying subsoil. For the purposes of this project, up to 12 inches of soil in open areas is considered topsoil.

##### 1.05 SUBMITTALS

- A. Comply with Section 01330.

- B. Submit:
  - 1. Materials used and layout of temporary fences.
  - 2. Proposed staging and stockpile locations.

#### 1.06 FENCES

- A. Erect temporary fences at the boundary of construction areas and in locations indicated on the Drawings to protect the public from entering work areas.

### **PART 2 - PRODUCTS**

#### 2.01 TEMPORARY CONSTRUCTION FENCES

- A. Type: Heavyweight, high visibility, flat laminar mesh design.
- B. Material: High-density polyethylene.
- C. Height: 48 inches.
- D. Posts: Wood or metal posts at 10-foot spacing. Secure fence to posts with plastic cable ties.

### **PART 3 - EXECUTION**

#### 3.01 LOCATING EXISTING FACILITIES

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 204.03.04.
- B. Review the design drawings, maps, and other sources of information and identify existing facilities at the site to determine and mark the approximate locations of underground facilities.
- C. Follow rules adopted by the Oregon Utility Notification Center regarding locating and marking existing buried utilities and contact owners of existing underground utilities prior to beginning work in the vicinity of their utilities.
- D. Refer to Section 02210. Locate existing utilities by exploratory excavations after field marking by the utility agencies and prior to excavations in the affected areas.

#### 3.02 SAFETY AND PROTECTIVE BARRIERS

- 1. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 202, 107.16.00, 107.20.00.
- B. Along Public Roadways:
  - 1. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 202 and 107.16.00.
  - 2. Install appropriate barriers such as temporary fencing, plastic drums, or concrete traffic barriers to protect public from construction areas and to protect workers and existing facilities from danger of passing vehicles.

- C. Temporary Fences:
  1. Prior to beginning excavation, erect temporary fences along boundaries of temporary easements and/or public areas adjacent to the work or access indicated on the Drawings.
  2. Maintain work activities outside of the protected areas.
  3. Remove temporary fences upon completion of work.
- D. Existing Trees: Erect temporary fences around trees at the drip line that are adjacent to the Work and may be subject to damage unless protected. Maintain work activities outside of protected areas. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Sections 203.03.01A and 210.08.07C.
- E. Provide protective concrete slabs, steel plates or encasements for existing buried facilities that may be damaged by Contractor's equipment and vehicles.
- F. Provide protective aggregate base cover over valve vaults, manholes, concrete pads or other surface facilities that may be damaged by Contractor's equipment and vehicles.

### 3.03 PRIMARY SITE ACCESS, WORK AND STORAGE AREAS

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Sections 105.14.00, 107.16.00, 202.02.01.
- B. Develop primary access routes, work areas and storage areas as indicated on the Drawings.
- C. Clean up areas at the conclusion of the project and return the areas to their original or better condition.

### 3.04 CLEARING, GRUBBING, AND STRIPPING

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 203.
- B. The work area shall be cleared above and below the natural ground surface of all debris and other objectionable materials. Tree stumps shall be completely removed to a depth not less than 24 inches below any subgrade within the designated excavation area.
- C. Remove loose boulders within 10 feet from the tops of cut slopes. Incorporate boulders into landscaping or remove from the site.
- D. Remove the top layer of soil containing sod, grass, weeds and other vegetation from areas that will be affected by construction and site grading operations. Grass and sod on areas to be occupied by fills shall be removed to a depth not less than 18 inches below subgrade or the slope surface on which the fill is to be constructed, per Section 203.03.00 of the City of Albany Standard Construction Specifications.
- E. Extend stripped areas at least 4 feet beyond the limits of cut and fill areas.

- F. Dispose of excess material per Section 204.04.10 of the City of Albany Standard Construction Specifications.

### 3.05 REMOVAL AND REPLACEMENT OF TOP SOIL

- A. Do not begin removal of topsoil until limits of work are marked, temporary construction fencing is in place and erosion control devices are properly installed.
- B. Prior to removing topsoil, remove trash, debris or and other waste material that may be encountered. Grass, weeds and other vegetation do not need to be removed prior to stripping top soil.
- C. Refer to Section 02782 for soil preparation procedures associated with reinforced grass paving.
- D. Set top soil material aside and maintain separation from the remainder of excavated trench material.
  - 1. Topsoil may be stockpiled near the work or moved to an off-site stockpile area. No stockpile areas have been designated on the Drawings.
  - 2. When topsoil is stockpiled along excavations, maintain edge of the stockpile a minimum of 6 feet away from the edge of the excavation.
  - 3. Limit height of stockpiles to 6 feet.
  - 4. Do not stockpile topsoil within tree protection zones.
- E. Replacement of Top Soil:
  - 1. After backfilling, grade and finish areas to receive topsoil, allowing for the specified depth of top soil replacement.
  - 2. Replace topsoil and smoothly spread material with a minimum of compaction.
  - 3. Finish areas covered with topsoil to blend into the finished topography with respect to the proper grade, contour and cross section. Rough grade replaced top soil to 2 to 4 inches higher than final elevations to allow for settlement.
  - 4. Bring the surface to a condition ready for planting operations.

### 3.06 TREE REMOVAL

- A. Remove specific trees indicated on the Drawings for removal. Cut trees so they fall into the area being cleared. Tree stumps shall be completely removed to a depth not less than 24 inches below any subgrade within the designated excavation area. Remove felled trees from the site.
- B. Timber Salvage: Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 203.03.02.

### 3.07 TREE TRIMMING

- A. Permits are required to prune, cut, break, or damage roots of street trees. Contractor maybe subject to fines if trees are removed prior to obtaining a permit and may also



be required to remove, replace, and mitigate for the loss of a damaged tree. The Contractor is required to coordinate with the Owner for tree trimming services required for this project.

- B. Per Section 203.03.01A of the City of Albany Standard Construction Specifications, cut and remove trees and branches only where approved by the City Engineer. When directed by the City Engineer, remove additional branches to provide a balanced appearance of any tree.
- C. Timely Contractor communication with the Owner is required regarding activities that will require tree trimming:
  - 1. At least two weeks before beginning work that requires tree trimming, attend a walk-through of the project area with the Owner, Engineer, and the City Forester. Identify trimming necessary to complete the Work. Notify the Engineer of additional tree trimming work that may be needed during the project.
  - 2. Following Project completion, attend a final walk-through of the project area and identify any needed post-construction tree-related work.

### 3.08 REMOVAL OF EROSION CONTROL DEVICES

- A. Remove erosion control devices when bare soils are sufficiently revegetated to prevent on-site or off-site soil erosion.
- B. Straw wattles containing plastic netting, including plastic specified as photodegradable, may not remain on site. Remove entire wattle or remove and dispose of plastic netting and spread straw from wattle across vegetated areas of site.

**END OF SECTION**

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## SECTION 02210

### SUBSURFACE INVESTIGATIONS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for subsurface investigations for locating existing utilities and points of connection to existing systems.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section:
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Submit completed subsurface investigation report.

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

#### PART 3 - EXECUTION

##### 3.01 GENERAL

- A. Contact the Oregon Utility Notification Center and have existing utilities marked prior to performing field investigations.
- B. No additional compensation will be provided for locating utilities whether or not the utility is shown with reasonable accuracy on the Drawings.
- C. Survey of existing utility field locations shall be conducted by a firm or individual that possesses a valid state registration for land surveying. Provide survey information using the same basis used for the Project.

##### 3.02 FIELD INVESTIGATIONS

- A. Perform field investigations prior to preparation of Shop Drawings for underground piping, and prior to excavation for installation of any underground facilities.
- B. Field locate existing underground utilities and other interferences shown on the Drawings or marked by the Oregon Utility Notification Center and facilities where connections will be made as part of the Work. At a minimum, locate the following existing underground facilities:
  - 1. Crossing utilities up to 2 feet beneath the proposed utility or structure subgrade.

2. Parallel utilities within 5 feet of the nearest trench wall of proposed utility or structure. Locate parallel utilities at a minimum every 100 feet. Decrease the spacing as necessary to accommodate fluctuations in the alignment of the existing utility.
  3. Proposed connections to existing underground utilities or facilities.
  4. Any other existing underground utility or facility that may affect the installation of the proposed underground facilities.
- C. Determine the following properties of each existing underground utility and interference.
1. Horizontal location, including the design station or coordinates where the existing utility will cross or interfere with the proposed underground facility.
  2. Elevation of the top and bottom of the existing utility. For round utilities, bottom elevation can be estimated provided the outside diameter of the utility is determined. For box-shaped utilities or conduit banks, excavate to the bottom of the utility to determine the bottom elevation.
  3. The utility size, material type, and type of existing backfill
- D. Determine the following properties for each connection to existing underground utilities or structures:
1. Horizontal location of the proposed connection point.
  2. Elevation of the top and bottom at the proposed connection point.
  3. Horizontal and vertical angle of existing utility in reference to the proposed underground utility.
  4. The utility size, material type, and type of existing backfill
- E. Prepare a detailed field investigation report to include the information described above. Organize the report by station.
- F. Following excavation and field data gathering, backfill excavations, and within paved areas, restore the surface pavement to match the material and thickness of the pre-investigation pavement unless otherwise required by the jurisdiction having authority over the pavement repairs.

**END OF SECTION**

## SECTION 02221

### DEMOLITION, SALVAGE AND ABANDONMENT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Demolition, salvage and abandonment of existing facilities.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 02300 – Earthwork

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Description of removal procedures for careful removal of materials and equipment and the protection of facilities which are to remain undisturbed.
- C. Time schedule for demolition work. Show demolition in relation to new construction, including any temporary facilities.

##### 1.04 EXISTING CONDITIONS

- A. Prior to the submittal of Bids, Contractor shall visit the site and inspect all facilities to become familiar with existing conditions and utilities.

##### 1.05 REGULATORY REQUIREMENTS

- A. Dispose of debris in accordance with the requirements of jurisdictional agencies.
- B. Comply with applicable air quality control regulations.
- C. Obtain necessary permits for transportation of debris to disposal site(s) and dust control.
- D. Erect appropriate safety devices to protect the general public, Owner's operations personnel, and workers from the hazards of demolition activities. Install barriers, fences, and provide appropriate warning signs.

##### 1.06 BURNING

- A. The use of burning at the project site for the disposal of refuse, debris, and waste materials will not be permitted.

#### PART 2 - (NOT USED)

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. The Drawings identify the major equipment and facilities to be demolished, salvaged or abandoned. Auxiliary utilities such as water, air, drainage, lubrication oil, electrical wiring, controls, and instrumentation are not necessarily shown. Remove auxiliary utilities, as well as equipment and pipe supports and associated instrumentation devices pertaining to piping or equipment designated to be removed.

### **3.02 PROTECTION OF EXISTING FACILITIES**

- A. Before beginning any cutting, trenching, or demolition work, carefully survey the existing work and examine the Contract Documents to determine the extent of the Work.
- B. Take precautions to prevent damage to facilities which are to remain in place or are to be salvaged, and be responsible for any damages to these facilities resulting from this work. Repair or replace damages to such work to return the facilities to its pre-existing condition at no additional cost to the Owner.

### **3.03 DEMOLITION**

- A. Demolish structures and equipment in an orderly and safe manner.
- B. Dispose of material not identified for salvage or re-installation at a new location.
- C. Minimize dust by sprinkling with water.
- D. Backfill excavations caused by demolition in accordance with Section 02300.

### **3.04 BURIED PIPELINES**

- A. Where buried pipelines are shown to be removed on the Drawings, they may be abandoned in place if there is no conflict with proposed construction and they are not located under or within 10 feet of any proposed structure. Plug abandoned lines with concrete or cap with a pipe cap of the same material as the pipe.

### **3.05 DISPOSAL OF DEMOLISHED MATERIALS**

- A. Concrete, site debris, rubbish, and other materials resulting from demolition operations, as well as mechanical and electrical equipment designated to be demolished, shall be the property of the Contractor and shall be legally disposed of at the Contractor's expense.

### **3.06 CLEANING**

- A. During and upon completion of the demolition operations, promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave work areas in a clean condition.

- B. Do not sweep, grade, or flush surplus materials, rubbish, or debris into storm drains, channels, lakes, or streams.

**END OF SECTION**

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**SECTION 02241**  
**CONTROL OF WATER**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Control of surface water and excavation drainage.
- B. Protection of the work against surface runoff, and exfiltration from existing pipes and structures.
- C. Collection, treatment, and disposal of removed water.

1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

1.04 DEFINITIONS

- A. Excavation drainage includes keeping excavations free of surface water, seepage water, and exfiltration from existing pipes and structures.
- B. Surface drainage includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect the work from any source of surface water.
- C. Construction Water: surface or groundwater that is subject to removal by the Contractor as necessary to complete the work.

1.05 PERMITS

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 107.07.00, 107.14.00.
- B. Comply with requirements of agencies having jurisdiction.
- B. Comply with all laws and regulations for development, drilling, and abandonment of wells used in dewatering systems.
- C. Develop Erosion and Sediment Control Plans and acquire dewatering permits required by governing agencies. The plan must be prepared and stamped by a Professional Civil or Geotechnical Engineer or Certified Professional in Erosion and Sediment Control, each as registered in the state of Oregon.

- D. Obtain and comply with all permits for the control and disposal of surface and groundwater.
- E. Obtain a 1200-CN and Erosion and Sediment Control Permit from the City of Albany.
- F. Obtain all necessary permits from agencies with regulatory jurisdiction over groundwater pumping, and matters affecting well installation.
- G. Take early action and allow time for the review and permitting processes may be lengthy.
- H. Pay all associated fees.

## **PART 2 - PRODUCTS**

### **2.01 FACILITIES AND EQUIPMENT**

- A. Provide all necessary facilities and equipment for controlling surface water and excavation drainage as necessary to complete the Work.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 105.11.00, 204.03.03, 204.04.11

### **3.02 NPDES PERMIT COMPLIANCE**

- A. Implement the Erosion and Sediment Control Plan as approved by the Oregon DEQ before beginning excavation. Notify Engineer in writing of any changes made to accommodate field conditions and changes to the work.
- B. Comply with all limitations and controls for water discharges, monitoring requirements and other special conditions specified in the permit.

### **3.03 SURFACE WATER CONTROL**

- A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other means. This requirement extends to temporary works required to protect adjoining properties from surface drainage caused by construction operations.
- B. Implement the appropriate level of surface water control to protect water quality throughout the construction period.
- C. Utilize Best Management Practices throughout the construction period.

### **3.04 CONTROL OF GROUNDWATER AND SEEPAGE THROUGH EMBANKMENTS**

- A. Provide labor, material, equipment, techniques and methods to lower, control and handle water in a manner compatible with construction methods and site conditions. Monitor effectiveness of the installed system and its effect on adjacent property.

- B. Prevent water from entering excavations, or, if conditions allow, intercept water flowing into excavations and divert it to sumps or ditches to allow pumping of collected water out of the excavation.

### 3.05 TREATMENT

- A. Provide settling basins, geotextile containment devices or other sediment removal and water treatment devices for water quality control and compliance with regulatory and permit requirements.
- B. Install geotextile containment devices in accordance with the manufacturer's instructions and requirements.

### 3.06 SYSTEM OPERATION

- A. Maintain dewatering operations to control and minimize erosion, to maintain a dry excavation, to create stable sides and bottoms of excavations, to stabilize constructed slopes, and to prevent settlement and damage to structures, embankments and utilities.
- B. Provide for continuous system operation, including nights, weekends, and holidays, by providing a backup power source for electrical service and assigning personnel to monitor operation of dewatering systems.
- C. Remove all groundwater control systems upon completion of construction or when dewatering and control of surface or groundwater is no longer required.

**END OF SECTION**

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## SECTION 02260

### EXCAVATION SUPPORT AND PROTECTION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Temporary excavation support systems for utility installations associated with trenching and deep excavations for the construction of the diversion structure, pump station wet well and force main.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  1. Section 01330 – Submittals
  2. Section 02300 – Earthwork
  3. Section 03600 – Grout
  4. Section 02262 – Settlement Monitoring

##### 1.03 REFERENCES

- A. Geotechnical Engineering Report, Riverfront Interceptor Sewer Pump Station and Force Main, by Shannon & Wilson. (Appendix A)
- B. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 DEFINITIONS

- A. Protection Systems:
  1. Sloping or benching systems for excavated slopes.
  2. Structural support systems, shield systems, and other systems for preventing excavation wall failure.

##### 1.05 SUBMITTALS

- A. Prepare and submit in accordance with Section 01330.
- B. Submit information as a complete package. Include all items required by the Contract Documents. Incomplete submittals will not be reviewed and will be returned for resubmittal as a complete package.
- C. Shop Drawings
  1. Prepared, signed and sealed by a professional engineer who is registered to practice in the State of Oregon.

2. Clearly indicate structural sections of shoring members, welding details, bolting details and bracing details.
  3. Indicate existing and new structures, pipelines and other improvements located in the vicinity and impacting the design of the shoring system.
  4. Provide details for bracing, reinforcement and sealing around penetrations.
- D. Calculations: Structural calculations verifying and demonstrating the structural safety and adequacy of the sheeting, shoring and bracing to be used.
1. Prepared, signed and sealed by a registered Professional Civil or Structural Engineer who is registered to practice in the State of Oregon.
  2. Provide calculations for the different load, support and other conditions that occur during the sequence of installation, construction of facilities protected by the shoring and the sequence of removal of the internal bracing and shoring.
- E. Sheet Pile Driving Equipment: Information on type of equipment to be used, including manufacturer, model number and driving energy.
- F. Qualifications of registered Professional Engineer and shoring installer, including project references.
- G. Prepare a detailed plan illustrating the sequence of installation and removal of shoring systems and internal bracing. Include sketches showing the various stages in the sequence.
- H. Letter confirming installation of the shoring system is in accordance with the shoring design.

#### 1.06 INSTALLER QUALIFICATIONS

- A. Shoring installer must have a minimum of five successful past installations of shoring systems of comparable overall heights and comparable penetration of soils similar to those found on the project site.

#### 1.07 PERFORMANCE REQUIREMENTS

- A. Design and install excavation support and protection systems that are capable of:
1. Supporting excavation sidewalls and bottom to maintain the required excavation or trench section.
  2. Resisting soil and hydrostatic pressure, superimposed construction loads, Cooper E80 railroad live load, and other live loads.
  3. Protecting existing facilities in the vicinity of the excavation from damage due to settlement or movement of soil
- B. Provide professional engineering services necessary to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer registered in the State of Oregon.

- C. Install and remove excavation support and protection systems without damaging existing buildings, pavements, utilities, railroad facilities and other improvements adjacent to excavation.
- D. Excavations
  - 1. Protect workers from hazard of caving ground and other hazards.
  - 2. Install excavation protection system in locations where:
    - a. Protection system is specifically indicated on the Drawings.
    - b. Excavations are equal to, or greater than, 5 feet deep.
    - c. Excavations are less than 5 feet deep, but there is a potential for cave-in.
    - d. Excavations near to, and parallel to the railroad.
    - e. When engineering analyses prepared by the Contractor indicate the stability of existing structures and facilities may be jeopardized by settlement or movement of soil.

#### 1.08 GENERAL DESIGN REQUIREMENTS

- A. Design excavation support systems to meet requirements and standards of the Occupational Safety and Health Administration (OSHA).
- B. Design excavation support systems to meet the requirements of Oregon Administrative Rules, Chapter 437, Division 3, Subdivision P for excavations less than 20 feet deep. Excavations that are greater than 20 feet must be designed by a registered professional engineer for the specific site conditions.
- C. Design structural steel members in accordance with the American Institute of Steel Construction (AISC) Manual of Steel Construction Allowable Stress Design and the Uniform Building Code.
- D. Excavation support systems for trench excavations shall be selected by the Contractor based on the soil conditions, depths of trench excavations, groundwater conditions and other site conditions. No attempt has been made by Engineer to define acceptable trench shoring options. Recommendations for acceptable shoring systems are presented in the Geotechnical Engineering Report.
- E. Allowable Deflection: Not more than 1/2-inch at any point on the shoring system.
- F. Cantilevered Design Limits:
  - 1. Maximum height of cantilevered shoring above the bottom of the excavation shall not exceed 15 feet.
- G. Resistance to Overturning
  - 1. Design soldier piles and sheet piles with sufficient depth below the excavation to:
    - a. Resist lateral movement or overturning of the pile, and

- b. Act as an effective water cutoff to prevent heaving or flow of soil into the excavation.
2. Calculate the required depth of pile below the bottom of the excavation by assuming the soil immediately below the bottom of excavation does not provide passive resistance for a depth of 1.5 times the effective pile diameter.

#### 1.09 GEOTECHNICAL REPORT

- A. A geotechnical report has been prepared for this Project and is available for information only. The geotechnical report is not part of the Contract Documents. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. The Owner will not be responsible for interpretations or conclusions drawn from this data.
  1. Make additional test borings and conduct other exploratory operations necessary for design of the excavation support systems.

#### 1.10 JOB SITE POSTINGS

- A. Maintain at least one copy of the protection system design at the job site while the excavation is open in accordance with the requirements of Oregon Administrative Rules, Chapter 437, Division 3, Subdivision P.

#### 1.11 SEQUENCE AND SCHEDULING

- A. Do not begin excavations or installation of excavation supports until submittals for excavation support systems have been accepted by the Engineer and until materials necessary for installation are on site.
- B. Do not begin excavations or installation of excavation supports until initial survey measurements on control points on existing structures and other improvements are obtained to document initial elevations and locations.
- C. Coordinate with Portland & Western Railroad (PNWR) to determine maximum train load widths allowed on the tracks in the vicinity of the Project. All shoring within the maximum train load width plus 5 feet on each side must be flush with the ground or finished by the end of the working day to allow safe passage of the trains. Shoring cannot interfere with railroad operations.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Steel Sheet Piling: ASTM A328, ASTM A572 or ASTM A690; with continuous interlocks.



## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Prior to beginning installation of the excavation support system, pothole to locate existing buried utilities in the vicinity of the excavation. Survey utilities and compare actual locations to those locations indicated on the Drawings and the Shop Drawings. Determine any areas of conflict and revise the design and layout of the excavation support system to eliminate these conflicts.

### **3.02 SLOPING AND BENCHING OF EXCAVATED FACES**

- A. Where structural excavation support systems are not specifically indicated on the Drawings, sloping and benching systems for exposed faces of excavations may be utilized.
- B. Construct sloping and benching systems in accordance with Section 02300.

### **3.03 TRENCHING SUPPORT SYSTEMS**

- A. Where structural excavation support systems are not specifically indicated on the Drawings, trench support systems consisting of hydraulic jacks and plates, trench shield systems, and other trench protection systems may be utilized.

### **3.04 SHEET PILING**

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

### **3.05 BRACING**

- A. Locate bracing to clear temporary and permanent work and to allow lowering of material and equipment into the excavation.
- B. If necessary to move brace, install new bracing before removing original brace.
- C. Install internal bracing when calculations indicate bracing is required to prevent spreading or distortion of braced frames.
- D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### **3.06 INSPECTION**

- A. Designer of the shoring system is responsible for confirming proper installation of the shoring system. Shoring system designer, or a representative of the designer, shall make site visits to confirm installation is in accordance with the accepted shoring design.
- B. Submit letter of proper installation confirming installation is in accordance with the shoring design.

### 3.07 REMOVAL

- A. Remove excavation support and protection systems when backfill can support the remaining open excavation and bear soil and hydrostatic pressures. Remove support and protection systems in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
- B. After removal, promptly fill voids resulting from the extraction of shoring with sand-cement grout conforming to the requirements of Section 03600. Repair or replace adjacent work damaged or displaced by excavation support and protection systems removal.

**END OF SECTION**

## SECTION 02262

### SETTLEMENT MONITORING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for settlement monitoring and contingency planning for protection of nearby existing structures and underground facilities from the effects of Contractor's construction of structures, pipelines, casings, tunnels, and other underground facilities.
- B. Develop a settlement monitoring and contingency program for any permanent existing structure including railroad track and railroad ties, and any structures which are within a horizontal distance 1.5 times the depth of any excavation deeper than 5 feet, or within 20 feet of the alignment of any borings, tunnels, and jacked casings. This paragraph does not limit Contractor's choice of construction methods based on the site conditions; it establishes minimum requirements for Contractor to monitor the effects of construction on existing site features and to demonstrate a reasonable preparedness to meet potential contingencies and protect existing site features.
- C. Provide an Oregon-Licensed Land Surveyor to perform the specified surveying

##### 1.02 REFERENCED SECTION

- A. The following Section is referenced in this Section:
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Provide submittals in accordance with Section 01330.
- B. Requirements:
  - 1. Monitoring plan showing locations, depths, dimensions, and materials for settlement monitoring devices.
  - 2. Name of Oregon-Licensed Land Surveyor who will be taking measurements and copy of sample survey report.
  - 3. Any drilling permits and third-party approvals required to perform the work.
  - 4. Approved City of Albany review including requirements for monitoring including traffic control and restricted access.
  - 5. Procedures for installation and removal of instruments and materials.

#### 1.04 REPORTS AND RECORDS

- A. Submit Baseline Survey report showing location and initial elevation of all monitoring points installed at least one week prior to any excavation.
- B. Submit updated survey reports each week during active excavation or construction in the area.
- C. Submit final report with final elevation measured at least one month following excavation and construction in the area.

#### 1.05 DEFINITIONS

- A. Surface Settlement Monitoring Point: Inscribed marking, approved surveyor's nail, rebar driven flush with surface, or brass cap installed at predetermined location to measure vertical (elevation) and horizontal (coordinate) locations of ground surface or structural element.
- B. Surface Settlement Monitoring Stations: A group of Surface Settlement Monitoring Points (one at centerline, two offset from centerline) located at a specific station along the pipeline alignment.

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

### **PART 3 - EXECUTION**

#### 3.01 GENERAL

- A. Install Surface Settlement and monitoring Points at locations shown on the approved monitoring plan.
  - 1. Develop Monitoring plan in accordance with location requirements shown on Plans and as specified.
- B. To avoid being damaged by construction operations or the general public, clearly mark and protect all parts.
- C. For work within Albany right of way, comply with Albany requirements including traffic control and restricted hours of access
- D. Prior to removal of any monitoring points, request and obtain written approval from the Construction Manager.
- E. Surveying shall be performed by an Oregon-Licensed Land Surveyor and vertical measurements shall be within a tolerance of 0.001 feet.

#### 3.02 SURFACE SETTLEMENT MONITORING LOCATIONS

- A. Establish Surface Settlement Monitoring Stations (SSMS) wherever shown on the Plans.
- B. Regardless of whether Surface Settlement Monitoring Stations are shown on the Plans, establish the following Surface Settlement Monitoring as a minimum.

1. Each Surface Settlement Monitoring Station shall include one point located on the pipe centerline and two points offset 15 feet to the left and right of the pipe centerline.
2. In paved or improved areas, Surface Settlement Monitoring Stations shall be located every 25 feet along the pipe centerline unless otherwise indicated.
3. In unimproved areas, Surface Settlement Monitoring Stations shall be located every 100 feet along the pipe centerline unless otherwise indicated.

### 3.03 MONITORING SCHEDULE

- A. Perform a baseline survey of all Surface Monitoring Points at least one week prior to any excavation or construction within 100 feet of the monitoring locations.
- B. Survey Surface Monitoring Points daily during any active construction (sheet pile driving, excavation, boring, microtunneling, pipe installation, backfilling, compaction, etc.) within 100 feet of the monitoring locations. Continue daily survey monitoring for 3 days after completion of active construction.
  1. Perform a final survey at least one month following completion of active construction.

### 3.04 ACTION REQUIREMENTS

- A. Provide survey reports for Surface Settlement Monitoring Points each week.
- B. In the event that Surface Settlement Monitoring Points show a deviation from the baseline survey of 0.50 inches (.04 feet), the Contractor shall stop work immediately, notify and meet with the Construction Manager to develop a plan for action before work can be resumed. The Construction Manager may require that the frequency of monitoring be increased.

**END OF SECTION**

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## SECTION 02300

### EARTHWORK

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Earthwork, including excavation, fill, grading and compaction; import of material; and disposal of surplus and unsuitable materials.
- B. Refer to Section 02320 for earthwork related to pipeline installation.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 01560 – Environmental Controls
  - 3. Section 02200 – Site Preparation
  - 4. Section 02241 – Control of Water
  - 5. Section 02260 – Excavation Support and Protection
  - 6. Section 02320 – Trenching
  - 7. Section 02321 – Boulder Excavation
  - 8. Section 02722 – Aggregate Base Course Material

##### 1.03 DEFINITIONS

- A. Backfill: Earthwork necessary to add fill between new structures and the excavation up to the sub or finish grade.
- B. Borrow Area: Area identified from which to obtain earthwork materials.
- C. Cut: Earthwork necessary to remove existing material to lower the existing grade in elevation to sub or finish grade.
- D. Embankment: Materials placed to form the subgrade for roadways or site improvements.
- E. Excavation: Earthwork necessary to remove existing material for the installation of structures.
- F. Fill: Earthwork necessary to add material to bring the existing grade up in elevation to sub or finish grade.
- G. Finish Grade: Final surface following placement of surfacing, if any, as indicated.
- H. Subgrade: The surface of the earthwork on which pavement, surfacing, base, subbase, or a layer of any other material is placed.

#### 1.04 SUBMITTALS

- A. Prepare submittals and submit in accordance with Section 01330.
- B. For imported materials, provide samples, certifications and lab tests demonstrating compliance with specified requirements, and material source.
- C. For excavations 5 feet or deeper: Submit detailed plan of all shoring, bracing, side sloping, or other provisions for worker protection against the hazard of caving ground during excavations in accordance with Section 02260.

#### 1.05 QUALITY ASSURANCE

- A. Comply with Section 106 of the City of Albany Standard Construction Specifications.
- B. Compaction Testing.
  - 1. Per 204.04.08C of the City of Albany Standard Construction Specifications.
- C. Compaction Testing Standards:
  - 1. In-place Density of Compacted Fill Material: Density determined in the field in accordance with ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
  - 2. Maximum Density of Compacted Material: determined in the laboratory in accordance with Method C of ASTM D1557-12e1 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)), or ASTM D4253 – Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table and D4254 – Standard Test Methods for Maximum Index Density of Soils and Calculation of Relative Density, for cohesionless, free draining soils.
- D. Noncompliance with Specified Density Requirements:
  - 1. Per 106.03.00 and 204.04.08D of the City of Albany Standard Construction Specifications.
- E. Compaction Specifications for Materials and Various Applications:
  - 1. Per 204.04.08A of the city of Albany Standard Construction Specifications.
- F. Compaction Methods and Equipment:
  - 1. Per 204.04.08B of the City of Albany Standard Construction Specifications.



G. Material Testing Standards:

1. Particle size analysis of soils and aggregates: ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.
2. Determination of sand equivalent value: ASTM D2419 – Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
3. Liquid limit, plastic limit, and plasticity index: ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
4. The testing for organic matter: ASTM D2974 – Standard Test methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
5. Testing for percentage of fractured particles: ASTM D5821.
6. References in this section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes. Contractor shall be bound by all applicable provisions of ASTM D2487 in the interpretation of soil classifications.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

A. General fill, backfill, and embankment materials:

1. Comply with Section 204.02.00 of the City of Albany Standard Construction Specifications as modified herein.
2. Selected or processed clean earth, rock, or sand, free from grass, roots, brush, other vegetation, corrosive and hazardous materials, manmade objects, and debris.
3. Materials not defined as unsuitable as indicated below, except some materials listed as unsuitable may be used, if indicated on the Drawings or when acceptable to the Engineer, when thoroughly mixed with suitable materials to form a stable composite.
4. Obtain suitable materials from one or more of the following:
5. Onsite excavations and designated borrow areas.
6. Processed on-site materials.
7. Imported from offsite borrow areas and processing plants.
8. If imported materials are required by this Section, or to meet the quantity requirements of the Project, provide the imported materials at no additional expense to Owner, unless a unit price item is included for imported materials in the Bidding Schedule.

9. Large rocky material: When embankment material consists of large rocky material, or hard lumps, such as hardpan or cemented gravel which cannot be broken down readily, distribute such material evenly throughout the embankment. Place sufficient earth or other fine material around the larger material as it is deposited so as to fill the interstices and produce a dense, compact embankment. Do not place rocks larger than 6 inches in diameter within the upper 2 feet of the embankment subgrade.
  10. The following types of suitable materials are defined:
    - a. Drainage Rock: Clean gravel or crushed rock of one-inch (1") maximum size, with no material passing a No. 4 sieve.
    - b. Aggregate Base Course Material shall meet the requirements of Section 02722.
    - c. Granular Site Fill: 3 to 4-inch minus gravel or rock that is free of plastic clays, organic matter or construction debris.
    - d. Select Fill: 3/4 to 1-1/2-inch minus clean, well-graded crushed gravel or rock with less than 5% passing the No. 200 Sieve.
    - e. Native Embankment Backfill: Soil excavated from reservoir site during excavation.
  11. Further condition fill, backfill, and embedment materials as described below or as indicated on the Drawings.
- B. Levee Berm Embankment Material:
- a. Lean clay, silty clay, sandy clay or gravelly clay soil.
  - b. Plasticity index of 20 or less.
  - c. Liquid limit of 40 or less.
  - d. Complying with the grading shown in the following table:

Sieve Size	Percentage Passing
6-inch	100
4-inch	85-100
No. 200	30-100

2. Aggregate Base Course Material: In accordance with Section 02722.

## 2.02 UNSUITABLE MATERIALS

- A. Unsuitable materials include the materials listed below:
  1. Soils which, when classified under ASTM D2487, fall in the classifications of Pt, OH, CH, MH, or OL, or in a classification that contains Pt, OH, CH, MH, or OL in combination with any other letter designation, such as CH/CL.

2. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use, or are unstable or pump regardless of the degree of compaction.
3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.
4. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistivity or pH less than the average values for existing onsite soils.
5. Topsoil, sludge and sludge-entrained soils.
6. Rocks, stones, and boulders larger than allowed for use as fill and backfill materials.

### 2.03 SOURCE QUALITY CONTROL

- A. Materials source testing will be performed by a testing laboratory by a testing laboratory of the Owner's choice at the Owner's expense as indicated below.
- B. Minimum Frequency of sampling:
  1. Fill, backfill and embankment material generated from earthwork activities:
    - a. One soil sample whenever the character of the soil changes.
    - b. One soil sample when directed by the Engineer.
    - c. Obtain samples that represent the predominate character of the soil that is encountered.
  2. Sampling of Imported Material
    - a. Obtain representative samples of product from supplier.
- C. Submit samples to the City Engineer. Samples should be marked with material type, material use and date.

## PART 3 - EXECUTION

### 3.01 EXCAVATION – GENERAL

- A. Excavation includes the removal of all materials of whatever nature encountered, including all obstructions of any nature.
  1. Per 204.04.01 of the City of Albany Standard Construction Specifications.
- B. Excavation shall conform to the lines and grades indicated on the Drawings.

- C. Clear, grub and strip in construction and borrow areas in accordance with Section 02200.
- D. Excavation Stability
  - 1. Slope excavated faces or otherwise support in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and in accordance with Section 02260.
  - 2. Furnish, place, and maintain supports and shoring required to maintain stability of the sides of excavations.
- E. Notify Engineer at least 1 working day in advance of completion of any structure excavation to allow inspection of the exposed subgrade before it is covered with backfill or with any construction materials.
- F. Erosion Control:
  - 1. Comply with Section 01560.
  - 2. Maintain earthwork surfaces true and smooth and protected from erosion.
  - 3. Construct erosion control measures identified in the Erosion and Sediment Control Plan prior to any clearing or grading activity.
- G. Control of Water: Control water entering the excavation as indicated in Section 02241.
- H. Existing Underground Utilities:
  - 1. Known existing underground utilities are generally shown on the Drawings in their approximate locations based on information of varying accuracy.
  - 2. Exercise care to avoid damage to all existing utilities whether shown or not.
  - 3. Conduct field explorations to locate all underground utilities in the vicinity of the Earthwork activities in accordance with Section 02200 and per 204.03.04B of the City of Albany Standard Construction Specifications.
  - 4. Alert the Engineer of the presence of existing utilities that are not shown on the Drawings or are in locations different than those shown on the Drawings.
- I. Existing Overhead Utilities: There may be existing overhead utilities in the vicinity of the Work which may or may not be shown on the Drawings. Identify existing overhead utilities, if any, and use extreme caution when working in the vicinity of overhead utilities.

### 3.02 EXCAVATION FOR FILLS AND EMBANKMENTS

- A. Benching and Keyways:

1. Where fill is to be placed against existing subgrade or existing grade that is sloped, excavate horizontal benches a minimum of 5 feet wide and located at vertical intervals of not more than 5 feet to provide for placement and compaction of the new fill on horizontal surfaces.
2. Excavate keyway along the base of the existing slope:
  - a. Extend the keyway at least 3 feet into competent native soil.
  - b. Width of Keyway: Minimum of 5 feet.
  - c. Keyway Side Slopes: Inclined at approximately 0.75:1.
  - d. Keyway Subgrade: Scarify the upper 8-inches of the exposed surface, moisture condition and re-compact.

B. Subgrade Preparation:

1. Subgrade Beneath Embankments:
  - a. Expose competent native soil within the planned new embankment footprint.
  - b. Scarify the exposed subgrade to a depth of 8 inches, moisture condition as necessary and re-compact.
  - c. Subgrade Beneath Structures:
  - d. Excavate to the subgrade soils beneath the bottom of the structure or bottom of crushed rock layer where indicated.
  - e. Scarify the top 12 inches of subgrade soils, moisture condition as necessary, and re-compact.

### 3.03 EXCAVATION IN VICINITY OF TREES

- A. Except where trees are indicated to be removed, protect trees from injury during construction
- B. Per 203.03.01A of the City of Albany Standard Construction Specifications.
- C. Do not cut tree roots over 2 inches in diameter without permission of the Engineer.
- D. Support trees during excavation by means approve by the Engineer.

### 3.04 OVER-EXCAVATION NOT ORDERED OR INDICATED

- A. Backfill areas over-excavated with the materials indicated for the backfill above the over-excavation or Aggregate Base and per 204.04.01A of the City of Albany Standard Construction Specifications.
- B. Backfill the over-excavation to restore the required subgrade elevation and compact.
- C. Any over-excavation carried below the grade indicated on the Drawings will be at no additional cost to Owner.

### 3.05 OVER-EXCAVATION WHERE ORDERED BY ENGINEER

- A. Where ordered by the Engineer, over-excavate beyond the depth of subgrade indicated to the dimensions ordered.
- B. Backfill areas over-excavated with the materials indicated for the backfill above the over-excavation or Aggregate Base and per 204.04.01A of the City of Albany Standard Construction Specifications.
- C. Backfill the over-excavation to restore the required subgrade elevation.
- D. Over-excavation less than 6 inches below the limits indicated: At no increase in cost to Owner.
- E. Over-excavation greater than 6 inches below the limits indicated: Payment will be made under separate unit price bid items for over-excavation if such bid items have been established. Otherwise, payment will be made in accordance with a negotiated price.
- F. Measurement and Payment
  - 1. Measurement of quantities for payment of over-excavation: By calculation by Engineer of the volume of materials removed as over-excavation based on the difference between the excavation dimensions before and after the over-excavation work. No compensation will be made for removal of materials beyond the limits of the additional excavation ordered by Engineer or for materials which may come into the excavation from outside the designated limits. No compensation will be made for removal of materials that are outside of the minimum horizontal dimensions indicated.
  - 2. Payment for over-excavation will be made by the cubic yard. The payment shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in excavating and backfilling the over-excavation completely. Payment shall also include full compensation for the removal and disposal of the excavated materials, import and installation of backfill materials, control of water in the excavation, excavation support, and all costs associated with interruption of construction operations during the review of the foundations, over-excavation, backfill, and all other operations required for, or as a result of, over-excavation.

### 3.06 BOULDER EXCAVATION

- A. Perform boulder excavation in accordance with Section 02321.

### 3.07 DISPOSAL OF UNSUITABLE, EXCESS EXCAVATED AND OTHER MATERIALS

- A. Dispose unsuitable or excess excavated materials at an appropriate site selected by Contractor unless otherwise indicated.
  - 1. Per Section 204.04.10 of the City of Albany Standard Construction Specifications.
- B. Obtain required permits, landowner, and agency approvals for disposal of unsuitable and excess excavated materials and pay costs associated with the removal and disposal of the materials.

### 3.08 FILL AND EMBANKMENT CONSTRUCTION

- A. Scarify foundation soils for fills and embankments bring to optimum moisture content, and re-compact with heavy compaction equipment to obtain compaction indicated.
- B. Place and compact fill and embankments in horizontal layers so that when compacted layers to not exceed thickness indicated.
- C. Provide keyways or benches where an embankment or fill is to be placed against slopes, hillsides, or fill slopes.
- D. Slopes: Construct slopes as indicated except construct no permanent fill or embankment slopes with slope inclinations that exceed 3:1 (horizontal: vertical) unless specifically indicated otherwise
- E. Over-construct fills and embankments to greater horizontal dimensions than indicated. Cut back slope following placement and compaction to expose well compacted fill.
- F. Construct the first 3 feet of embankment or fills over pipelines using placement and compaction equipment that do not damage the pipe. Keep heavy construction equipment a minimum distance of the edge of the trench equal to the depth of the trench until at least 3 feet of fill over the pipe has been completed.

### 3.09 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

- A. Adjust moisture condition of soils to achieve a water content of 3 percent, plus or minus 0.5 percent, above the optimum moisture content as determined through laboratory testing of the soil.
- B. Compact each layer in a uniform and systematic manner.
- C. For materials with less than 10 percent passing the No. 4 sieve, compact by means of at least 2 passes from a flat plate vibratory compactor.
- D. For materials with 10 percent or more passing the No. 4 sieve, mechanically compact to the indicated percentage of density each layer of backfill materials.

1. Use equipment that is consistently capable of achieving the required degree of compaction.
  2. Compact each layer over its entire area while the material is at the required moisture content.
- E. Do not use flooding, ponding, or jetting as a method of compaction.
- F. Do not use equipment weighing more than 10,000 lbs closer to structure walls than a horizontal distance equal to the depth of the fill at the time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.
- G. Compaction Requirements:
1. Where agency or utility company requirements govern, the highest compaction standards shall apply.
  2. At a minimum, achieve in-place density of compacted fill materials in accordance with the following requirements:
    - a. Base or subbase material beneath structures and slabs: 95 percent of maximum density.
    - b. Base or subbase beneath paved areas: 95 percent of maximum density.
    - c. Embankments and fills: 95 percent of maximum density.

### 3.10 FIELD QUALITY CONTROL AND TESTING

- A. Contractor to hire testing laboratory to conduct tests that Contractor determines are needed to control earthwork operations in the field and pay associated costs.
- B. If requested by the Owner, remove soil above the level at which the Owner wishes to test. Backfill and re-compact material after testing is completed.
- C. Remove surface material at locations designated by the Engineer for sample collection and other tests.
- D. Construct inspection trenches, including trench support and groundwater removal, in compacted or consolidated backfill as requested by Engineer for confirmation testing.
- E. If compaction fails to meet specified requirements, perform remedial work by one of the following methods:
1. Remove and replace backfill at proper density.
  2. Bring density up to specified level by other means acceptable to Owner.
  3. Retesting:



- a. Costs for conducting additional tests to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the Contractor.
  - b. Conduct compaction tests at twice as frequently specified for the initial confirmation tests.
- F. Where soil compaction is specified as a percentage of maximum density, determine the maximum density at optimum moisture content by laboratory testing in accordance with Method C of ASTM D1557.
  - G. Where compaction of cohesionless, free draining soil is specified as a percentage of relative density, determine relative density by laboratory testing in accordance with ASTM D4253 and D4254.
  - H. Determine In-Place Density of Compacted Fill Material by performing field tests of soil density in accordance with ASTM D6938.
  - I. Frequency of Compaction Confirmation Testing at intervals not less than as follows:
    - 1. Embankments and Fills: 2 tests every 500 cubic yards.
    - 2. Structure Backfill: 1 test every 5 feet in elevation per 100 horizontal feet of backfill.

### 3.11 FINISH GRADES

- A. Surface: Reasonably smooth and free of grade breaks, irregular surface changes, protrusions and other defects.
- B. Restore un-improved areas back to pre-construction grades.
- C. Backfill topsoil in all areas where the topsoil was removed as part of the site preparation.
  - 1. Comply with Section 204.04.02A of the City of Albany Standard Construction Specifications.
- D. Restore drainage swales and water courses to their pre-construction alignments and grades unless otherwise modified by the Work. Grade surface to drain away from structures. Direct drainage to collection points.
- E. Provide smooth transitions to existing grades.
- F. Repair and reestablish grades to required elevations and slopes due to any settlement or erosion that may occur prior to final acceptance.
- G. Vertical Tolerance:
  - 1. Subgrade under paved areas: 0.0 feet above and 0.08 feet below.
  - 2. Subgrade under structures: 0.0 feet above and 0.08 feet below.
  - 3. Landscaped areas: 0.1 feet above and 0.1 feet below.
  - 4. Unimproved areas: 0.1 feet above and 0.1 feet below.

**END OF SECTION**

## SECTION 02320

### TRENCHING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Trench excavation and backfilling for pipe and pipeline appurtenances.
- B. Minor structure excavation and backfill associated with pipeline construction.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 02081 – Controlled Low Strength Material
  - 3. Section 02200 – Site Preparation
  - 4. Section 02210 – Subsurface Investigations
  - 5. Section 02241 – Control of Water
  - 6. Section 02260 – Excavation Support and Protection
  - 7. Section 02321 – Rock Excavation
  - 8. Section 02722 – Aggregate Base Course Material
  - 9. Section 02950 – Site Restoration
  - 10. Section 02953 – Pavement Restoration
  - 11. Section 03301 – Cast-in-Place Concrete

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 DEFINITIONS

- A. Backfill: Earthwork necessary to provide fill between new structures and excavation up to the sub or finish grade.
- B. Bedding Zone: The area from the trench subgrade to the bottom of the pipe.
- C. Embedment or Pipe Zone: The area from the top of the Bedding Zone to the bottom of the Trench Zone as indicated on the Drawings.
- D. Excavation: Earthwork necessary to remove existing material for the installation of structures.
- E. Finish Grade: Final surface following placement of surfacing, if any, as indicated.

- F. Native Material: Naturally occurring soils excavated from the trench after top soil, if any, has been removed.
- G. Open Areas: Areas along the pipeline route that are outside Roadway Shoulders or in open pasture.
- H. Pavement Section: The upper portion of the trench within paved areas comprising the base and finished surface materials.
- I. Roadway Shoulders: Paved areas and unpaved areas outside the traveled way and extending to the outside edge of any roadside drainage features.
- J. Subgrade: The surface of the earthwork on which bedding, base materials, pavement, other surfacing materials, or structure bases are placed.
- K. Traveled Way: The portion of the roadway where vehicles travel, does not include shoulders.
- L. Trench Backfill: Materials used to backfill the trench including bedding zone, pipe zone, and trench zone backfill.
- M. Trench Zone: The area from the top of the Pipe Zone to the bottom of the pavement base (subgrade), ground surface or other surface material over the trench excavation.
- N. Wet Trench: Trench with water or groundwater present in the trench.

#### 1.05 SUBMITTALS

- A. Prepare submittals and submit in accordance with Section 01330.
- B. Name of City approved testing laboratory Contractor intends to use to control compaction operations and lab qualifications and certifications.
- C. Compaction test results for tests conducted by Contractor.
- D. Material Data: Submit the following for each material type imported to the site:
  - 1. Material source.
  - 2. Gradation.
  - 3. Moisture-density curves.
  - 4. Permeability tests (for clay material).
- E. All material submittals must be dated to less than 1 year prior to Notice-to-proceed.
- F. Submit detailed plan of all shoring, bracing, side sloping, or other provisions for worker protection against the hazard of caving ground during excavations in accordance with Section 02260.

#### 1.06 QUALITY ASSURANCE

- A. Comply with Section 106 of the City of Albany Standard Construction Specifications.
- B. Compaction testing:
  - 1. Per 204.04.08C of the City of Albany Standard Construction Specifications.

2. Noncompliance with Specified Density Requirements:
  3. Per 204.04.08D of the City of Albany Standard Construction Specifications.
- C. Compaction Specifications for Materials and Various Applications:
- D. Per 204.04.08A of the City of Albany Standard Construction Specifications or the Drawings, whichever is most stringent. Compaction Methods and Equipment:
1. Per 204.04.08B of the City of Albany Standard Construction Specifications.
- E. Materials Testing Standards:
1. Particle size analysis of soils and aggregates: ASTM D422 – Method for Particle-Size Analysis of Soils.
  2. Determination of sand equivalent value: ASTM D2419 – Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
  3. Liquid limit, plastic limit, and plasticity index: ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  4. Testing for organic matter: ASTM D2974 – Standard Test methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
  5. Testing for percentage of fractured particles: ASTM D5821.
  6. References in this section to soil classification types and standards: Meanings and definitions indicated in ASTM D2487 – Classification of Soils for Engineering Purposes.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. General:**

1. Comply with Section 204.02.00 of the City of Albany Standard Construction Specifications as modified herein.
2. Obtain trench backfill materials from one or more of the following:
  - a. Processed on-site materials,
  - b. Imported from off-site borrow areas,
  - c. Processing plants.
3. Provide materials as indicated or as may be necessary to complete the Work at no additional cost to the Owner, unless a unit price item is included for trench backfill materials in the bidding schedule.
4. Soils unsuitable for use as trench backfill materials:
  - a. Materials containing organic matter, clay, or other materials or conditions detrimental to construction of firm, dense, and sound fills.

- b. Soils classified under ASTM D2487 categories Pt, OH, CH, MH, or OL; or soils that contain classifications Pt, OH, CH, MH, or OL in combination with any other soil classification, such as CH/CL.
  - c. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use, are highly expansive, or are unstable or "pump", regardless of the degree of compaction.
  - d. Soils that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable Regulations.
  - e. Soils that contain greater concentrations of chloride or sulfate ions or have a soil resistivity or pH less than the existing on-site soils.
  - f. Topsoil, except as allowed below.
  - g. Soils containing rocks, stones, or boulders larger than specified.
  - h. Soils that contain more than 5 percent organic matter when tested in accordance with ASTM D2974.
- B. Pipe Bedding and Pipe Zone:
- 1. 3/4"-0" crushed aggregate meeting the requirements of Section 00405.12 of the 2018 Oregon Standard Specifications for Construction (2018 OSSC).
- C. Trench Zone:
- 1. For areas not subject to vehicular traffic and not within the public right-of-way, use native material generated from on-site materials deemed suitable by the Engineer. Maximum particle size shall not exceed 3 inches and be free of leaves, grass, roots, stumps, and other vegetable matter. Refer to the Project Geotechnical Report (Appendix A) for recommendations on select native fill in unimproved areas.
  - 2. For areas within public right-of-way, subject to vehicular traffic, beneath existing or future pavement, or under paved streets, gravel streets, paved or gravel parking lots and driveways or alleys, use 3/4"-0 crushed aggregate, with less than 5 percent by dry weight passing a U.S. Standard No. 200 sieve and shall meet the requirements of Section 00405.14 of the 2018 OSSC (Class B backfill).
- D. Controlled Low Strength Material (CLSM): In accordance with Section 02081.
- E. Aggregate Base: As specified in Section 02722.
- F. Concrete: In accordance with Section 03301.
- G. Force Main Locate Balls:
- 1. Per Section 401.02.04D of the City of Albany Standard Construction Specifications.

## 2.02 SOURCE QUALITY CONTROL

- A. Comply with Section 106 of the City of Albany Standard Construction Specifications

## PART 3 - EXECUTION

### 3.01 EXISTING UTILITY LOCATIONS

- A. Perform subsurface investigations to locate existing underground utilities in accordance with Section 02210.

### 3.02 REMOVAL AND REPLACEMENT OF PAVEMENT

- 1. Remove and Restore pavement in accordance with Section 02953.

### 3.03 TRENCH EXCAVATION

#### A. General Requirements

- 1. Stabilize and support all faces of the trench excavation as specified in Section 02260.
- 2. Control groundwater as specified in Section 02241.
- 3. Clear, grub, and strip construction area as necessary to remove all vegetation and top soil as specified in Section 02200.

#### B. Open Trenches

- 1. Comply with the City of Albany Standard Construction Specifications, including, but not limited to Sections 204.04.03 and 204.04.07.
- 2. Any open trenches paralleling the railroad and within the zone of influence of railroad live loads must be adequately supported to withstand railroad loads in addition to all other live loads, dead loads, and surcharge loads. Comply with the requirements of Section 02260.
- 3. Open Trench Safety Requirements:
  - a. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 107.16.00.
  - b. Provide traffic control in accordance with the 2011 Edition of the Oregon Temporary Traffic Control Handbook. The handbook is applicable for establishing temporary traffic control work zones in place continuously for three days or less on public roads in Oregon.
  - c. Erect traffic control meeting requirements of the current "Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation"
  - d. Erect barricades and warning lights where open trench is within 12 feet of any travelled way.
  - e. Erect signs to warn oncoming vehicles of rough road or steel plates in road, as appropriate.

- f. Provide fencing or warning tape to protect the public from open trench in open areas.

C. Trench Excavations

- 1. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 204.04.01 and 204.04.03.
- 2. Excavate trenches and maintain excavation such that pipe and pipeline accessories are installed in an open trench.
- 3. Excavate to subgrade elevation and to trench width dimensions indicated in the Contract Documents and the City of Albany Standard Construction Specifications.
- 4. Excavate all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution of the trenching Work unless otherwise indicated.
- 5. Where pipelines are to be installed in embankments, fills, or structure backfills, construct fill to a level at least one foot above the top of the pipe before the trench is excavated.

D. Trench Bottom: Excavate and shape trench bottoms to provide uniform subgrade for placement of Bedding Material.

- 1. Unsuitable Trench Bottom: If bottom of excavation is found to consist of rock or any material that cannot be excavated to provide uniform bearing surface or soft or unstable material which is incapable of properly supporting pipe or wet trench conditions are encountered:
  - a. Notify Engineer of the conditions encountered and obtain concurrence that an unsuitable trench bottom is unsuitable.
  - b. Remove material and install replacement material as indicated in the Drawings and in accordance with the City of Albany Standard Construction Specifications.
  - c. Confirm removal depth of unsuitable material with the Engineer.
- 2. Over-excavation
  - a. Measurement and Payment for Over-excavation: Per 204.05.04 of the City of Albany Standard Construction Specifications:
- 3. Over-excavation not ordered by the Engineer:
  - a. Any over-excavation not approved by the Engineer or carried below the grade ordered or indicated, shall be backfilled to the required grade with the indicated material and compaction. Such work shall be performed by Contractor at no additional cost to Owner.

3.04 EXCAVATION FOR MANHOLES, VAULTS AND OTHER PIPELINE STRUCTURES.

- A. Unless otherwise indicated, provide excavations sufficient to leave at least 12 inches clear between structure outer surfaces and the face of the excavation or any shoring which may be used to support the face of the excavation.



- B. Excavate to the subgrade soils beneath the bottom of the structure or bottom of crushed rock layer where indicated.
- C. Scarify the top subgrade soils to a depth of 6 inches, moisture condition, and re-compact to 95 percent of maximum dry density.

### 3.05 EXCAVATION IN VICINITY OF TREES

- A. Except where trees are indicated to be removed, protect trees from injury during construction.
- B. Do not cut tree roots over 2 inches in diameter without permission of the Engineer.
- C. Support trees during excavation by means approve by the Engineer.

### 3.06 BOULDER EXCAVATION

- A. Perform boulder excavation in accordance with Section 02321.

### 3.07 BEDDING ZONE

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 204.04.04B.
- B. Bedding Material: As scheduled herein or as indicated on the Drawings
- C. Depth of Bedding Material: As indicated on the Drawings.
- D. Place Bedding Material in a single lift, and at uniform density, with minimum possible compaction. Grade material to allow installation of the pipe at the design invert elevations.
- E. Depressions for Assembly of Joints
  - 1. Dig holes for bell or coupling assembly after Bedding Material has been placed at the trench bottom and fine graded to the design elevation.
  - 2. Create sufficient width and depth to provide ample room for tightening bolts, welding, or other joint assembly activities.
  - 3. Excavate holes only as necessary in making joints. Ensure that pipe rests upon prepared trench bottom and is not supported by any portion of the joint.
- F. Manually compact spaces under the haunches of the pipe. Do not damage the pipe during compaction under the haunches. Compact the pipe zone backfill to 95 percent per modified proctor test method ASTM D1557.

### 3.08 PIPE ZONE

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 204.04.04B.
- B. Pipe Zone Material: As scheduled herein or as indicated on the Drawings.
- C. Dimensions of Pipe Zone Material: As indicated on the Drawings.

- D. After the pipe is laid, place material within the Pipe Zone in lifts:
  - 1. Place backfill only after all water is removed from the excavation and the trench sidewalls have been dried to a moisture content suitable for compaction.
  - 2. Immediately prior to placing backfill materials remove all loose, sloughing, or caving soils and rock materials from the trench.
  - 3. Place in lifts not exceeding 6 inches in un-compacted thickness and compact as indicated on the Drawings. Maintain level backfill on each side of pipe.
  - 4. Do not dump backfill materials directly on the pipe.
- E. Pipe Displacement
  - 1. Take necessary precautions in placement and compaction of to prevent displacement of piping.
  - 2. In the event there is movement of the pipe, excavate and re-lay the pipe.
- F. Consolidation:
  - 1. Do not use water-settling methods to consolidate trench backfill materials.
  - 2. Use shovel slicing to compact granular backfill materials under pipe haunches.
- G. Compact backfill to 95 percent per modified proctor test method ASTM D1557.

### 3.09 TRENCH ZONE

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 204.04.05 and as modified herein.
- B. Trench Zone Material: As scheduled herein or as indicated on the Drawings.
- C. Dimensions of Trench Zone Material: As indicated on the Drawings
- D. Backfill voids that may form when removing shoring and bracing.
- E. Do not use water-settling methods to consolidate Trench Zone Material.
- F. Compact backfill to 93 percent per modified proctor test method ASTM D1557.

### 3.10 SITE RESTORATION

- A. Perform site restoration in accordance with Section 02950.

### 3.11 CONCRETE PIPE ENCASEMENT

- A. Provide concrete pipe encasement where indicated on the Drawings.
- B. Concrete: 2,000 psi
- C. Provide temporary bulkheads to contain concrete at each end of encasement. Remove temporary bulkheads after concrete has set.
- D. Install reinforcing steel, where indicated, in accordance with Section 03301.

- E. Mix and place concrete in accordance with Section 03301
- F. Control placement of concrete to prevent movement of the pipe from either displacement or buoyancy forces.
- G. Support pipeline on concrete blocks, sand bags, or pre-mixed cement bags unless otherwise noted. Place supports a minimum of 10 feet on center.
- H. Maintain groundwater removal, as necessary, at least until completion of concrete placement.
- I. Do not place backfill on top of concrete within 4 hours of the completion of concrete placement.

### 3.12 CONTROLLED DENSITY FILL

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Sections 205.03.02C.
- B. Provide where indicated on the Drawings and with prior authorization of the City Engineer.
- C. Provide temporary bulkheads to contain cement slurry at each end of cement slurry backfill segments. Remove temporary bulkheads after slurry has set.
- D. Control placement of cement slurry backfill to prevent movement of the pipe from either displacement or buoyancy forces.
- E. Support pipeline on concrete blocks, sand bags, or pre-mixed cement bags unless otherwise noted. Place supports a minimum of 10 feet on center.
- F. Maintain groundwater removal, as necessary, at least until completion of cement slurry backfill placement.
- G. Do not place backfill on top of cement slurry backfill within 4 hours of the completion of cement slurry backfill placement.
- H.

### 3.13 PIPE IDENTIFICATION

- A. Force Main Locate Balls:
  - 1. Per Section 401.02.04D of the City of Albany Standard Construction Specifications.

### 3.14 DISPOSAL OF EXCESS EXCAVATED MATERIAL

- A. Dispose of excess excavated material according to Section 204.04.10 of the City of Albany Standard Construction Specifications.

**END OF SECTION**

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## SECTION 02321

### BOULDER EXCAVATION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Boulder excavation using conventional excavation equipment and methods.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section:
  - 1. Section 01330 – Submittals
  - 2. Section 02300 – Earthwork
  - 3. Section 02320 – Trenching

##### 1.03 REFERENCES

- A. 2018 ODOT Standard Specifications for Construction

##### 1.04 DEFINITIONS

- A. Boulder excavation: The removal, without drilling, or blasting, of masses of boulder or non-intact rock pieces having one or more dimensions of 2 feet or greater, and not classified as Common excavation.
- B. Common excavation: As defined in Earthwork or Trench Excavation Sections of this specification.
  - 1.

##### 1.05 SUBMITTALS

- A. Submit the following per Section 01330:
  - 1. Equipment/procedures to be used if boulders are encountered during excavation.

#### PART 2 - MATERIALS (NOT USED)

#### PART 3 - EXECUTION

##### 3.01 BOULDER EXCAVATION

- A. Conduct excavation in accordance with Section 02300 or Section 02320.
- B. Excavate to the lines, depths, grades and cross sections shown on the Drawings or as established. Variations will be permitted only when necessary to ensure firm foundations and when such variations will not be detrimental to the work.

- C. Where boulder excavation, as defined in this Section is required, remove the boulder to provide the minimum clearances shown on the Drawings. Excavate and remove the overburden and expose the boulder, as feasible, to allow the Engineer to measure the boulder prior to removal.
- D. Boulders which extend into the excavation limits from sidewalls or subgrade shall be chipped or broken by mechanical means (i.e. no blasting) to get within tolerances.
- E. No rocks, boulders, or extraneous materials to be used in backfilling of trenches.

### 3.02 REPLACING OVEREXCAVATED BOULDER MATERIAL

- A. Replace excavation carried below grade lines, “within” limits of boulder excavation, shown or established by Engineer and/or Owner as follows:
  - 1. Beneath Structure Foundations: Crushed Rock Drainage Layer or imported Crushed Rock Fill according to Earthwork or Trenching Sections or as shown on Drawings.
  - 2. Beneath Trench Fill or Backfill: Same material as specified for overlying fill or backfill according to Earthwork or Trenching Sections or as shown on Drawings.

### 3.03 TOLERANCES

- A. Subgrade for boulder excavation surface under pipe trenches and structures shall be plus 0.25 feet. Boulder surfaces above 0.25 feet shall be lowered as described in Paragraph 3.01.D.
- B. Sidewall for boulder excavation surface surrounding pipe trenches and structures shall be plus 0.5 feet. Boulder surfaces above 0.5 feet shall be removed as described in Paragraph 3.01.D.

### 3.04 DISPOSAL

- A. Disposal of boulders shall be offsite and the responsibility of the Contractor.

### 3.05 MEASUREMENT AND PAYMENT

- A. Payment for boulder excavation will be as provided in the Bid form as a unit price item, where provided. If a unit price item for boulder excavation is not provided in the Bid form, the extra cost for excavation of boulders will be treated as a Change Order item.
- B. Measurement and Payment
  - 1. Measurement of quantities for payment of boulder excavation shall be by calculation by Engineer of the volume of in-place materials removed as boulder excavation. No compensation will be made for removal of materials beyond the limits of the boulder excavation in the project drawings or ordered by Engineer or for materials which may come into the excavation from outside the designated limits. No compensation will be made for

excavation wider or deeper than the minimum indicated. Volume of each boulder removed will be approximated based on the length, width, and height agreed upon by the Engineer and Contractor.

2. Payment for boulder excavation will be made by the cubic yard unless otherwise indicated. The payment shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in excavating and backfilling the excavation completely, subgrade elevation indicated. Payment shall also include full compensation for the removal and disposal of boulder excavation materials, costs associated with the additional time to remove out of tolerance boulders, and all other costs and operations required for, or as a result of, boulder excavation.

**END OF SECTION**

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## SECTION 02401

### STEEL CASINGS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for installing carrier pipes inside casings.
- B. Steel casing pipe for installation of a carrier pipe.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 02320 – Trenching
  - 3. Section 02449 – Carrier Pipe Installation
  - 4. Section 09960 – High Performance Coatings

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data:
  - 1. Diameter, thickness and class of steel casing.
  - 2. Field joint welder qualifications.

##### 1.05 OTHER REQUIREMENTS

- A. Provide steel casing in compliance with the City of Albany Standard Construction Specifications.

#### PART 2 - PRODUCTS

##### 2.01 CASING PIPE

- A. Pipe Casing: Welded steel pipe conforming to ASTM A139, Grade B.
- B. Joints: Prepare ends for butt welding, squared and beveled at 37-1/2 degrees.
- C. Wall Thickness: Not less than the requirements listed in the table below. Increase wall thickness as necessary to accommodate the maximum jacking load, earth load

and live load imposed on the casing during installation. Contractor is fully responsible for the sufficiency of the casing wall thickness.

**Required Minimum Wall Thickness for Steel Casing**

Casing Diameter (inches)	AREMA E80 Loading Requirements	
	Coated or Cathodically Protected (inches)	Uncoated or Cathodically Protected (inches)
6	0.188	0.188
12	0.188	0.188
14	0.188	0.250
16	0.219	0.281
18	0.250	0.312
20	0.281	0.344
24	0.312	0.375
28	0.375	0.438
30	0.406	0.469
36	0.469	0.531
38	0.500	0.563
40	0.500	0.563
42	0.500	0.563
48	0.563	0.625
54	0.656	0.719
60	0.719	0.781
62	0.750	0.813
66	0.813	0.875
72	0.875	0.938
Notes: Thicker casing may be substituted for required casing thickness. When crossing both highway and railroad, use thickest casing listed		

- D. Coating: Coat exterior surface of the casing sections:
  1. In accordance with Section 09960 – System E-3
  2. Field repair coating at welds per Section 09960

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF CASING PIPE**

- A. Contractor to notify Portland and Western Railroad a minimum of 4 weeks prior to trenching under the tracks.

WEST YOST GUIDE SPECIFICATION

- B. Install casing and backfill per Portland and Western Railroad requirements between the hours of 7 AM and 6 PM on the same day to allow the railroad to maintain service.
- C. Install casing utilizing tunneling methods to open trench under the railroad. Remove only the minimum amount of in situ material to allow proper installation of casing.
- D. Do not remove or disturb the tracks, ties, or any other part of the railroad system at any time.
- E. Adequately support tracks, ties and any other Railroad components during installation.
- F. Adhere to the requirements in Section 02320.
- G. Protect the tracks during casing installation and backfilling of the trench.
- H. Steel casing field joints: Full penetration welds in accordance with AWWA C206. Submit evidence of welder qualifications in accordance with AWS D1.1

### 3.02 INSTALLATION OF CARRIER PIPE

- A. After casing installation, install carrier pipe in accordance with Section 02449.

**END OF SECTION**

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## SECTION 02449

### CARRIER PIPE INSTALLATION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for installing carrier pipes inside casings.
- B. End seals and spacers for installation of a carrier pipe.

##### 1.02 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Submit complete product data for the following:
  - 1. Casing spacers and end seals for carrier pipe.

#### PART 2 - PRODUCTS

##### 2.01 CASING END SEALS

- A. Casing End Seals: 1/8-inch thick neoprene rubber fastened to the casing and carrier pipes with Type 316 stainless steel band straps to provide a tight seal while allowing pipe movement.
- B. Manufacturers: One of the following, or equal:
  - 1. Link Seal End Seal as manufactured by Pipeline Seal and Insulator, Inc.
  - 2. Model AC or AW End Seal as manufactured by Advance Products & Systems, Inc.
- C. Spare casing and caps: Seal ends of spare casings with neoprene end caps similar to casing end seals except without provision for carrier pipe.

##### 2.02 CARRIER PIPE SPACERS

- A. Provide casing spacers/isolators/insulators to both support the carrier pipe within the casing and electrically isolate the carrier pipe from the casing.
- B. Install carrier pipe spacers within 2' of every pipe bell and additional spacers at an interval not to exceed 8 feet on center.
- C. Spacer Design: Consist of a band with a flexible liner and stainless steel risers that support the carrier pipe and fiberglass reinforced runners.
  - 1. Bands: Two-segment, 14 gauge, Type 304 stainless steel.

2. Risers: 10 gauge, Type 304 stainless steel.
  3. Liner: PVC or EPDM.
  4. Runners: 8-inch long by 2-inch wide molded glass reinforced polymer. Attach to the band and risers with stainless steel fasteners, which are set below the wearing surface of the runner.
- D. Manufacturers: One of the following or equal:
1. Pipeline Seal and Insulator, Inc.
  2. Advanced Products & Systems, Inc.

### 2.03 BACKFILL

- A. None

## **PART 3 - EXECUTION**

### 3.01 INSTALLATION OF CARRIER PIPE

- A. Remove debris from casing prior to installation of carrier pipe.
- B. Install carrier pipe spacers in accordance with pipe manufacturer's instructions, these specifications and at a minimum of two spacers on each section of carrier pipe. Locate carrier pipe spacers within 12 inches of each end. Install spacers so that centerline of the carrier pipe is located at centerline of the casing pipe.
- C. Push carrier pipe through casing pipe and make each joint as the carrier pipe is being inserted. Install joint restraints where shown on the drawings.
- D. Seal ends of casing with casing end seals.

**END OF SECTION**

## SECTION 02511

### UTILITY PIPELINES AND SITE PIPING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for furnishing and installing utility and site piping systems and pipelines, including modification and connections to existing piping.

##### 1.02 REFERENCED SECTION

- A. The following Sections are referenced in this Section:
  - 1. Section 01140 – Work Sequence and Constraints
  - 2. Section 01330 – Submittals
  - 3. Section 02210 – Subsurface Investigations
  - 4. Section 02320 – Trenching
  - 5. Section 03301 – Cast-In-Place Concrete
  - 6. Section 05501 – Anchor Bolts and Anchoring Devices
  - 7. Section 09960 – High Performance Coatings
  - 8. Section 09972 – Hot-Dip Zinc Coatings
  - 9. Section 15117.1 – Wastewater Combination Air Valves
  - 10. Section 15951 – Testing Gravity Flow Pipelines
  - 11. Section 15996 – Testing Pressure Piping

##### 1.03 SYSTEM REQUIREMENTS

- A. Each system shall be complete, including but not limited to, all necessary fittings, supports, anchors, thrust restraints, thrust blocks, expansion joints, valves, accessories, insulation, lining and coating, testing, excavation, backfill, and encasement as necessary to provide a complete and functional installation.
- B. The piping shown on the Drawings is intended to define the general layout, configuration, routing, pipe sizes, and pipe types. The Drawings are not pipe construction or fabrication drawings. Not all pipe supports, fittings, reducers, anchorages, and expansion provisions are indicated on the Drawings. It is Contractor's responsibility to develop the details necessary to construct all piping systems and to provide and install all piping components for a complete and functional system.

#### 1.04 SUBMITTALS

- A. Submit complete Shop Drawings and certificates, test reports, and affidavits of compliance of piping systems, in accordance with the requirements in Section 01330 and the requirements of the pipe material Technical Specifications.
- B. Include necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists.
- C. Include detailed layout, spool and fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, valves, and pipe supports necessary to provide complete and functional piping systems.
- D. Submit statements from the pipe fabricators certifying that pipes will be fabricated subject to an established quality control program.
- E. Submit tabulated data resulting from the field investigations, exploratory excavations, and surveying for underground utilities in accordance with Section 02210.
- F. Provide Shop Drawings for modifications and connections to existing piping and structures.

#### 1.05 QUALITY ASSURANCE

- A. Pipe shall be subject to inspection at the place of fabrication and manufacture. During the manufacture of the pipe, Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with the Specifications.
- B. Except where otherwise specified, test all materials used in the manufacture of pipe in accordance with applicable specifications and standards. Test welds as specified. Perform tests at no additional cost to Owner.
- C. Contractor to pay costs for making samples for certification of tests.

#### 1.06 MANUFACTURER'S SERVICE REPRESENTATIVE

- A. Where the assistance of a manufacturer's service representative is advisable, to obtain pipe joints, supports, or special connections in compliance with the Contract Documents, furnish such assistance at no additional cost to Owner.
- B. **INDUSTRY STANDARDS**
  - 1. MFMA-4 - Metal Framing Manufacturer's Association, Metal Framing Standards Publication

### **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. Furnish pipes, fittings, and appurtenances in accordance with the requirements of the applicable Technical Specifications and as specified herein.
- B. Provide coatings in conformance to the manufacturer's requirements and Section 09960.



- C. Comply with application, thickness, and curing of pipe coatings and linings of the applicable pipe and coating Technical Specifications.
- D. External ferrous metal surfaces of pipes above ground or in structures: Prepare surface and apply prime coatings in the shop and apply finish coatings in the field after installation, all in accordance with Section 09960.
- E. Design and install piping thrust restraints to accommodate 150 percent of the maximum test pressure unless otherwise indicated.

## 2.02 PIPE

- A. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed on the piping system specification sheets. Piping materials shall conform to detailed specifications for each type of pipe and piping appurtenance specified in Division 15. If, in addition to the pipe service symbol, the Drawings contain specific callouts for pipe materials, the information on the Drawings shall govern on an exception basis.

## 2.03 BOLTS, NUTS, TIE RODS, AND OTHER FASTENERS FOR DUCTILE IRON PIPE:

- A. Flange bolts and nuts:
  - 1. Above Grade or Submerged Conditions:
    - a. Type 316 stainless steel.
  - 2. Buried:
    - a. High strength, low alloy steel in accordance with AWWA C111.
    - b. Hot dipped galvanized in accordance with Section 09972.
- B. Tie-rod bolts and nuts:
  - 1. Type 316 stainless steel.
- C. Coupling and appurtenance bolts and nuts (not including flanges):
  - 1. Type 316 stainless steel.
- D. Furnish fasteners for ductile iron pipe in unopened containers with the product labels and alloy type intact and legible.

## 2.04 PIPE FLANGES

- A. General
  - 1. Do not bolt flat-faced flanges to raised-face flanges.
  - 2. Coat machined faces of metal blind flanges and pipe flanges with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
  - 3. Studs and bolts shall extend through the nuts a minimum of 1/4-inch.

4. Use all-thread studs only on valve flange connections where space restrictions preclude the use of regular bolts.
- B. Flanges for Ductile Iron Pipe
1. Conform to AWWA C115.
  2. Use threaded connections to connect flanges to pipe, or flanges may be integrally cast with the pipe.
  3. Design pressure: Rated for a 250-psi working pressure.
  4. Dimensions: ASME B16.5, Class 150 flanges.
- C. Flange Gaskets
1. Full-faced, compressed sheets of aramid fiber base, with nitrile or neoprene binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to eleven, and pressures to 1,000 psig.
  2. 1/16-inch thick for flange sizes up to 24 inches, and 1/8-inch thick for sizes greater than 24 inches.
  3. Gaskets for blind flanges shall cover the entire inside face of the blind flange and be cemented to the blind flange.
  4. Manufactured by, or equal:
    - a. John Crane, Style 2160;
    - b. Garlock, Style 3000 or 3300.

## 2.05 PIPING SUPPORTS AND HANGERS

### A. General

1. All piping shall be supported against sag, lateral and vertical movement in a manner which will prevent undue strain on any valve, fitting, pipe or piece of equipment.
2. Unless otherwise indicated on the Plans, exposed piping shall be supported at the base of all risers, at intervals not to exceed 5 feet on all horizontal runs of pipe 2-inch. and smaller, at intervals not to exceed 8 feet on all horizontal runs of pipe 2-1/2 inch. through 4 inch, and at intervals not to exceed 12 feet. on all horizontal runs of pipe larger than 4-inch.
3. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, at pipe connections to equipment and where otherwise shown.
4. Piping shall be supported as described hereinafter and as shown by the pipe support details on the Plans.
5. Manufacturer's catalog figure numbers are typical of the types and quality of standard pipe supports and hangers to be employed.
6. No attempt has been made to show all required pipe supports in all locations, either on the Plans or in the details.

7. The absence of pipe supports and details on any Plans shall not relieve the Contractor of the responsibility of providing a satisfactory piping support system in conformance with the functional and specific support spacing requirements of these specifications.
8. Do not permit contact between a pipe and hanger or support component, constructed of dissimilar metals. Where concrete or metal support is used, place 1/8-inch thick Teflon, neoprene rubber, or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and pipe support. Prevent contact between dissimilar metals when supporting copper tubing by using copper-plated, rubber, plastic or vinyl coated, or stainless steel hanger and support components.

B. Hangers and Supports

1. Pedestal pipe supports shall be adjustable, with stanchion, saddle, and anchoring flange as shown, Grinnel, Fee, and Mason, or equal.
2. Non-shrink grout shall be used under the floor flanges to give level bearing, and floor flanges shall be bolted to the floor with two stainless steel bolts cast in the concrete, if possible, or using stainless steel concrete anchors.

C. Framing Channel

1. Continuous slot, bolted metal framing channels with all associated fittings and hardware. All strut, fittings and hardware shall be made of AISI Type 304 stainless steel. Framing channel shall be 1-5/8 inches wide in varying heights and welded combinations as required to meet load capacities.
2. Comply with the latest revision of MFMA Standards Publication Number MFMA-4, "Metal Framing Standards Publication".

D. Anchors

1. All piping, raceways, accessories, and appurtenances shall be anchored to resist a lateral seismic force of 60 percent of its operating weight.
2. This force shall be considered acting at the center of gravity of the piece under consideration.
3. Piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system.

## 2.06 BLIND FLANGES

- A. Conform to AWWA C207, or as required by the requirements for the respective pipe materials in the Technical Specifications.
- B. Provide blind flanges for pipe sized 12-inches and over shall with lifting eyes in form of welded or screwed eye bolts.

## 2.07 FLANGED COUPLING ADAPTERS

- A. All flanged coupling adapters shall be constructed to diameters that properly fit the connecting plain end pipe and the flanged fitting.
- B. Conform to AWWA C219.
- C. Provide anchor pins for all sizes up to and including 12-inch.
- D. Lining and Coating:
  - 1. Coat all ferrous metal surfaces with fusion bonded epoxy per Section 09960
- E. Followers:
  - 1. Single-piece contoured mill sections, welded and cold-expanded as required to fit the middle rings.
  - 2. Sufficient to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling.
  - 3. Designed to provide positive confinement of the gasket.
- F. Coat all ferrous metal surfaces with fusion bonded epoxy in accordance with Section 09960.
- G. Pipe End Preparation
  - 1. Prepare pipe ends by holding back pipe end coating, abrasive blasting surface, and coating with fusion bonded epoxy in accordance with the pipeline Technical Specifications or the coupling manufacturer.
- H. Flange:
  - 1. Compatible with ANSI Class 125 & 150 bolt circles.
- I. Gaskets for Water and Wastewater Service
  - 1. Rubber compound material manufactured in accordance with ASTM D2000 MBA 710 that will not deteriorate from age or exposure to air under normal storage or use conditions.
  - 2. Compatible with the piping service and fluid.
- J. Bolts and Nuts:
  - 1. Per Section 05501
- K. Manufacturers:
  - 1. Romac FCA501
  - 2. Or Equal

## 2.08 PIPE THREADS

- A. Conform to ASME B1.20.

## 2.09 CONCRETE FOR ENCASEMENTS AND THRUST BLOCKS

- A. Conform to Section 03301.

## 2.10 TAPPING VALVES AND SLEEVES

- A. Comply with Section 502 of the City of Albany Standard Construction Specification.

## 2.11 WASTEWATER COMBINATION AIR VALVES

- A. Conform to Section 15117.1.

## 2.12 VALVES

- A. Conform to the Division 15 Technical Specifications.

# PART 3 - EXECUTION

## 3.01 GENERAL

- A. Deliver pipe materials, fittings, valves, and accessories in a clean and undamaged condition.
- B. Store off the ground, to provide protection against damage and degradation caused by ground contact.
- C. Replace defective or damaged materials with new materials.
- D. Cover plastic and rubber pipe materials, and pipe materials with tape or paint-type coatings, during storage to prevent direct exposure to sunlight.
- E. Perform subsurface investigations per Section 02210 prior to the preparation of Shop Drawings and prior to excavating for installation of underground piping. No additional compensation will be awarded for failure to locate existing utilities indicated on the Drawings or identified by utility markings in the field.
- F. Install buried piping in conformance with Section 02320.
- G. Pipe ends at mechanical couplings: Abrasive blast and epoxy-coat prior to assembly in accordance with Section 09960.
- H. Electrically isolate metallic pipes or metallic pipe sleeves that pass through concrete walls from the reinforcing steel. Do not touch reinforcing steel or connected to it for support.

## 3.02 PIPE

- A. Install pipe, fittings, and appurtenances in accordance with the requirements of the applicable Technical Specifications of the type and locations indicated.

## 3.03 THRUST RESTRAINT

- A. Provide thrust restraint as necessary to prevent joint separation or movement due to internal pressure.

- B. Install thrust restraint as indicated on the Drawings and as indicated in the pipe Materials Technical Specifications.
- C. If thrust restraint is not indicated, install thrust restraint system in conformance with the pipe manufacturer's recommendations.
- D. Install concrete thrust blocks only where indicated on the Drawings or in locations approved by the Engineer.
  - 1. Conform to the requirements of the pipe materials Technical Specifications.

### 3.04 MODIFICATIONS AND CONNECTIONS TO EXISTING PIPING

- A. Coordinate with the owner of the existing pipeline to be connected to prior to making connection. Conform to pipeline owner's requirements for connection.
- B. Perform demolition of existing pipelines and yard piping as shown or necessary to make connection. Preserve, in undamaged condition, piping that is to remain and where connections are to be made as part of the Work.
- C. Modify and connect to existing piping in accordance with the materials, joint requirements, welding, coatings, linings, and other provisions of this Section and the Technical Specifications for the pipe to which connections are to be made. Where specific details are indicated on the Drawings, provide the pipe connections, joints, fittings, and appurtenances as indicated.
- D. Coordinate with the pipeline owner to have the pipeline de-energized. Affect lock-out/tag-out procedures as necessary to prevent the accidental use of the pipeline.
- E. Carefully cut existing pipe using saws and cutting equipment acceptable to Engineer. Do not torch cut metallic pipe for preparation of pipe at connections.
- F. Grind ends of steel pipe to remove corrosion and foreign materials where sleeve couplings are to be installed. Power tool clean and epoxy coat pipe ends prior to assembly for sleeve and grooved end-type couplings.
- G. Use pipe fittings for modifications and connections. Do not use saddle-type connections unless specifically indicated on the Drawings.
- H. Complete pressure testing, and obtain utility owner's approval prior to making connections to existing piping systems, unless otherwise indicated.

### 3.05 TAPPING VALVES AND SLEEVES

- A. Comply with Section 502.02.02 of the City of Albany Construction Specifications.

### 3.06 APPURTENANCES

- A. Wastewater Combination Air Valves:
  - 1. Install air/vacuum release valves as indicated on the Drawings.
  - 2. Adjust location of valves as necessary so that they are located at the local high point at each valve location. Any change to the valve location or high point must be pre-approved by the Engineer.

- B. Valves:
  - 1. Install valves where indicated and according to the technical specifications.

### 3.07 FIELD TESTING

- A. Conduct pipeline testing in accordance with Section 15951 and Section 15996 at the test pressures indicated.

**END OF SECTION**

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## SECTION 02722

### AGGREGATE BASE COURSE MATERIAL

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Aggregate base course material and placement.

##### 1.02 DEFINITIONS

- A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.
- B. Completed Lift: Compacted with uniform surface reasonably true to cross-section.

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Product Data: Source, gradation, and testing data records for aggregate base course material previously produced by the supplier, which demonstrates compliance with the specified gradation and physical requirements.

##### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

##### 1.06 QUALITY ASSURANCE

- A. Comply with Section 106 of the City of Albany Standard Construction Specifications.
- B. Compaction testing:
  - 1. Per 204.04.08C of the City of Albany Standard Construction Specifications.
- C. Noncompliance with Specified Density Requirements:
  - 1. Per 106.03.00 and 204.04.08D of the City of Albany Standard Construction Specifications.
- D. Compaction Specifications for Materials and Various Applications:
  - 1. Per 204.04.08A of the City of Albany Standard Construction Specifications or the Drawings, whichever is most stringent.
- E. Compaction Methods and Equipment:
  - 1. Per 204.04.08B of the City of Albany Standard Construction Specifications.

- F. Acceptance of materials will be performed according to Section 205.03.04 of the City of Albany Standard Construction Specifications.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Aggregate: Dense-graded consisting of crushed rock, hard, durable particles or fragments of stone or gravel, screened or crushed to the specified grading and free from vegetable matter, lumps or balls of clay, alkali, adobe, or other deleterious matter.
- B. Use 3/4"-0 aggregate grading unless otherwise indicated. Do not change grading without authorization from the Engineer. Comply with Section 205.03.01 of the City of Albany Standard Construction Specifications and Section 00405.12 of the 2018 Oregon Standard Specifications for Construction (2018 OSSC).

## **PART 3 - EXECUTION**

### **3.01 PLACEMENT**

- A. Comply with Section 302.02.00 of the City of Albany Standard Construction Specifications.
- B. Obtain Engineer's acceptance of subgrade before placement of base course.
- C. Do not place aggregate base material in standing water or on soft, muddy or frozen or otherwise unsatisfactory subgrade. Comply with Section 302.02.02 of the City of Albany Standard Construction Specifications.
  - 1. Place base and sub-base according to Section 302.02.03 of the City of Albany Standard Construction Specifications.

### **3.02 DENSITY REQUIREMENTS**

- A. Compact aggregate base course material to obtain an In-Place Density of 98 percent of maximum density determined by ASTM D1557, unless otherwise indicated.
- B. Commence compaction effort by starting at the outer edges of the layer and continue toward the center.
- C. Apply water as needed to obtain required In-Place Density.
- D. Place and compact each lift to required density before succeeding lift is placed.
- E. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.

### **3.03 TOLERANCES**

- A. Per 302.02.05 of the City of Albany Standard Construction Specifications.

### 3.04 FIELD QUALITY CONTROL

- A. Comply with Section 302.02.06 of the City of Albany Standard Construction Specifications.
- B. Contractor's compaction testing responsibilities:
  - 1. Accomplish specified degree of compaction in accordance with this specification.
  - 2. Undertake and control compaction effort by confirmation tests to verify that the compaction work complies with the specified degree of compaction.
  - 3. Pay for compaction testing services and submit compaction test reports to the Engineer.
  - 4. If compaction fails to meet specified requirements bring density up to specified level and retest.
    - 1) Costs for conducting additional tests to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the Contractor.
    - 2) Conduct compaction tests at twice as frequently specified for the initial confirmation tests.
- C. Frequency of Compaction Testing
  - 1. Structures: Make one compaction test for each 50 cubic yards of aggregate base course material placed, with a minimum of one compaction test per structure.
  - 2. Roadway and Paved Areas: Make one test every 1500 square feet of pavement.
- D. Owner's Compaction Compliance Testing
  - 1. Owner may periodically make compliance tests to independently verify that compaction is meeting the specified requirements.
  - 2. If necessary, remove overburden above the test location and backfill and re-compact as necessary after the testing has been completed.

**END OF SECTION**

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**SECTION 02780**  
**CONCRETE PAVERS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES:

- A. Requirements for the Removal and Replacement of Interlocking Concrete Paver Units.
- B. Bedding and Joint Sand.
- C. Edge Restraints.

1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01600 – Materials and Equipment

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C33, Standard Specification for Concrete Aggregates.
  - 2. ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.
  - 3. ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - 4. ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
  - 5. ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
  - 6. ASTM C936, Standard Specification for Solid Concrete Interlocking Paving Units.
  - 7. ASTM C979, Standard Specification for Pigments for Integrally Colored Concrete.
- B. Interlocking Concrete Pavement Institute (ICPI):
  - 1. ICPI Tech Spec Technical Bulletins

1.04 SUBMITTALS

- A. Sieve analysis per ASTM C136 for grading of bedding and joint sand.
- B. Paver Installation Subcontractor:
  - 1. A copy of Subcontractor's current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

2. Job references from projects of a similar size and complexity.

#### 1.05 QUALITY ASSURANCE

##### A. Qualifications:

1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

##### B. Mock-Ups:

1. Install a 7 ft x 7 ft (2 x 2 m) paver area.
2. Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s) and texture of the job.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and properly dispose of mock-up.

##### C. Coordination with Owner:

1. Prior to removal of concrete pavers located at Jackson and Hill street Intersections, coordinate with the Owner to confirm the Owner has replacement pavers available in case any removed pavers are damaged during construction. Confirm number of pavers available for replacement at each intersection and that no additional pavers are required from the manufacturer.

#### 1.06 DELIVERY, STORAGE AND HANDLING

##### A. General: Comply with Section 01600.

1. Delivery: Coordinate delivery of any required replacement pavers with the City of Albany.
2. Unload pavers at job site in such a manner that product is not damaged.

##### B. Storage and Protection: Store materials protected such that they are kept free from mud, dirt, and other foreign materials.

1. Cover bedding sand and joint sand with waterproof covering if needed to prevent exposure to rainfall or removal by wind. Secure covering in place.
2. Store in a location that prevents damage to the pavers.

#### 1.07 PROJECT/SITE CONDITIONS

##### A. Environmental Requirements:

1. Do not install sand or pavers during heavy rain or snowfall.

2. Do not install sand and pavers over frozen base materials.
3. Do not install frozen sand or saturated sand.
4. Do not install concrete pavers on frozen or saturated sand.

**PART 2 - PRODUCTS**

**2.01 INTERLOCKING CONCRETE PAVERS**

- A. Reinstall existing pavers that are removed during trenching operations. If any damage occurs to the concrete paver during construction or removal or paver, contact the Owner to acquire a replacement paver.

**2.02 BEDDING AND JOINT SAND**

- A. Provide bedding and joint sand as follows:
  1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
  2. Do not use limestone screenings, stone dust, or sand for the bedding sand material that does not conform to the grading requirements of ASTM C33.
  3. Do not use mason sand or sand conforming to ASTM C144 for the bedding sand.
  4. Where concrete pavers are subject to vehicular traffic, utilize sands that are as hard as practically available.
  5. Sieve according to ASTM C136.
  6. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C33 with modifications as shown in Table 1.

Table 1 Grading Requirements for Bedding Sand ASTM C33	
Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075 mm)	0 to 1

7. Joint Sand Material Requirements: Conform to the grading requirements of ASTM C144 as shown with modifications in Table 2 below:

Table 2 Grading Requirements for Joint Sand ASTM C144		
Sieve Size	Percent Passing	
	Natural Sand	Manufactured Sand
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 16 (1.18 mm)	70 to 100	70 to 100
No. 30 (0.600 mm)	40 to 75	40 to 100
No. 50 (0.300 mm)	10 to 35	20 to 40
No. 100 (0.150 mm)	2 to 15	10 to 25
No. 200 (0.075 mm)	0 to 1	0 to 10

### 2.03 EDGE RESTRAINTS

- A. Provide edge restraints installed around the perimeter of all interlocking concrete paving unit areas as follows:
  1. Portland Cement Concrete as shown on the Construction Drawings.

### 2.04 ACCESSORIES

- A. Geotextile Fabric:
  1. The subgrade geotextile fabric shall meet the Oregon Standard Specifications for Construction Section 00350, Geosynthetic Installation and Table 02320-1.

## PART 3 - EXECUTION

### 3.01 ACCEPTABLE INSTALLERS.

- A. See experience requirements above.

### 3.02 PAVER REMOVAL

- A. Careful remove the existing concrete pavers to allow trenching and installation of the force main. Remove as many pavers as required to ensure no remaining pavers near the trench are damaged.
- B. Store and protect pavers according to Paragraph 1.06.C.

### 3.03 EXAMINATION

- A. Acceptance of Site Verification of Conditions:
  1. Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.
    - a. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.



- b. Verify that geotextiles, if applicable, have been placed according to Construction Drawings and specifications.
  - c. Verify that aggregate base materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
  - d. Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage inlets.
2. Do not proceed with installation of bedding sand and interlocking concrete pavers until subgrade soil and base conditions are corrected by the Contractor or designated subcontractor.

### 3.04 PREPARATION

- A. Verify base is dry, certified by Contractor as meeting material, installation and grade specifications.
- B. Verify that base and geotextile is ready to support sand, pavers and imposed loads.

### 3.05 PAVER REINSTALLATION

- A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1-1/2 in. (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.
  1. Do not disturb screeded sand.
  2. Screeded area shall not substantially exceed that which is covered by pavers in one day.
  3. Do not use bedding sand to fill depressions in the base surface.
- B. Reinstall pavers back to their original patterns. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.
- C. Provide joints between pavers between 1/16-inch and 3/16-inch (2 and 5 mm) wide. No more than 5% of the joints shall exceed 1/4 in. (6 mm) wide to achieve straight bond lines.
- D. Joint (bond) lines shall not deviate more than  $\pm 1/2$  in. ( $\pm 15$  mm) over 50 ft. (15 m) from string lines.
- E. Fill gaps at the edges of the paved area with cut pavers or edge units.
- F. Cut pavers to be placed along the edge with a double blade paver splitter or masonry saw.
- G. Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.

- H. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.
- I. Use a low-amplitude plate compactor capable of at least minimum of 4,000 lbf (18 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.
- J. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 to 6 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.
- K. All work within 6 ft. (2 m) of the laying face shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.
- L. Remove excess sand from surface when installation is complete.
- M. Surface shall be broom clean after removal of excess joint sand.

### 3.06 FIELD QUALITY CONTROL

- A. The final surface tolerance from grade elevations shall not deviate more than  $\pm 3/8$ -inch ( $\pm 10$  mm) under a 10 ft (3 m) straightedge.
- B. Check final surface elevations for conformance to drawings.
  - 1. Note: For installations on a compacted aggregate base and soil subgrade, the top surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.
- C. The surface elevation of pavers shall be 1/8 in. to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.
- D. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

### 3.07 PROTECTION

- A. After work in this section is complete, the Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

**END OF SECTION**

## SECTION 02782

### REINFORCED GRASS PAVING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Providing and installing sandy gravel road base as per Owner's Representative's recommendations and/or as shown on Contract Documents, to provide adequate support for project design loads.
- B. Provide Grasspave2 Paving System products including Grasspave2 units, Hydrogrow soil polymer, and installation per the manufacturer's instructions furnished under this section.
- C. Provide and install clean sharp sand to fill the Grasspave2 units, when needed.
- D. Provide and install grass by using sod.

##### 1.02 REFERENCED SECTIONS:

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 QUALITY ASSURANCE

- A. Installation: Performed only by skilled workpeople with satisfactory record of performance on landscaping or paving projects of comparable size and quality.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Submit manufacturer's product data and installation instructions.
- C. Submit a 10" x 10" section of Grasspave2 material for review. Reviewed and approved samples will be maintained on-site for reference.
- D. Submit material certificates for base course and sand fill materials.
- E. Contractor shall submit product operation requirements and train Owner personnel on maintenance and replacement requirements for the pervious pavement material.

##### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect Grasspave2 units from damage during delivery and store under tarp to protect from sunlight, when time from delivery to installation exceeds one week. Keep Hydrogrow in a dark and dry location.

## 1.06 PROJECT CONDITIONS

- A. Review installation procedures and coordinate Grasspave2 work with other work affected. Generally, Grasspave2 is installed at the same time as project grass installation, nearly the last site construction activity.
- B. All hard surface paving adjacent to Grasspave2 areas, including concrete walks and asphalt paving must be completed prior to installation of Grasspave2.
- C. Gradients for grass porous paving surfaces can vary from flat to 20%, depending upon vehicle types to use the surface. Please note that fire lanes, or other emergency vehicles, will generally require a gradient that is less than 6%.
- D. Protect partially completed paving against damage from other construction traffic when work is in progress, and until grass root system has matured (about 3 to 4 weeks). Any barricades constructed must still be accessible by emergency and fire equipment during and after installation.
- E. Protect adjacent work from damage during Grasspave2 installation.

## PART 2 - PRODUCTS

### 2.01 BASIS OF DESIGN

- A. Manufacturer: (Grasspave2, Hydrogrow) Invisible Structures, Inc., 16265 E 33rd Dr, Ste 20, Aurora, Colorado 80011. Call from USA and Canada 800-233-1510 toll free, International 303-233-8383, Fax 303-233-8282.
- B. Equivalent materials may be used; submit product data to the Owner's Representative for approval prior to ordering material.

### 2.02 MATERIALS

- A. Base Course: Sandy gravel material from local sources commonly used for road base construction, passing the following sieve analysis.

Sieve	%Passing
1"	100
3/4"	90-100
3/8"	70-80
#4	55-70
#10	45-55
#40	25-35
#200	3-8

- 1. Sources of the material can include either "pit run" or "crusher run."
  - a. Crusher run material will generally require sharp sand to be added to mixture (33% by volume) to ensure long-term porosity.
  - b. If there is difficulty in finding local sources to meet this sieve analysis, an alternative mixture can be created by mixing 2/3

- crushed drainage rock (0.75" dia) with 1/3 course, well-draining sand (AASHTO M6 or ASTM C33).
2. Selected materials should be nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for turf.
  3. Alternative materials such as crushed shell, limerock, and/or crushed lava may be considered for base course use, provided they are mixed with sharp sand (33%), and brought to proper compaction. (Crushed shell and limerock alone can set up like concrete without sand added.)
- B. Hydrogrow Mix: A proprietary soil amendment manufactured by Invisible Structures, Inc., provided with Grasspave2.
- C. Grasspave2 Grass Paving Units:
1. Lightweight injection-molded plastic units 20"x20"x1" high, 2.7 ft<sup>2</sup> each with hollow rings rising from a strong open grid allowing maximum grass root penetration and growth.
  2. Unit weight = 510 g (18 oz.), volume = 8% solid.
  3. The plastic shall be 100% pre-consumer recycled HDPE plastic resin, with minimum 3% carbon black concentrate added for UV protection.
  4. Loading capability is equal to 402 kg/cm<sup>2</sup> (5721 psi, 823,824 psf, 7.4 million psy, 39,273 kPA, 3707 tons/sq.yd.) when filled with sand, over an appropriate depth of base.
  5. Grasspave2 is shipped in pre-assembled rolls that vary from 10 square meters (108 sf) to 50 square meters (1345 sf).
  6. Male/Female Fastener Tensile Strength (from a Pull Test) is equal to 80,208 N/m (450 lbsf/in.)
  7. Standard color is black.
- D. Sand: To fill the one-inch high rings and spaces between the rings when seeding or using half inch thick sod (soil thickness):
1. Coarse, well-draining sand (washed concrete sand- AASHTO M6 or ASTM C33).
- E. Sod:
1. Use sod materials, of the preferred species for local environmental and projected traffic conditions, from certified sources.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine subgrade and base course installed conditions. Do not start Grasspave2 installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.

- B. Installation constitutes approval of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Project Manager for resolution.

### 3.02 PREPARATION

- A. Ensure that sub-base materials are structurally adequate to receive designed base course, wearing course, and designed loads. Generally, excavation into undisturbed normal strength soils will require no additional modification. Fill soils and otherwise structurally weak soils may require modifications, such as geotextiles, geogrids, and/or compaction (not to exceed 90%). Ensure that grading and soil porosity of the sub-base will provide adequate subsurface drainage.
- B. Place base course material over prepared sub-base to grades shown on contract documents, in lifts not to exceed 6", compacting each lift separately to 95% Modified Proctor. Leave minimum (1" to 1.5" for Grasspave2 unit and sand/sod fill to Final Grade.
- C. Spread all Hydrogrow mix provided (spreader rate = 4.53 kg per 100 m<sup>2</sup> (10 lbs per 1076 ft<sup>2</sup>) evenly over the surface of the base course with a hand-held, or wheeled, rotary spreader. The Hydrogrow mix should be placed immediately before installing the Grasspave2 units to assure that the polymer does not become wet and expanded when installing the units.

### 3.03 INSTALLATION OF GRASSPAVE2 UNITS

- A. Install the Grasspave2 units by placing units with rings facing up, and using pegs and holes provided to maintain proper spacing, interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves and slopes shall be anchored to the base course, using 16d Common nails with fender washer, as required to secure units in place. Tops of rings shall be between 0.25" to 0.5" below the surface of adjacent hard-surface pavements.
- B. Install sand in rings as they are laid in sections by "back-dumping" directly from a dump truck, or from buckets mounted on tractors, which then exit the site by driving over rings already filled with sand. The sand is then spread laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water from hose, irrigation heads, or rainfall, with the finish grade no less than the top of rings and no more than 0.25" above top of rings.

### 3.04 INSTALLATION OF GRASS

- A. Roll sod material over the Grasspave2 product. Assure seams between sections of sod are minimal.
- B. Once laid over the Grasspave2 roll sod with weight roller to embed sod into the cell openings of the Grasspave2.

### 3.05 PROTECTION

- A. Protect sodded areas from any traffic, other than emergency vehicles, for a period of 4 to 8 weeks, or until the grass is mature to handle traffic.

### 3.06 CLEANING

- A. Remove and replace segments of Grasspave2 units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.
- B. Perform cleaning during the installation of work and upon completion of the work.
- C. Remove all excess materials, debris, and equipment from site.
- D. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

**END OF SECTION**

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## SECTION 02950

### SITE RESTORATION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. The restoration of features and includes restoration of surface features damaged during the course of execution of this contract to be restored as part of this work. The work may include such repairs as manhole appurtenances, pavement, sidewalk, curb, gutters, fencing, landscape, vegetation, grass, and plants.
- B. Unless otherwise specified, restore all public and private property impacted by construction shall be restored to original condition or better.
- C. Restrict operations to cause the least amount of damage to surrounding property and do not damage off-site features or adjacent vegetation.
- D. The Contractor shall be held responsible for any damage to existing structures, features, materials, or equipment due to the work in this contract. Repair or replace any damaged structures, features, materials or equipment to the satisfaction of the property owner.
- E. Notify Construction Manager immediately if accidental damage occurs.
  - 1. Ensure that adjacent roads are maintained and clear of soil and/or other debris at all times during the construction period.
  - 2. Before making any changes or modifications to this plan, obtain approval from the Construction Manager.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are reference in this Section:
  - 1. Section 01330 – Submittals
  - 2. Section 02320 – Trenching
  - 3. Section 02953 – Pavement Restoration

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. At minimum, submit the following:
  - 1. Methods, materials, and equipment to be used at each site requiring restoration.

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

## **PART 3 - EXECUTION**

### **3.01 TRENCHING EXCAVATION AND BACKFILL**

- A. Trench requirements are specified in Section 02320.

### **3.02 PAVEMENT RESTORATION**

- A. Asphalt pavement that has been removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be brought to original grade and section and resurfaced.
- B. Before resurfacing material is replaced, sawcut edges of pavement to provide clean solid vertical faces.
- C. Any areas deemed unsafe by the Construction Manager shall be immediately temporarily repaired by the Contractor at no cost to the Owner.
- D. Complete pavement repair in accordance with Section 02953.

### **3.03 CLEANING PAVED SURFACES AND APPURTENANCES**

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 209.02.04.

### **3.04 SITE RESTORATION**

- A. Unless indicated otherwise on the Drawings, restore the Site to the topography that existed prior to construction by excavation, compaction, finish grading and other earthwork operations, as necessary, for the areas affected by construction.
- B. Backfill with stockpiled topsoil in all areas where the original topsoil was removed as part of the site preparation and construction activities.
- C. Restore all drainage swales and water courses to their original alignments and grades.

### **3.05 RESTORING MOBILIZATION, BORROW, AND DISPOSAL AREAS**

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 209.02.05.

### **3.06 PROTECTION OF EXISTING INSTALLATIONS**

- A. Immediately repair or replace existing equipment, controls, structures, or facilities which are damaged as part of the Work.
- B. Take measures that are necessary to ensure that construction debris and materials are kept out of the wastewater system.

### **3.07 FENCES**

- A. Maintain all existing fences affected by the work until completion of the work.

1. If fences interfere with construction operations, relocate or dismantle them for the period of the construction at that particular property; replace after demobilization of equipment.
  2. If any fences are weakened or destroyed by construction activity, reconstruct them at no cost to the owner.
- B. Provide temporary fencing for protection of property where fencing is dismantled or modified for construction.

### 3.08 TREES AND PLANTS

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 209.02.01.
- B. Protect trees and plants not removed against injury from the construction operations.
- C. If irrigation systems are damaged or modified during construction, repair or replace in kind to the satisfaction of the Construction Manager.
- D. Disturbed grass areas shall be seeded. Grass seed will be provided by the City of Albany Parks and Maintenance department.

### 3.09 CURB, GUTTER AND SIDEWALK

- A. Restore concrete in accordance with the City of Albany Standard Construction Specifications
- B. Repair curb, gutter and sidewalks by removing and replacing the entire portions between joints or scores.

### 3.10 DRAINS

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 209.02.03.

### 3.11 OTHER SITE FEATURES

- A. All other site features either damaged or destroyed during the execution of this contract shall be repaired or replaced to the satisfaction of the Construction Manager to the installation specifications of the manufacturer of the approved replacement item.

### 3.12 REMOVAL OF EQUIPMENT AND MATERIALS

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 209.02.02.

### 3.13 WARRANTY

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to, Section 107.15.

**END OF SECTION**

## SECTION 02953

### PAVEMENT RESTORATION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. The restoration of asphalt and concrete pavements and surfaces, including roadways, driveways, road shoulders, medians, traffic signal loops, pavement markings, pavement base, curbs, gutters, sidewalks, and any other surfaces that may be damaged as a result of the work.
- B. See Specification Section 02780 for concrete paver replacement.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section:
  - 1. Section 01140 – Work Sequence and Constraints
  - 2. Section 01330 – Submittals
  - 3. Section 02300 – Earthwork
  - 4. Section 02722 – Aggregate Base Course
  - 5. Section 02780 – Concrete Pavers

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01330.
- B. Submit information for materials to be used in restoring surfaces including mix designs, aggregates, asphalt, pavement fabrics, liquid priming asphalt, surface sealers, roadway striping products, and all other materials to be used for surface restoration.
- C. Submit temperature-viscosity curves for each mixture.
- D. Submit recommended temperature ranges for mixing and placement for each mix.
- E. Submit signature of the Certified Mixture Design Technician confirming mixes were prepared according to the appropriate sections of the Oregon Standard Specifications for Construction and meet the mixture requirements of this specification.

1. A mix design approved within the previous 12 months may be submitted. Provide temperature-viscosity curves for each mixture. The mix design shall include recommended temperature ranges for mixing and placement, shall be signed by a Certified Mixture Design Technician.

#### 1.05 DEFINITIONS

- A. Surface Restoration: The repair or replacement of surface materials back to pre-construction condition or better or as indicated due to the work or damaged as a result of the work.
- B. Warm-Mix Asphalt (WMA): additives or processes that allow a reduction in the temperature at which asphalt concrete mixtures are produced and placed. All other specifications in the Special Provisions and the Standard Construction Specifications shall apply. Unless otherwise approved by the Engineer, use only WMA additives or processes approved by the Oregon Department of Transportation.

#### 1.06 QUALITY ASSURANCE

- A. For WMA mixtures containing Reclaimed asphalt shingles (RAS) or a combination of Reclaimed asphalt pavement (RAP) and RAS, following any addition of fine aggregate as an anti-clumping agent, test the material according to ODOT TM 319 to establish the asphalt content, material specific gravities, and gradation. Develop mixture designs according to the ODOT Contractor Mix Design Guidelines for Asphalt Concrete.
- B. The Contractor shall schedule a pre-paving meeting with the Engineer at least one week prior to paving and submit a paving plan for review and approval. The plan shall outline the width, direction, and order of paving panels, expected production rates, installation of pavement markings, and how the hot mat will be protected from truck or other heavy traffic until the panel is ready to be reopened to traffic.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Warm Mix Asphalt (WMA):
  1. Unless otherwise approved by the Engineer, use only WMA additives or processes approved by the Oregon Department of Transportation.
  2. Provide a Superpave mix design for dense graded, Level 2, 1/2-inch warm-mix asphalt concrete., Mix design shall be prepared according to the appropriate sections of the Oregon Standard Specifications for Construction, and meet the following mixture requirements:
    - a. Compaction gyrations/blows: 65

- b. Air Voids, percent: 4.0
  - c. VMA, percent: 14.0 – 16.0
  - d. P200/AC ratio: 0.8 – 1.6
  - e. TSR, percent minimum: 80
  - f. VFA, percent: 65.0 – 78.0
  - g. Reclaimed Asphalt Binder Replacement: 35% maximum
3. The grade of asphalt cement used in the mix design shall be as follows:
- a. PG 64-22: Reclaimed asphalt binder replacement under 25%
  - b. PG 58-28: Reclaimed asphalt binder replacement 25% or greater
4. Reclaimed asphalt shingles (RAS) used in the production of new warm-mix asphalt is optional. Either manufacturer waste (post-manufacturer) RAS or tear-off (post-consumer) RAS may be used. Manufacturer waste RAS refers to processed asphalt shingle material derived from manufacturer's shingle scrap. Tear-off RAS refers to processed asphalt shingle material derived from shingle scrap removed from residential structures.
5. RAS shall be processed by grinding at ambient temperature so that 100% of the shredded pieces are less than 3/8 inch in any dimension when sampled according to AASHTO T 2 and tested according to AASHTO T 27. Processed RAS shall be sampled and tested for gradation at a frequency of one test for every 50 tons of RAS processed.
6. The Contractor shall certify that the RAS does not contain asbestos fibers according to the policies and procedures established by the Department of Environmental Quality. RAS shall be tested for deleterious materials according to ODOT TM 335 at a frequency of one test for every 50 tons of RAS material. The percentage of deleterious materials shall be limited to 1.0%. If fine aggregate will be added as an anti-clumping agent, sample and test processed RAS for harmful substances before adding the fine aggregates.
7. Fine aggregate meeting the requirements of section 00745.10(c) of the Oregon Standard Specifications for Construction may be added to the RAS in a quantity not to exceed 4% by weight of RAS to keep the material workable and to prevent conglomeration of the shingle particles in the stockpile. Any added fine aggregate for these purposes shall be taken into account in the mix design. RAS may also be blended with RAP in controlled percentages to preclude clumping. Stockpiled RAS shall not be contaminated by dirt or other foreign materials.
8. No more than 5% RAS by total weight of aggregate will be allowed in WMA mixtures. The maximum allowable percentage of asphalt

binder replacement shall be restricted to 20% in WMA containing only RAS. When RAS is used in conjunction with RAP, the maximum allowable percentage of binder replacement shall be restricted to 35%.

9. For WMA mixtures containing RAS or a combination of RAP and RAS, following any addition of fine aggregate as an anti-clumping agent, test the material according to ODOT TM 319 to establish the asphalt content, material specific gravities, and gradation. Develop mixture designs according to the ODOT Contractor Mix Design Guidelines for Asphalt Concrete.
10. Warm-mix asphalt shall be mixed at a maximum temperature of 275°F and be a minimum of 215°F behind the paver.

B. Tack coat:

1. Liquid asphalt shall conform to requirements for tack coat in Section 205.02.01B of the City of Albany Standard Construction Specifications.

C. Joint Sealer:

1. Liquid asphalt shall conform to requirements for tack coat in Section 205.02.01C of the City of Albany Standard Construction Specifications.

D. Aggregate Base:

1. 3/4"–0 base aggregate as defined in Section 02722, unless otherwise indicated.

E. Rock Surfacing:

1. 3/4"–0 crushed aggregate as defined in Section 02722, unless otherwise indicated.

F. Traffic Stripes and Pavement Markers:

1. Striping materials shall conform to Sections 304.01.02 and 307.01.00-307.01.02 of the City of Albany Standard Construction Specifications.
2. Pavement markings shall conform to Sections 304.01.03 and 307.01.00-307.01.02 of the City of Albany Standard Construction Specifications.

G. Forms:

1. Per Section 206 of the City of Albany Standard Construction Specifications.

H. Concrete Pavement:

1. Per Section 205 and 305.01.00 of the City of Albany Standard Construction Specifications.



2. 10-inch concrete pavement replacement shall have a minimum three-day compressive strength of 4,000psi.
- I. Concrete Driveways, Sidewalks, and Curbs:
    1. Per Section 205 and 306.01.00 of the City of Albany Standard Construction Specifications.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Reconstruct surfaces to pre-construction condition or better unless otherwise indicated, including curbs, gutters, sidewalks, driveways, road shoulders, medians, pavement, ditches, drainage ways, and related items that have been temporarily removed, damaged, or displaced as part of the work.
- B. Reconstruct pavements in conformance with the Section 208 of the City of Albany Standard Construction Specifications.
- C. Coordinate the trench surface pavement restoration with the requirements in Section 01140 and as indicated on the Drawings.
- D. Perform trench pavement restoration following the approved hydrostatic test results of the section being tested unless otherwise indicated.
- E. Trench pavement restoration in areas where the pipe is installed with double-welded lap or double gasketed joints may be completed after the joints have been air tested and the trench backfilled prior to pipe hydrostatic test.
- F. Surface Smoothness and workmanship shall be per Section 208.03.01C of the City of Albany Standard Construction Specifications.
- G. Contractor shall adhere to weather limitations stated in Section 208.03.01D of the City of Albany Standard Construction Specifications.
- H. Contractor shall protect adjacent structures and property according to Section 208.03.01E of the City of Albany Standard Construction Specifications.

#### **3.02 SAWCUTTING**

- A. Comply with the City of Albany Standard Construction Specifications including, but not limited to Section 208.03.01A. If any conflicts are found between the City of Albany standards and these specifications, the City of Albany Standard will take precedence.
- B. Sawcut existing pavement surfaces prior to surface restoration as indicated on the Drawings.

- C. Sawcut in straight lines parallel or perpendicular to existing roadway centerlines a minimum of 12 inches outside the edge of trench unless otherwise indicated.
- D. Where sections of existing pavement remain that are less than 2 feet wide between the proposed sawcut and an existing edge of asphalt concrete, curb, or gutter, remove the existing remaining pavement and replace it as part of the pavement restoration.
- E. Where pavement is damaged outside of sawcut lines, re-cut lines and remove damaged pavement.
- F. Where voids develop under existing pavement to remain, re-cut lines, remove pavement and fill voids.

### 3.03 PAVEMENT BASE

- A. Pavement base shall be placed in conformance with Section 208.03.01B of the City of Albany Standard Construction Specifications

### 3.04 TEMPORARY COLD MIX ASPHALT

- A. Temporary cold mix asphalt shall be placed in conformance with Section 208.03.02 of the City of Albany Standard Construction Specifications

### 3.05 ASPHALT CONCRETE PAVEMENT RESTORATION

- A. Place asphalt concrete pavement in accordance with the following:
  1. Prepare the road subgrade as specified in Section 02300.
  2. Apply Tack Coat in conformance with applicable requirements in Section 304 of the City of Albany Standard Construction Specifications.
  3. Place tack coat shall be placed prior to paving. Schedule a pre-paving meeting with the Engineer at least one week prior to paving and submit a paving plan for review and approval. The plan shall outline the width, direction, and order of paving panels, expected production rates, installation of pavement markings, and how the hot mat will be protected from truck or other heavy traffic until the panel is ready to be reopened to traffic.
  4. Place Asphalt Concrete Pavement according to Section 208.03.03B of the City of Albany Standard Construction Specifications, as modified herein.
  5. Warm-mix asphalt shall be mixed at a maximum temperature of 275°F and be a minimum of 215°F behind the paver.
  6. Apply joint sealer according to Section 208.03.03C of the City of Albany Standard Construction Specifications.

7. Asphalt Pavement: Pavement thickness shall be as follows:
  - a. Water Avenue (Lift Station Site to Lafayette Street) - 2”
  - b. Water Avenue (Lafayette Street to Main Street) – 4”
  - c. Water Avenue (Main Street to Geary Street/Water Avenue Intersection) – 3”
  - d. Geary Street – 4”
  - e. Front Avenue – 3”

### 3.06 CONCRETE PAVEMENT RESTORATION

- A. Place concrete pavement in accordance with the following:
  1. Prepare the road subgrade as specified in Section 02300.
  2. Comply with Section 208.03.04 of the City of Albany Standard Construction Specifications.
  3. Following sawcutting, insert dowels into existing concrete as shown in drawings.
  4. The contractor shall provide, transport, place, finish, cure, and protect concrete pavement in conformance with applicable provisions of Sections 206 of the City of Albany Standard Construction Specifications.

### 3.07 CONCRETE DRIVEWAYS, SIDEWALKS, AND CURBS

- A. Replace Concrete driveways, sidewalks, gutter, curbs, wheelchair ramps, medians, valley gutters and any other concrete surface according to Section 208.03.05 of the City of Albany Standard Construction Specifications. Prepare the subgrade according to Section 02300.
- B. Provide crushed aggregate for the leveling course that meets the material requirements of Section 02722.

### 3.08 RESTORATION OF PRIVATE ROADS, PARKING AREAS, AND OTHER PRIVATE IMPROVED AREAS

- A. Reconstruct finished surfaces of private roads, parking areas, and other improved areas with the same materials and to not less than the pre-construction dimensions, unless otherwise indicated.
- B. Reconstruct improvements damaged as part of the work to pre-construction condition or better.
- C. Asphalt Pavement: Match existing pavement thickness, or at least 4 inches of asphalt concrete, whichever is greater.
- D. Gravel, stone, or aggregate surfaces: Match existing thickness, or at least 6 inches, whichever is greater.

3.09 TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Replace traffic stripes and pavement markings in conformance with Section 208.03.01F and 307.02.00 of the City of Albany Standard Construction Specifications.
- B. Do not replace the center stripe on Front Street

3.10 RAISING MANHOLE, VALVE, AND OTHER UTILITY COVERS

- A. Place temporary steel covers over manhole and valve boxes prior to placing permanent pavement.
- B. Following pavement installation, remove the temporary covers and install grade rings as necessary to adjust the surface of the frames and covers to conform to the surface of the surrounding pavement surface.
- C. Following adjustment of the frames and covers, neatly chip with a flat tool or sawcut the pavement around each frame to provide a smooth, even, vertical surface.
- D. Install asphalt concrete in accordance with this Section, to provide a smooth surface around each frame, so that the frame, cover and pavement surfaces match.

**END OF SECTION**

## SECTION 03301

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for cast-in-place concrete work.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Shop Drawings
  - 1. Reinforcing Steel: Prepare shop fabrication and field installation drawings in accordance with CRSI Manual of Standard Practice and ACI SP.
  - 2. Layout drawings for construction joints.
- C. Product Data: Curing compound data.
- D. Concrete Mix Design: Data on the concrete mix, including aggregate gradations and admixtures, in accordance with ASTM C94.
- E. Quality Control Submittals
  - 1. Manufacturer's application instructions for curing compound.
  - 2. Ready-mix delivery tickets for each truck in accordance with ASTM C94.

##### 1.04 QUALITY ASSURANCE

- A. Supplier Qualifications: A minimum of 5 years' experience manufacturing ready-mixed concrete and that complies with ASTM C94 for production facilities and equipment.
- B. Source Limitations: Use the same brand of cement from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. Concrete and Reinforcement: Unless otherwise specified, meet the requirements of ACI 301 and 318.
- D. Hot Weather Concreting: Conform to ACI 305R.

## **PART 2 - PRODUCTS**

### **2.01 FORMWORK**

- A. Exposed Areas: Use hard plastic finished plywood.
- B. Unexposed Areas: Use new ship lap or plywood.
- C. Earth cuts may be used for forming footings.

### **2.02 CONCRETE**

- A. Ready-mixed meeting ASTM C94, Option A.
- B. Portland Cement: ASTM C150, Type II.
- C. Aggregates: Furnish from one source.
  - 1. Natural Aggregates
    - a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
    - b. Free of materials and aggregate types causing pop outs, discoloration, staining, or other defects on surface of concrete.
  - 2. Non-Potentially Reactive: In accordance with ASTM C33, Appendix XI, paragraph XI.1.
  - 3. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
  - 4. Fine Aggregates
    - a. Clean, sharp, natural sand.
    - b. ASTM C33.
    - c. Materials Passing 200 Sieve: 4 percent maximum.
    - d. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
  - 5. Coarse Aggregate
    - a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
    - b. Materials Passing 200 Sieve: 0.5 percent maximum.
- D. Admixtures: Do not use admixtures that contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Air-Entraining: ASTM C260.
  - 2. Water-Reducing: ASTM C494, Type A or D.

3. Superplasticizers: ASTM C494, Type F or G.
4. Fly Ash: ASTM C618, Class C or F.
5. Color Pigments: Inert mineral or metal oxide pigments, natural or synthetic; resistant to lime and other alkalies.

E. Concrete Mix Design

1. Minimum Compressive Field Strength: 4,000 psi at 28 days when cured and tested in accordance with ASTM C31 and C39.
2. Coarse Aggregate Size: 1-1/2 inches and smaller.
3. Slump Range: 3 to 5 inches.
4. Air Entrainment: Between 3 and 6 percent by volume.
5. Water Reducers: Use in concrete without plasticizers.

F. Proportions

1. Design mix to meet aesthetic and structural concrete requirements.
2. Water-cement ratio (water-cement plus fly ash ratio) shall control amount of total water added to concrete as follows:

Coarse Aggregate Size	W/C Ratio
1½ inch	0.50
1 inch	0.45

3. Minimum Cement Content (or Combined Cement Plus Fly Ash Content When Fly Ash is Used):
  - a. 517 pounds per cubic yard for concrete with 1½ inch maximum size aggregate.
  - b. 540 pounds per cubic yard for 1 inch maximum size aggregate.
4. Increase cement content (combined cement plus fly ash content), as required meeting strength requirements and water-cement ratio.
5. Fly Ash Content: minimum 10 percent, maximum 50 percent by weight of total cement content.

- G. Mixing: Minimum 70 and maximum 270 revolutions of mixing drum. Non-agitating equipment is not allowed.

## 2.03 REINFORCING STEEL

- A. Deformed Bars: ASTM A615, Grade 60.
- B. Deformed Bars to be Welded or Field Bent: ASTM A706, Grade 60.
- C. Welded Wire Reinforcement: ASTM A185, fabricated from as-drawn steel wire into flat sheets.

- D. Bar Supports:
  - 1. For Slab Rebar: Concrete blocks or plastic bar supports.
  - 2. For Rebar in Walls, Beams, Columns, and Slabs Exposed to View: Galvanized steel chairs with plastic tips or plastic bar supports and side form spacers.

## 2.04 ANCILLARY MATERIALS

- A. Curing Compound
  - 1. Material: Solvent based containing acrylic solids in accordance with ASTM C1315, with additional requirement that the moisture loss not exceed 0.030 gram per centimeter squared per 72 hours.
  - 2. Manufacturers and Products
    - a. Master Builders Co.; Masterkure CC 250SB
    - b. Euclid Chemical Co.; Euco Super Diamond Clear
- B. Epoxy Bonding Agent and Adhesives (for Binding New Concrete to Existing Concrete)
  - 1. Epoxies: Two component material for use on dry or damp surfaces and conforming to the requirements of ASTM C881.
  - 2. Apply in accordance with manufacturer's recommendations.
  - 3. Manufacturers: One of the following or equal:
    - a. Sika Armatec 110 EPOCEM; Sika Chemical Corporation.
    - b. CCS Bonder Paste LWL; Chemco Systems.
- A. Expansion Joint Filler: ASTM D994, 1/2-inch thick, or as shown.
- B. Surface Hardener
  - 1. Premixed, noncolored, nonmetallic Master Builders, Mastercron; Sonneborn, Harcol; A. C. Horn Inc., Durafax; Burke Company Non-Metallic Floor Hardner; or equal.
  - 2. Apply in accordance with manufacturer's instructions.
- C. Concrete for Electrical Conduits
  - 1. Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.
- D. Waterstops
  - 1. General: Place hydrophilic and/or rubber dumbbell type or center bulb type waterstops at construction joints and other joints as specified and indicated on the Drawings.
  - 2. Hydrophilic Waterstops:



- a. Use: For concrete repairs or when attaching new concrete to existing structures.
  - b. Manufacturers: One of the following or equal:
    - 1) Greenstreak, Hydrotite CJ.
    - 2) Tremco, Parastop II.
  - c. Installation: As indicated on the Drawings and in accordance with manufacturer's instructions.
3. Rubber Waterstops
- a. Use: At new construction joints where indicated on the Drawings.
  - b. Material: PVC or rubber waterstops manufactured by one of the following, or equal:
    - 1) Greenstreak.
    - 2) Progress Unlimited.
    - 3) Williams Products.
  - c. Size:
    - 1) Construction and Contraction Joints. 6-inch flat dumbbell type.
    - 2) Expansion Joints: 9-inch wide dumbbell with hollow center bulb.
- E. Vapor Barrier
- 1. Material: 15 mil, multilayer plastic, 0.01 minimum permeance rating.
  - 2. Manufacturers: One of the following or equal:
    - a. StegoWrap, Stego Industries.
    - b. Premoulded Membrane Vapor Seal with Plasmatic Corel, W. R. Meadows.

## **PART 3 - EXECUTION**

### **3.01 FORMWORK**

- A. Design, construct, erect, brace and maintain formwork in accordance with ACI 301.
- B. Form Ties
  - 1. Fixed conical or spherical type inserts that remain in contact with forming material and allow for dry packing of form tie holes.
  - 2. Space ties to withstand pressures and to limit deflection of forms to acceptable limits.
  - 3. Wire ties are not acceptable.
- C. Construction
  - 1. In accordance with ACI 347.

2. Make joints tight to prevent escape of mortar and to avoid formation of fins.
3. Brace as required to prevent distortion during concrete placement.
4. On exposed surfaces locate form ties in uniform pattern or as shown.
5. Construct so ties remain embedded in the wall with no metal within 1-inch of concrete surface when forms, inserts, and tie ends are removed.

D. Form Removal

1. Remove after concrete has attained 28 day strength, or approval is obtained in writing from Engineer.
2. Remove forms with care to prevent scarring and damaging the surface.

### 3.02 PLACING REINFORCING STEEL

- A. Unless otherwise specified, place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.
- B. Field bending or welding of reinforcing bars will not be allowed unless previously authorized by the Engineer.
- C. Bar Supports: Provide in sufficient quantity to prevent sagging and to support bars during concrete placement.
- D. Splices and Laps
  1. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.
  2. Horizontal wall bars are considered top bars.
  3. Bar lap splices shall conform to General Structural Notes on the Drawings.
  4. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

### 3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Before placing concrete:
  1. Check reinforcing steel for proper placement and correct discrepancies.
  2. Remove excessive rust, mill scale, dirt, oil and other material from rebar that may adversely affect bonding to concrete.
  3. Remove water from excavation and debris and foreign material from forms.
- C. Before depositing new concrete on existing concrete, clean surface using sandblast or other mechanical means to obtain a 1/4 inch rough profile, and apply epoxy bonding agent in accordance with the manufacturer's instructions.
- D. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 2 feet deep. Place within 1-1/2 hours after adding cement to mix.

- E. Placement Limitations: 8 feet maximum vertical drop to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.
- F. Hot Weather
  - 1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
  - 2. Maintain concrete temperature below 80 degrees F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking due to heat of hydration. Ingredients may be cooled before mixing to maintain fresh concrete temperatures at 80 degrees F or less.
  - 3. Make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover, or other means to provide concrete with temperature specified.
  - 4. Maximum allowable temperature differential between reinforcing steel and concrete: Not greater than 20 degrees F at the time of concrete placement.

### 3.04 COMPACTION

- A. Vibrate concrete as follows:
  - 1. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius.
  - 2. Apply close enough to forms to vibrate surface effectively but not damage form surfaces.
  - 3. Vibrate until concrete becomes uniformly plastic.
  - 4. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

### 3.05 CONSTRUCTION JOINTS

- A. Locate as shown or as approved.
- B. Maximum Spacing Between Construction Joints: 40 feet, unless otherwise indicated.

### 3.06 CRACK CONTROL JOINTS

- A. Provide crack control joints in concrete slabs on grade, curbs, gutters, sidewalks and other concrete flatwork as follows:
  - 1. Install crack control joints by use of grooving tool on fresh concrete or saw-cut by use of a saw designed for crack control joints as soon as the concrete hardens sufficiently to support the saw, however, no longer than 12 hours after concrete placement.
  - 2. Depth: 1/4 the thickness of the slab.
  - 3. Frequency: Unless otherwise indicated,

- a. At least 2 times the slab thickness in feet (6-inch slab = 12 foot on center).
- b. Rectangular slabs: Maximum spacing 1-1/2 to 1

### 3.07 FINISHING FLOORS AND SLABS

- A. Unexposed Slabs: Screed to true surface, bull float with wood float, and wood trowel to seal surface and to provide a uniform surface.
- B. Exposed Slabs to Receive Grout: Screed to indicated elevation and leave without special finish.
- C. Exposed Floors and Slabs: Screed to true surface and use bull float to form a uniform surface with minor texture then apply final surface finish.
- D. Surface Finishes for Exposed Floors and Slabs: Apply final surface finish as scheduled.
  1. Walkway finish: Apply to concrete surfaces that will be used for foot traffic such as walkways around basins and sidewalks. Apply steel trowel surface, then a light hairbroom finish to produce a profile that is parallel to the slab drainage.
- E. Tolerances: Exposed surfaces shall not vary from level or true plane more than ¼ inch in 10 feet when measured with a straightedge.

### 3.08 FINISHING AND PATCHING FORMED SURFACES

- A. Contact Engineer prior to patching concrete surfaces with defects greater than ½-inch deep.
- B. Unexposed Surfaces: Provide rough-formed concrete texture as imparted by form-facing material, fill form tie holes with nonshrink grout and grind off projections, fins, and rough spots.
- C. Exposed Surfaces: Provide smooth-formed concrete texture as imparted by form-facing material, arranged in an orderly and systematic manner with a minimum number of seams. Fill form tie holes with nonshrink grout and grind off projections, fins, and rough spots. Where scheduled, apply rubbed surface as follows:
  1. Smooth Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive to produce a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes.
    - a. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces.

- b. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout.
    - a. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces.
    - b. Compress grout into voids by grinding the concrete surface in a swirling motion, then finish the surface with a cork float.:
- D. Patching Defective Areas: Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.
  - 1. Cut out honeycombed and defective areas.
  - 2. Cut edges perpendicular to surface at least 1-inch deep. Do not feather edges. Soak area with water for 24 hours.
  - 3. Finish surfaces to match adjacent concrete.
  - 4. Keep patches damp for minimum 7 days or spray with curing compound to minimize shrinking.

### 3.09 PROTECTION AND CURING

- A. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.
- B. Keep concrete slabs continuously wet for a 7 day period. Intermittent wetting is not acceptable.
- C. Use curing compound only where approved by Engineer. Cure formed surfaces with curing compound applied in accordance with manufacturer's directions as soon as forms are removed and finishing is complete.
  - 1. Do not use curing compound on concrete surfaces that will be painted.
- D. Remove and replace concrete damaged by freezing.

### 3.10 FIELD QUALITY CONTROL

- A. Concrete Samples:
  - 1. Provide concrete for making composite samples for testing slump, air content, and for making cylinders for determination of compressive strength.
  - 2. Prepare samples in accordance with ASTM C172. Select trucks or batches of concrete on a random basis.
  - 3. Samples may be obtained at the discharge chute of the truck or at the point of discharge into forms.

- B. Sampling Frequency: One composite sample for each 100 cubic yards of structural concrete, or fraction thereof, of each concrete mixture placed in any one day.
- C. Evaluation will be in accordance with ACI 301, Chapter 17 and Specifications.
- D. Slump tests and concrete cylinders will be made by the Contractor. Contractor will handle cured test cylinders, transport to the testing laboratory and pay testing costs.
- E. Enforcement of Compressive Strength Requirements:
  - 1. Compressive strength of concrete will be considered acceptable if the following conditions are satisfied:
    - a. Averages of all sets of 3 consecutive strength test results are greater or equal to the specified compressive strength.
    - b. No individual strength test (average of 2 cylinders) falls below specified compressive strength by more than 500 pounds per square inch.
  - 2. Whenever one, or both, of 2 conditions stated above is not satisfied, provide additional curing of affected portion of structure, then obtain test cores from the affected area.
    - a. Obtain 3 test cores in accordance with ASTM C42 and ACI 318.
    - b. Concrete will be considered acceptable if the average compressive strength of the 3 test cores is equal to at least 90 percent of the specified 28-day compressive strength and no single core is less than 80 percent of the specified 28-day compressive strength.
    - c. Concrete will be designated as defective when the specified conditions are not achieved.
    - d. Fill core holes with concrete.
  - 3. Engineer may require the Contractor to strengthen defective concrete by means of additional concrete, additional reinforcing steel, or replacement of defective concrete, all of the Contractor's expense.

**END OF SECTION**

## SECTION 03600

### GROUT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Grout for uses other than masonry construction, including:
  - 1. Dry pack grout
  - 2. Cement grout
  - 3. Nonshrink grout, non-metallic
  - 4. Pressure grout
  - 5. Epoxy grout
  - 6. Polymer concrete

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 03301 – Cast-in-Place Concrete

##### 1.03 SUBMITTALS

- A. Conform to Section 01330.
- B. Product Data
  - 1. Manufacturer's product data of all materials proposed for use in the Work.
  - 2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of gout used in the Work
- C. Laboratory Test Reports
  - 1. Test reports on previously tested materials shall be accompanied by the manufacturer's statement that the previously tested material is the same type, quality, manufacture, and make as that proposed for use in this project.
  - 2. When sources of aggregate are changed, test reports shall be provided for the new material. The tests specified shall be performed prior to commencing grout work.
  - 3. Test reports are required for the following:
    - a. Cement
    - b. Aggregates

- c. Bonding compounds
  - d. Admixtures
- D. Certifications that all grout used on the project are free of chlorides or other chemicals that may cause corrosion.

#### 1.04 QUALITY ASSURANCE

- A. Field tests
  - 1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Owner to insure compliance with the Contract Documents.
  - 2. The test specimens will be obtained, tested, and paid for by the Contractor including the cost of any additional tests on work which does not meet the Specifications.
  - 3. Compression tests for grout and non-shrink grout:
    - a. Per ASTM C109.
    - b. Obtain three samples.
    - c. At a minimum test at 7 and 28 days.
  - 4. Compression test for epoxy grout:
    - a. Per ASTM C579 Method B.
    - b. Obtain three samples.
    - c. At a minimum test at 7 days.
  - 5. Remove and replace all grout that does not meet the Specification requirements at no additional cost to the Owner.

### **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. Use grouts indicated in the grout schedule whether called for on Drawings or not.

#### 2.02 CEMENT GROUT

- A. Portland cement ASTM C150 Type II or Type V
- B. Low alkali, containing less than 0.60 percent alkalis.
- C. Aggregate
  - 1. Nonreactive and washed before use.
  - 2. Fine Aggregate
    - a. Hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine and shall conform to ASTM C33 as modified herein.



- b. Gradation (ASTM C136): 100 percent by weight will pass a standard No. 8 mesh sieve and no less than 45 percent by weight will pass a standard No. 40 mesh sieve.
- c. Tolerance: The average of three consecutive tests fall within the limits listed below:

US standard sieve size	Permissible variation in individual tests, percent
30 or coarser	2.0
50 or finer	0.5

- 3. Meet the requirements of the following specifications:

Test	Test Method	Requirements
Organic Impurities	ASTM C40	Color lighter than standard
Amount of Material Passing No. 200 Sieve	ASTM C117	3% maximum by weight
Soundness	ASTM C88	10% maximum loss with sodium sulfate
Reactivity	ASTM C289	Innocuous aggregate
Sand Equivalent	ASTM D2419	Minimum 80

- 4. Admixtures

- a. General
  - 1) Compatible with the grout.
  - 2) Do not use calcium chloride or admixtures containing calcium chloride.
  - 3) Follow the manufacturer's recommendations for use.
  - 4) Add separately to the grout mix.
- b. Water Reducing Retarder
  - 1) ASTM C494 Type D.
  - 2) Manufactured by:
    - a) Master Builders MasterSet R 300,
    - b) Sika Corporation Plastiment,
    - c) Or equal.
- c. Lubricant for Cement Pressure Grouting
  - 1) Manufactured by:
    - a) Intrusion Prepakt Intrusion Aid,
    - b) Sika Intraplast N,
    - c) Or equal.

5. Water
  - a. Free from oil and deleterious amounts of acids, alkalies, and organic materials;
  - b. Do not use water containing more than 500 mg/1 of chlorides as Cl, nor more than 800 mg/1 of sulfates as SO<sub>4</sub>;
  - c. Do not use water containing impurities that may cause a change of more than 25 percent in the setting time of the cement nor a reduction of more than 5 percent in the compressive strength of the grout at 14 days when compared with the result obtained with distilled water.
  - d. Do not use water for curing that discolors the grout.
- D. Drypack Grout
  1. A mixture of approximately one part cement, 1-1/2 to 2 parts sand, water reducing retarder, and sufficient water to make a stiff workable mix.
  2. Consistency: Plastic and moldable but does not flow.
- E. Cement Grout
  1. Mixture of one part cement, two parts sand, proportioned by volume, admixtures for pressure grouting, and sufficient water to form workable mix.
  2. Maximum slump: 4 inches.

## 2.03 PREPACKAGED GROUT

- A. Non-shrink Grout
  1. Cementitious non-shrink, non-metallic grout
  2. Conform to ASTM C1107, Grades B and C.
  3. Manufactured by:
    - a. Sika Corporation, SikaGrout 212
    - b. Five Star Products, Inc. Five Star Grout
    - c. Chemrex Inc. Masterflow 928
    - d. Euclid Chemical Co. High-Flow Grout
    - e. Or equal.
- B. Epoxy grout bonding/grouting adhesive
  1. Multi-purpose, two-component, 100% solids, moisture-tolerant, structural adhesive.
  2. Conform to ASTM C881, Types I, II and V, Grade-2.
  3. Manufactured by:
    - a. Sika Corporation, Sikadur 32, Hi-Mod

- b. Chemrex Inc. MasterFlow 649
  - c. Or equal.
- C. Epoxy grout paste adhesive
  - 1. High modulus, two-component, moisture insensitive, 100 percent solids, thermosetting modified polyamid epoxy compound.
  - 2. Paste form consistency capable of not sagging in horizontal or overhead anchoring configurations.
  - 3. Conform to ASTM C881 Type 1, Grade 3
  - 4. Heat deflection temperature: In excess of 130 degrees F.
  - 5. Manufactured by:
    - a. Chemrex Inc. Coneresive Paste LPL
    - b. Sika Corporation Sikadur Hi-Mod Series
    - c. Adhesive Technology Corporation Ultrabond 1350
    - d. Or equal,
- D. Epoxy grout for pressure grouting
  - 1. Two-component, 100% solids, moisture-tolerant, epoxy adhesive. Low-viscosity, high-strength adhesive formulated specifically for injection grouting.
  - 2. Consistency as necessary to achieve complete penetration in hairline cracks and larger.
  - 3. Conform to ASTM C881 Type 1 and 2, Grade 1.
  - 4. Manufactured by:
    - a. Sika Corporation Sikadur 52
    - b. Chemrex Inc. Coneresive LV1
    - c. Adhesive Technology Corporation SLV 300 series
    - d. Or equal.
- E. Polymer concrete grout
  - 1. Liquid binder and dry aggregate mixed together to make a mortar or grout of a consistency as necessary for the application.
  - 2. Liquid binder: Chemical and oil resistant, stress relieved, low modulus, moisture insensitive, two-component epoxy-resin compound.
  - 3. Consistency similar to lightweight oil for proper mixing with aggregate.
  - 4. Conform to ASTM C881 Type 3 Grade 1,
  - 5. Aggregate:
    - a. Size and consistency compatible with recommendations of manufacturer of liquid binder for intended application.

- b. Keep aggregate oven dry in sealed packages until time of mixing.
- 6. Manufactured by:
  - a. Sika Corporation Sikadur Lo-Mod series
  - b. Adhesive Engineering Coneresive 1470
  - c. Adhesive Technology Corporation 400 series
  - d. Or equal.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Conduct mixing, surface preparation, handling, placing, consolidation, and curing for prepackaged grouts according to the instructions and recommendations of the grout manufacturer.
- B. Bonding compound for use with grout is specified in Section 03301.
- C. Provide primer if required for polymer concrete, per manufacturer's recommendation.

#### **3.02 DRYPACK GROUT**

- A. Roughen surfaces to be built up with drypack grout by brushing
- B. Clean, and coat surface with bonding compound in conformance to Section 03301 before the application of the grout.
- C. Apply drypack grout immediately following the application of the bonding compound in layers to the required thickness.
- D. Finish the surface smooth.
- E. Where construction joints are necessary, slope face of construction joints and clean and wet the existing grout before application is resumed.
- F. Cure drypack grout in accordance with manufacturer's recommendations.
- G. Do not place drypack grout during freezing weather unless adequate protection is provided.

#### **3.03 CEMENT GROUT**

- A. Except for the specialized equipment for pressure grouting, mixing and placing apparatus use equipment similar to that normally used for cast-in-place concrete.
- B. Mix grout for a period of at least 1 minute. Diluted grout shall be agitated to keep ingredients mixed.

#### **3.04 NONSHRINK GROUT**

- A. Place in accordance with manufacturer's instructions.

### 3.05 EPOXY GROUT

- A. Prime surface to be grouted in accordance with the grout manufacturer's instructions.
- B. Use of epoxy grout for anchorage of bolts or reinforcing dowels shall be subject to the following conditions:
  - 1. Use shall be limited to locations where exposure, on an intermittent or continuous basis, to acid concentrations higher than 10 percent, to chlorine gas, or to machine or diesel oils, is extremely unlikely.
  - 2. Use shall be limited to applications where exposure to fire or exposure to concrete or rod temperature above the product's heat deflection temperature or 120 degrees F (whichever is less) is extremely unlikely. Overhead applications (such as pipe supports) because of the above concerns, shall be disallowed.
  - 3. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
  - 4. Anchor diameter and grade of steel shall be per contract documents or per equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.
  - 5. Embedment depth and hole diameter shall be as specified.
  - 6. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.
  - 7. Anchor shall be left undisturbed and unloaded for full curing period.
  - 8. Anchors shall not be placed in concrete below 25 degrees F.

### 3.06 PRESSURE GROUTING

- A. Prior to grouting, wash clean surfaces and holes to be grouted, prior to grouting.
- B. Washing is not required for grouting soil voids outside pipe cylinders or casing pipes.
- C. Once commenced, continue grouting to completion without stoppage.
- D. In case of breakdown of equipment, wash out the grouting system sufficiently to ensure fresh grout and adequate bond and penetration will occur upon restarting the grouting operation.
- E. Maintain grout pressure until grout has set.

### 3.07 GROUT SCHEDULE

- A. Use grout type indicated in the table below unless otherwise indicated.

Grout	Application
Drypack Cement Grout	Built-up surfaces, setting miscellaneous metal items and minor repairs.
Cement Grout	Filling nonbearing portions of equipment pads and pressure grouting.
Non-shrink Grout	Bearing surfaces of machinery and equipment bases, column base plates, and bearing plates, and setting handrail, guardrail, or fence posts in pipe sleeves.
Epoxy Grout	Reinforcing steel set in grout, repairing cracks in concrete, concrete repair.
Pressure Grout	Repairing cracks in concrete.
Polymer Cement Grout	Repair of concrete floors, patching.

**END OF SECTION**

## SECTION 04200

### CONCRETE MASONRY UNITS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Concrete masonry units, mortar, grout, and reinforced masonry construction.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 04220 – Face Brick Veneer
  - 3. Section 09900 – Architectural Paint

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: For each type of masonry unit, masonry accessory, and admixture to be incorporated into the Work.
- C. Shop Drawings: Submit reinforcement placing drawings with details of bond beams and lintels. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls with locations of control joints and wall penetrations.
- D. Samples for each type and color of exposed masonry units and colored mortars.
- E. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
  - 1. For masonry units include material test reports substantiating compliance with requirements.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

##### 1.04 QUALITY ASSURANCE

- A. Preconstruction Testing Service: Contractor shall engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services shall be made by Contractor.
  - 1. Concrete Masonry Unit Test: For each type of unit required, per ASTM C140.
  - 2. Mortar Test (Property Specification): For each mix required, per ASTM C780.

3. Grout Test (Compressive Strength): For each mix required, per ASTM C1019.
- B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- C. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.
  1. Build sample panel for typical exterior wall in sizes approximately 48 inches long by 48 inches high. The sample may be incorporated into the construction. If incorporated into the construction, the location of the sample panel shall be approved by the City.
  2. Sample panel shall establish the workmanship, block coursing, tooling of joints, colors, and texture of masonry units.

#### 1.05 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

### **PART 2 - PRODUCTS**

#### 2.01 CONCRETE MASONRY UNITS

- A. General
  1. Modular dimensions and air, water, or steam cured.
  2. Surface Texture: Provide ground-faced blocks face on one side.. Face the finished ground face shall be on the exposed interior surfaces.
- B. Hollow Load Bearing Concrete Masonry Units
  1. Provide hollow load-bearing units conforming to ASTM C90, Grade N, Type I, made with lightweight or normal weight aggregate.
  2. Provide load-bearing units unless otherwise specified.
  3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1500 psi.
  4. Weight Classification: Light weight or Normal weight.
- C. Hollow Nonload-bearing Concrete Masonry Units
  1. Use in locations where specifically indicated on the Drawings or where specified.



2. Provide hollow non-load bearing units conforming to ASTM C129, Type I, made with lightweight or normal weight aggregate.
  3. Load bearing units may be provided in lieu of non-load bearing units.
- D. Special Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- E. Colors, Textures, and Patterns: Ground face, comprised of 16-inch long by 8-inch wide by 8-inch tall units arranged to form a running bond pattern. The color will be selected by the Owner from the manufacturer's standard color range. The standard color range shall include at least two shades of light grey.

## 2.02 VENEER UNITS

- A. Provide brick veneer and brick mortar in accordance with Section 04220
- B. Anti-Graffiti Coating: To be applied on Face Brick Veneer. See Section 09900.

## 2.03 MORTAR MATERIALS

- A. Cementitious Materials
1. Portland Cement: Conforming to ASTM C150, Type I or II. Type III may be used for cold-weather construction upon approval of the Engineer.
  2. Hydrated Lime: Conforming to ASTM C207, Type S.
  3. Mortar Cement: Conforming to ASTM C1329.
- B. Sand for Mortar: Conforming to ASTM C144.
1. For joints less than 1/4-inch-thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- C. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units and formulated to minimize efflorescence while enhancing the bond between the mortar and masonry units.
1. Products: One of the following, or equal:
    - a. Addiment Incorporated; Mortar Tite.
    - b. Grace Construction Products, Dry-Block Mortar Admixture.
    - c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.
- D. Water: Use potable water.

## 2.04 GROUT MATERIALS

- A. Cementitious Materials
1. Portland Cement: Conforming to ASTM C150, Type I or II. Type III may be used for cold-weather construction upon approval of the Engineer.
  2. Hydrated Lime: Conforming to ASTM C207, Type S.

- B. Fine and Coarse Aggregates: Conforming to ASTM C404.
- C. Water: Use potable water.

## 2.05 MORTAR AND GROUT MIXES

- A. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification, Type M, 2500 psi compressive strength at 28 days.
- B. Grout for Unit Masonry: Proportion by volume in accordance with ASTM C476 to achieve a minimum compressive strength of 2500 psi.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
  - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143.
- C. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

## 2.06 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: Conforming to ASTM A615, Grade 60.
- B. Horizontal Joint Reinforcement
  - 1. Cold drawn steel wire conforming to ASTM A82, hot dipped galvanized after fabrication in accordance with ASTM A153.
  - 2. Acceptable Configurations:
    - a. Truss type with two or more longitudinal wires welded to a continuous diagonal cross wire.
    - b. Ladder type with perpendicular cross wires not more than 1 inch on center.
  - 3. Dimensions:
    - a. Provide in 10-foot long flat sections.
    - b. Preformed Tees and Corner reinforcement: Approximately 30 inches long.
    - c. Overall Width: Approximately 2 inches less than the nominal wall thickness.

## 2.07 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall.

- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).
- D. Brick Anchors and Ties: Provide anchors and ties in accordance with Section 04220.
- E. Anchor Bolts Cast into Concrete Masonry Units: Provide anchor bolts complying with ASTM A307A with nuts and washers to match with hot dipped galvanized finish.

## 2.08 MASONRY CLEANERS

- A. Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
- B. Manufacturers: One of the following or equal:
  - 1. Diedrich Technologies, Inc.
  - 2. EaCo Chem, Inc.
  - 3. ProSoCo, Inc.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- C. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
  - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

### 3.02 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Step back unfinished walls for joining with new walls, toothing will not be permitted.
- D. Built-in Work: Build in door and window frames, fan and louver openings, pipe and conduit sleeves, and other items as the masonry construction progresses. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- F. Completely fill all cores in hollow concrete masonry units with grout.

### 3.03 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

### 3.04 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting

1. Grout Types:
  - a. Use fine grout in grout spaces that are less than 2 inches in any horizontal dimension after deducting the thickness of horizontal reinforcement.
  - b. Use fine grout in grout spaces where clearance between the reinforcing bars and the masonry is less than  $\frac{3}{4}$ -inch.
  - c. Use coarse grout in all other locations.
2. Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
3. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
4. Limit height of vertical grout pours to not more than 60 inches.
5. Place grout in a continuous pour and agitate to eliminate voids. If masonry units are dislodged or displaced by the grouting operation, remove masonry units and relay in alignment with fresh mortar.

3.05 TOLERANCES

- A. Complete masonry work within the following tolerances:
1. Face of Concrete Masonry Unit: 1/16-inch from face of adjacent unit.
  2. Variation from True Plane: 1/4-inch in 10 feet and 1/2-inch maximum in 20 feet or more.
  3. Variation from Plumb: 1/4-inch in each story, noncumulative and 1/2-inch maximum in two stories or more.
  4. Variation from Level: 1/8-inch in 3 feet, 1/4-inch in 10 feet, and 1/2-inch maximum.
  5. Variation in Wall Thickness: Plus or minus 1/4-inch.

3.06 FIELD QUALITY CONTROL

- A. Special Inspection of masonry work shall be performed by the City's Testing Laboratory in conformance with the requirements of 2014 Oregon Structural Specialty Code (OSSC), and errata which is based on the 2012 IBC. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Masonry Work to Receive Special Inspection: All masonry work shall receive Special Inspection in accordance with Oregon - 2014 OSSC Section 1705.4, Masonry Construction. Bolts installed in masonry, which require Special Inspection, shall be so noted on the drawings. Review Inspection protocol with

Construction Manager specifically regarding OSSC section 2105.3 for compliance with f m.

- C. Three representative full-size sample masonry units showing full range of color, texture, finish, and dimensions are to be submitted for review.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C140.
- F. Mortar Test (Property Specification): For each mix provided, per ASTM C780. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, per ASTM C1019.

### 3.07 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
  - 2. Protect adjacent surfaces from contact with cleaner.
  - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 4. Clean masonry by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

**END OF SECTION**

**SECTION 04220**  
**FACE BRICK VENEER**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Architectural Face Brick
- B. Reinforcement and Anchorage
- C. Accessories:
  - 1. Expansion Joints
  - 2. Mortar
  - 3. Flashing

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 05501 – Anchor Bolts and Anchoring Devices
  - 3. Section 07600 – Flashing and Sheet Metal
  - 4. Section 07900 – Sealants

1.03 REFERENCES

- A. ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- B. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- D. ASTM A996 – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
- E. ASTM A1008 – Standard Specification for Steel Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- F. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
- G. ASTM C150 – Standard Specification for Portland Cement.
- H. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.

- I. ASTM C216 – Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
- J. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
- K. ASTM D1056 – Standard Specification for Flexible Cellular Materials, Sponge or Expanded Rubber.
- L. Brick Industry Association (BIA) - Technical Note 20, Cleaning Brickwork.
- M. TMS 402 - Building Code Requirements for Masonry Structures.
- N. TMS 602 - Specification for Masonry Structures.

#### 1.04 SUBMITTALS

- A. Submit in accordance with Section 01330.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
- C. Color Charts: For each finish product specified, submit three complete sets of brick color charts showing range of color and textures. Up to 4 selection samples may be requested for final color selection.
- D. Selection Samples: For each finish product requested in paragraph C above, submit two complete sets of brick samples showing range of color and texture to be expected.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

#### 1.05 QUALITY ASSURANCE

- A. Sourcing: All primary products specified in this section shall be supplied by a single manufacturer
- B. Manufacturer Qualifications: 10 years' experience manufacturing similar products and with production capability to meet the Project schedule.
- C. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
- D. Test Reports:
  - 1. Testing and reports shall be completed by an independent laboratory.
  - 2. Test reports for each type of building and facing brick shall be submitted to the Architect for review.
  - 3. Test reports shall indicate:
    - a. Compressive strength.
    - b. 24 hour cold water absorption.
    - c. 5-hour boil absorption.



- d. Saturation coefficient.
  - e. Initial rate of absorption.
  - f. Efflorescence.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship. The mock-up will be used for quality control purposes.
- 1. Coordinated the location and schedule for fabricating the mock-up area with the City.
  - 2. Do not begin final installation of brickwork until the City approves the mock-up. Unsatisfactory mock-up will be removed and redone until the workmanship is approved by the City.
  - 3. Accepted mock-ups may remain as part of the completed work and will set the standard of acceptance for remaining work including bond, mortar, workmanship, appearance and project specific criteria.

#### 1.06 PRE-INSTALLATION MEETING

- A. Convene at the Project site minimum two weeks prior to starting work of this section to discuss:
- 1. Method and sequence of masonry construction.
  - 2. Special masonry details.
  - 3. Standard of workmanship.
  - 4. Quality control requirements.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in the manufacturer's unopened packaging with manufacturer's identification and labels intact until ready for installation.
- B. Store materials to prevent damage due to moisture, contamination, breakage, chipping or other causes.
- C. Store materials on pallets or stable aggregate bed to reduce contamination and soiling. Cover with a non-staining waterproof membrane allowing for airflow around brick while protecting it from airborne contaminants and wind-borne dirt.

#### 1.08 PROJECT CONDITIONS

- A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.
- B. Cold Weather Procedures:
- 1. Preparation:
    - a. If ice or snow has formed on the masonry bed, remove it by carefully applying heat not to exceed 120 degrees F until the surface is dry to the touch.

- b. Remove any brick units or mortar that is frozen or damaged.
      - c. When the clay masonry unit suction exceeds 30 grams per minute per 30 square inches, sprinkle with heated water as follows:
        - 1) When units are 32 degrees F or above, heat water to 70 degrees F or above.
        - 2) When units are below 32 degrees F, heat water to 130 degrees F or above.
  - 2. Work in Progress:
    - a. Air temperature 40 degrees F to 32 degrees F:
      - 1) Heat sand or mixing water to produce mortar temperatures that match air temperature.
    - b. Air temperature 32 degrees F to 25 degrees F:
      - 1) Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
      - 2) Maintain temperature of mortar on boards above freezing.
      - 3) Installation in colder air temperatures will require heat sources on the wall and the use of windbreaks or tents to create a controlled environment suitable for proper bonding and curing.
  - 3. Completed Work and Work Not in Progress:
    - a. Mean daily air temperature of 40 degrees F to 32 degrees F: Protect masonry from rain and snow for 24 hours by covering with a weather-resistive membrane.
    - b. Mean daily air temperature of 32 degrees F to 25 degrees F: Cover masonry with a weather-resistive membrane for 24 hours.
    - c. Mean daily air temperature of 25 degrees F to 20 degrees F: Cover masonry with insulating blankets for 24 hours.
- C. Hot Weather Procedures:
- 1. When ambient temperature exceeds 90 degrees F and wind exceeds 8 miles per hour:
    - a. Maintain temperature of mortar and grout between 70 degrees F and 120 degrees F.
    - b. Limit the spread of the mortar bed to 4 feet and place units within 1 minute of spreading mortar.
    - c. Control moisture evaporation in partially or newly completed walls by fog spraying with potable water, covering with opaque plastic or canvas or both.
  - 2. Protection of Work in Progress:
    - a. Covering:

- 1) Cover tops of walls with a strong waterproof membrane at the end of each day or work shutdown. Extend the waterproof membrane cover a minimum of 24 inches down the side of each wall.
- 2) Hold cover securely in place.
- b. Load Application:
  - 1) Do not apply uniform floor or roof loading for at least 12 hours after completing columns and walls.
  - 2) Do not apply concentrated loads for at least 3 days after completing columns and walls.
- c. Staining:
  - 1) Prevent grout and mortar from staining the face of masonry.
  - 2) Remove grout and mortar that comes in contact with masonry units immediately.
  - 3) Protect sills, ledges and projections from mortar droppings.
  - 4) Protect base of wall from rain-splashed mud and mortar splatter.
  - 5) Turn scaffold boards on edge when work is not in progress to lessen splattering.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: The project is designed around Pacific Clay, Western Ridge series Face Brick.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01330.

### **2.02 ARCHITECTURAL FACE BRICK**

- A. Face Brick: Brick shall be Type FBX, and conforms to the requirements of ASTM C216, Grade SW.
- B. Size: Modular 3.625 inches wide by 2.25 inches high by 7.625 inches long.
- C. Special shape face bricks shall be as detailed and at locations as indicated on the Drawings.
- D. Furnish special uncured face brick in locations where cores would be exposed in finish work.

### **2.03 REINFORCEMENT AND ANCHORS**

- A. Steel Reinforcement:
  1. Billet Steel Deformed Bars: ASTM A615.
  2. Rail Steel Deformed Bars: ASTM A996.

3. Axle Steel Deformed Bars: ASTM A996.
- B. Fabricated Steel Lintels: Requirements for loose steel lintels are shown on the Drawings
- C. Brick Anchors and Ties: Provide to sizes and types indicated on the Drawings.
  1. Corrugated Ties: ASTM A1008, 20 gauge, galvanized in accordance with ASTM A153, Class B-2.
  2. Joint Reinforcement: ASTM A82, galvanized in accordance with ASTM A153, Class B-2.
  3. Wire Wall Ties, ASTM A82:
    - a. Galvanized in accordance with ASTM A153, Class B-2.
  4. Dovetail Anchors, ASTM A1008:
    - a. Galvanized in accordance with ASTM A153, Class B-2.

## 2.04 ACCESSORIES

- A. Expansion Joints:
  1. Premolded Foam: ASTM D1056, Type 2, Class A, Grade 1
  2. Neoprene: ASTM D1056, Type 2, Class A, Grade 1.
  3. Sealant: Shall be in accordance with Section 07900.
- B. Mortar: Mortar should be mixed by proportion according to ASTM C270 for Type N mortar
  1. Portland Cement: ASTM C150, Type I.
  2. Hydrated Lime: ASTM C207, Type S.
  3. Sand: ASTM C144.
  4. Water: Potable.
- C. Flashing: Build in all flashings which enter the masonry as the work progresses Flashing are specified in Section 07600.
- D. Cleaners: Compatible with substrate and acceptable to masonry manufacturer.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built in items are in proper location, and ready for roughing into masonry work
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Remove mud, loose rust, ice and contaminants that may interfere with mortar-to-unit bonding or mortar-to-footing/brick ledge bonding.
- C. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coursing:
  - 1. Establish lines, levels, and coursing indicated. Protect from displacement.
  - 2. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
  - 3. Lay brick units in bond indicated on the Drawings.
- C. Laying Clay Masonry Units:
  - 1. Lay brick making sure head joints and bed joints are full of mortar.
  - 2. Lay brick units plumb and true to line.
  - 3. Where fresh mortar joins partially set mortar, remove loose brick and mortar and lightly wet the exposed surface of set masonry.
  - 4. When adjustment must be made after mortar begins to harden, remove hardened mortar and replace it with fresh mortar.
  - 5. Remove excess mortar as Work progresses.
- D. Masonry Reinforcing and Anchors: Install as indicated and in accordance with the reinforcing manufacturer's requirements.
- E. Fabricated Steel Lintels: Install as indicated.
- F. Tooling and Pointing:
  - 1. Tool mortar joints to shape(s) indicated on the Drawings.
  - 2. Tool exposed joints when they are thumbprint hard.
  - 3. Flush-cut all joints when they are not tooled.
  - 4. When re-pointing a section in a wall, rake the mortar joints to a depth of not less than 1/2 inch. Fill the joint completely with pointing mortar and tool to match the surrounding masonry.
- G. Flashing:
  - 1. Build in all flashings that enter the masonry, as the work progresses. Install as indicated and as specified in Section 07600.

2. Remove any projections on the brick surface or mortar bed that might puncture the flashing material.
  3. Place through-wall flashing on a bed of mortar so that the flashing projects 1/4 inch from wall face and forms a drip edge. Overlap flashing a minimum of 6 inches.
  4. Cover flashing with mortar.
- H. Weeps:
1. Install weeps in the head joints of the first brick course immediately above the through-wall flashing. Place weeps at not more than 24 inches on center horizontally.
  2. Keep the air cavity free of mortar as much as possible. Expansion Joints:
- I. Control and Expansion Joints:
1. Install control and expansion joints as indicated on Drawings.
  2. Keep joints free of mortar and any debris that may hinder movement.
  3. Install expansion joint material and finish the joint with a sealer.

### 3.04 CLEANING

- A. Cut out defective mortar joints and holes in exposed masonry and re-point with mortar.
- B. Clean a sample wall area. Do not proceed with cleaning without Architect's approval.
- C. Clean brick in accordance with BIA Technical Note Number 20 and the proprietary cleaning product manufacturer's recommendations.

### 3.05 PROTECTION

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

## END OF SECTION

**SECTION 05100**  
**STRUCTURAL METALS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Structural metals consisting of standard shapes, fasteners, rods and plates that are used in structural supports and connections.

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section:
  1. Section 01330 – Submittal Procedures
  2. Section 03301 – Cast-in-Place Concrete
  3. Section 09972 – Hot-Dip Zinc Coating

1.03 QUALITY ASSURANCE

- A. General
  1. Structural assemblies and shop and field welding shall meet the requirements of the AISC Manual of Steel Construction.
  2. The use of salvaged, reprocessed or scrap materials shall not be permitted.
- B. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
AISC	Steel Construction Manual, 15th Edition
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
ASTM A320/A320M	Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A276	Standard Specification for Stainless Steel Bars and Shapes.
ASTM B308/B308M	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
AWS-B3.0	Welding Procedures and Performance Qualifications
AWS-D1.1	Structural Welding Code--Steel

## 1.04 SUBMITTALS

- A. Submittals shall be in accordance with Section 01330.
- B. Submit welding procedures and welder qualification records using forms provided in the appendix to AWS D1.1 welding code prior to any production welding.
- C. Certifications:
  - 1. Submit current certifications of welders qualifications as per AWS D1.1, paragraph 5.30 prior to welding work. Welder certifications shall verify the qualifications for the welding process and procedure to be used.
  - 2. Submit certifications, mill tests, or reports from an approved independent testing laboratory for the conformance of structural steel to be used with the specified ASTM requirements.
- D. Fabrication Drawings:
  - 1. Submit fabrication drawings for Engineer's review prior to fabrication. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including location, type, and size of bolts, weld, member sizes and lengths, connection details, blocks, copes, cuts and cambers. Use AWS standard welding symbols. Indicate finished weight of individual pieces. Verify measurements in the field prior on fabrication drawings. Indicate field measurements that differ from contract drawings on fabrication drawings.
- E. Erection Drawings:
  - 1. The drawings shall indicate methods of installation, the location of any item substitutions, and details requiring coordination and/or installation by other trades.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Steel
  - 1. Materials for structural metals shall be as specified in the Table below

Material	Specification
Standard rolled steel sections	ASTM A992 Gr 50
Pipe columns	ASTM A53, Grade B
Structural steel tubing	ASTM A500, Grade B
Structural bars, plates and similar items	ASTM A36 or A283
Stainless steel	ASTM A276, Grade A, Type 316
Stainless steel bolts, nuts and washers	ASTM A276, Type 316
Steel bolts	ASTM A325, Grade N



B. Aluminum

1. Unless otherwise specified, aluminum shall be extruded from 6061-T6 alloy, conforming to ASTM B308.

C. Fabrication

1. All fabrication and erection of steel elements shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings” and the “Code of Standard Practice for Steel Buildings and Bridges” except as modified by the applicable building codes, unless specified otherwise.
2. The Contractor shall qualify all welders and welding procedures in accordance with the latest edition of AWS D1.1, Section 4, Structural Welding Code-Steel. Notify the Engineer in advance of welder and welding procedure qualification so the Engineer may witness qualification.

D. Metal Bar Gratings

1. Produce metal bar gratings of material and description indicated per NAAMM marking system that comply with the following:
  - a. Metal Bar Grating Standard “Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads” published in ANSI/NAAMM A202.1, Metal Bar Grating Manual.
  - b. Heavy Duty Metal Bar Grating Standard: “Guide Specifications for Heavy Duty Metal Bar Grating” published in NAAMM, Heavy Duty Metal Bar Grating Manual.
2. Fabricate welded Metal Bar Grating to comply with material, sizes and configurations shown.
3. Fabricate removable grating sections with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or if not indicated, as recommended by the manufacturer for attachment to supports.
  - a. Provide not less than 4 anchor blocks for each section of grating composed of bearing bars over 3/16 inch in thickness, with each block shop welded to 2 bearing bars.
  - b. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced not less than 15/16 inch on center with each clip designed and fabricated to fit over 2 bearing bars.
  - c. Provide threaded bolts with nuts and washers for each clip required.
  - d. Provide self-drilling fasteners with washers for each clip required.
4. Furnish toe plates for attachment in the field.
5. Fabricate cut outs in grating sections for penetrations required for the work. Arrange layout of cut outs to permit grating removal without disturbing items penetrating gratings.

- a. Edge band openings in grating with bars of the same size and material as bearing bars.
  - b. Do not notch bearing bars at supports to maintain elevation.
- E. Vertical Ladders
- 1. Provide vertical ladders as detailed on drawings.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Verify measurements in the field prior to installation.
- B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- C. Set sleeves and embeds in concrete with surface flush with finish surface. Protect from water and concrete entry.

### **3.02 INSTALLATION**

- A. General
  - 1. Fabrication and installation shall conform with the AISC Steel Construction Manual.
  - 2. Holes shall be punched 1/16-inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or drilled. No drifting of bolts nor enlargement of holes will be allowed to correct misalignment. Mismatched holes shall be corrected with new material.
  - 3. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint.
  - 4. Metalwork to be embedded in concrete shall be as specified in Section 03300. Metalwork shall be placed accurately and held in correct position while the concrete is placed or, if specified, recesses or blockouts shall be formed in the concrete after design strength is attained, and the metalwork shall be grouted in place in accordance with Section 03300. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned.
  - 5. Structural steel completely encased in concrete shall not be galvanized or painted and shall have a clean surface for bonding to concrete. Metalwork which is bent, broken or otherwise damaged, shall be repaired or replaced by the Contractor.

B. Welding

1. Welding shall be done by operators who have been qualified by tests as prescribed by AWS WI Section 7 to perform the type of work required. The quality of welding shall conform to AWS Code for Arc Welding in Building Construction Section 4, Workmanship.
2. Unless otherwise specified, continuous welds shall be provided on all structural members that are exposed to weather or submerged in water or wastewater, and continuous seal welds shall be provided on both sides of all plates or structural shapes that are in contact with or submerged in water or wastewater.

C. Bolted Connections:

1. Bolted connections shall conform to AISC Framed Beam Connections and shall be bearing type connections with threads excluded from shear planes.

D. Corrosion Protection

1. Unless otherwise specified, all structural metal and structural steel, including that used in the fabrication of process equipment, shall be either aluminum, stainless or galvanized as shown on the drawings.

E. Cleaning

1. After installation, scratched surfaces of shop primed metals shall be cleaned and touched up with same material used for the shop coat. Damaged surfaces of galvanized metals shall be repaired as specified in Section 09972.

**END OF SECTION**

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## SECTION 05501

### ANCHOR BOLTS AND ANCHORING DEVICES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Anchor bolts, concrete anchors, adhesive anchors, and other anchoring devices.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: Manufacturer's data for nuts, bolts, concrete anchors, chemical anchors and other fasteners.
- C. Catalog data and ICBO reports for each type of anchor bolt.

##### 1.04 QUALITY ASSURANCE

- A. For applications that require special inspection in accordance with building codes, coordinate the progress of the Work with the required inspection activities.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Unless otherwise specified or indicated on the Drawings, materials of construction for anchoring devices shall conform to the following:
  - 1. Anchor bolts and other anchoring devices, nuts and washers installed indoors: Type 304 stainless steel.
  - 2. Anchor bolts and other anchoring devices, nuts and washers installed outdoors or in locations exposed to wastewater: Type 316 stainless steel.
    - a. Locations exposed to wastewater includes:
    - b. Below tops of walls of water-containing structures.
    - c. Underside of roof, slab or walkways of enclosed water-containing structures.
    - d. Dry side of walls on water-containing structures.

##### 2.02 CAST-IN-PLACE ANCHOR BOLTS

- A. Locations

1. Use cast-in-place anchor bolts:
  - a. In locations indicated on the Drawings.
  - b. To anchor engine-driven equipment and equipment with motors 3 horsepower and larger.
- B. Cast-in-Place Anchor Bolts
  1. Material: Stainless steel conforming to ASTM A320.
  2. Minimum Length of Bolt: As indicated on the Drawings. When not indicated, provide bolt length such that the length of the embedded anchor is at least 10 bolt diameters.
  3. Minimum length of 90-degree hook: 4 bolt diameters.

## 2.03 CONCRETE ANCHORS

- A. Concrete Anchors: Drilled in place wedge-type anchors with threaded stud body, stainless steel expansion clip, nut and washer.
- B. Materials: Type 304 or Type 316 stainless steel, depending upon installed location.
- C. Code Compliance: Test in accordance with, and comply with requirements of, ASTM E488 and ICC-ES AC193.
- D. Manufacturers: One of the following or equal:
  1. Hilti Kwik Bolt 3.
  2. ITW Redhead, Trubolt Wedge Anchor.
  3. Powers Fasteners, Power-Stud SD4 or SD6.
  4. Wej-It Corporation, Ankr-Tite Wedge Anchors.

## 2.04 STUDS

- A. Material: Conforming to ASTM A108 with 50,000 pounds per square inch minimum yield strength, and 60,000 pounds per square inch minimum tensile strength.
- B. Manufacturers: One of the following or equal:
  1. Nelson Stud Welding Company, S3L Shear Connectors or H4L Concrete Anchors.
  2. Stud Welding Products, Headed Concrete Anchors and Shear Connectors or Concrete Anchors.

## 2.05 ADHESIVE ANCHORS

- A. Applications: Use for bonding threaded rods and concrete reinforcing bars to hardened concrete and grouted cement masonry. Do not use in overhead applications, in chlorine gas environments, or where anchor may be exposed to machine oil or diesel oil.

- B. Code Compliance: Test in accordance with, and comply with requirements of, ASTM E488 and ICC-ES AC58.
- C. Materials
  - 1. Epoxy Adhesive: Two component, injectable epoxy adhesive.
  - 2. Concrete Reinforcing Bars: Grade 60.
  - 3. Threaded Rods: Type 304 stainless steel all-thread rod conforming to ASTM F593.
- D. Manufacturers: One of the following or equal:
  - 1. Hilti HVA Adhesive Anchor System.
  - 2. ITW Redhead G5 Adhesive Anchoring System.
  - 3. Powers Fasteners PE1000+ Epoxy Anchoring System.

## **PART 3 - EXECUTION**

### **3.01 GENERAL ANCHORING REQUIREMENTS**

- A. Use equipment shop drawings, anchorage layout drawings, and anchor bolt layout templates to accurately position anchor bolts.
- B. Install anchor bolts, concrete anchors and other anchoring devices with at least 2 threads projecting beyond the nut, but no more than 1/2-inch projecting beyond the nut.
- C. Prior to installing nuts, coat threads of stainless steel bolts with material to prevent galling of threads.
  - 1. Manufacturers: One of the following or equal:
    - a. Never Seez Compound Corporation, Never-Seez.
    - b. Oil Research, Inc., WLR No. 111.
- D. Tighten nuts on anchor bolts, concrete anchors and other anchoring devices to the "snug-tight" condition, defined as tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary wrench.

### **3.02 CAST-IN-PLACE ANCHOR BOLTS**

- A. Do not use expansion type concrete anchors or adhesive anchors as substitution for cast-in-place anchor bolts.
- B. Accurately place anchor bolts to be embedded in concrete within the formwork and perpendicular to surface from which they will project. Secure in correct position while concrete is placed.
- C. Do not allow anchor bolts to touch reinforcing steel. Where anchor bolts are within 1/4 inch of reinforcing steel, isolate with a minimum of 4 wraps of 10 mil polyvinyl chloride tape in area adjacent to reinforcing steel.

- D. In anchoring machinery bases subject to heavy vibration, use 2 nuts, with 1 serving as a locknut.
- E. Where bolts are indicated on the Drawings for future use, first coat thoroughly with non-oxidizing wax, then turn nuts down full depth of thread and neatly wrap exposed thread with waterproof polyvinyl tape.
- F. Where indicated on the Drawings, set anchor bolts in metal sleeves having inside diameter approximately 2 inches greater than the bolt diameter and a minimum of 10 bolt diameters deep. Fill sleeves with grout when equipment is grouted in place.

3.03 CONCRETE ANCHORS AND ADHESIVE ANCHORS

- A. Cast-in-place anchor bolts may be used in place of concrete anchors and adhesive anchors at Contractor’s option.
- B. Installation
  - 1. Drill holes using concrete drill bits and impact type drill motors. Hole diameter shall be in accordance with the manufacturer’s recommendations.
  - 2. Clean drilled hole using compressed air to dislodge and remove drilling dust.
  - 3. Accurately locate concrete anchors and set anchors with axis perpendicular to surfaces from which they will project.
  - 4. Do not disturb adhesive anchors until cure time has elapsed.
  - 5. Unless otherwise indicated on the Drawings or as required by structural calculations prepared by the equipment supplier, comply with minimum embedment lengths identified in the following table.

Minimum Embedment Lengths for Concrete and Adhesive Anchors

Diameter of Anchor or Bar, inches	Embedment Length for Concrete Anchors, inches	Embedment Length for Adhesive Anchors or Reinforcing Bars
1/4	1-3/4	As indicated on the Drawings
3/8	1-7/8	
1/2	2-1/4	
5/8	2-3/4	
3/4	3-1/4	
(1) Provide longer embedment where otherwise indicated		

**END OF SECTION**



**SECTION 06100**  
**ROUGH CARPENTRY**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Requirements for general carpentry, wood blocking, nailers, plywood sheathing, manufactured wood trusses and light gage metal connectors.

1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section:
  - 1. Section 01330 – Submittals

1.03 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. WWPA: Western Wood Products Association.
  - 2. WCLIB: West Coast Lumber Inspection Bureau.

1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Lumber: None Required
- C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the WCLIB.
- D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Wood-preservative-treated wood.
- E. Shop Drawings: For manufactured wood trusses to show layout, elevation of each truss type, member sizes, type of material, connection details, bridging, bracing, and blocking required for fabrication and erection. Shop drawings shall be stamped by a civil or structural engineer registered in the State of Oregon.
- F. Structural Calculations: For manufactured wood trusses showing all stresses and deflections in members and connection for design loads including dead, live, snow, wind and seismic loads. Structural calculations shall be stamped by a civil or structural engineer registered in the State of Oregon.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: Framing shall be Douglas Fir Coast Region, No. 2, conforming to West Coast Lumber Inspection Bureau Standard Grading and Dressing Rule No. 17, as amended to date.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
  - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 4. Provide dressed lumber, S4S, unless otherwise indicated.

### 2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA C2
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated "PT" on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with concrete or masonry.

## 2.03 PLYWOOD

- A. General: Plywood shall conform to US Product Standard PS 1-95, American Plywood Association. Each Sheet shall be stamped with the PS or APA grademark.
- B. Roof Plywood: Provide 5 ply, exposure 1, BD, span rating 32/16, Species Group 2 or better.
- C. Wall Plywood: Provide 3 ply, exposure 1, BD, span rating 24/0, Species Group 2 or better.

## 2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, with ASTM F436 flat washers. Recessed where required not to interfere with flashing assemblies.
- F. Light Gage Metal Connectors: Simpson Strong Tie or equal.

## 2.05 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4-inch-thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.
- D. Adhesives for Gluing Furring to Concrete: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
  - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

## 2.06 MANUFACTURED WOOD TRUSSES

- A. Design: Manufactured wood trusses, bridging, bracing and blocking in accordance with the current edition of the Oregon Structural Specialty Code and the Control Manual for the Truss Plate Institute.
- B. Layout: Provide manufactured wood trusses with depths, layout and slope as shown on the drawings. Provide diagonal or continuous bridging, bracing and blocking as indicated on the drawings, manufacturer's shop drawings and calculations.
- C. Loads:
  - 1. Top Chord Dead Load: 10 pounds per square foot
  - 2. Bottom Chord Dead Load: 10 pounds per square foot
  - 3. Top Chord Snow Load: 25 pounds per square foot
  - 4. Bottom Chord Live Load: 5 pounds per square foot
- D. Wind Load: 120 MPH, Exposure B
- E. Deflection Criteria: Manufactured wood trusses shall not deflect more than  $L/360$  of the span for Live+Snow Load or  $L/240$  of the span for total loads, 1" maximum.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.

- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
  2. Table 2304.9.1, "Fastening Schedule," in IBC's International Building Code.
  3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
  4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
  5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
  6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
- H. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

### 3.02 PLYWOOD SHEATHING INSTALLATION

- A. Install in accordance with the Drawings and requirements above.
- B. Install the B side of the plywood facing the interior.

### 3.03 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

### 3.04 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

**END OF SECTION**

**SECTION 07212**  
**BOARD INSULATION**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Rigid board insulation at roof construction. Provide all building insulation required for this work including, but not necessarily limited to:
  - 1. Where shown or indicated on Drawings.

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 07411 – Metal Roofing Panels

1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Include a copy of this specification section with addendum updates, all referenced and applicable sections, and each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
- C. Certification: Upon completion of the work of each part of this section, applicator or installer shall furnish a certificate that the material or system has been applied or installed as specified to meet sound rating, fire resistance ratings, thickness requirements, etc., and manufacturer's application or installation requirements and that the material is applicable for the intended use.
- D. MSDS data sheet.
- E. Manufacturer's standard product information, U.L. listings and installation requirements.

1.04 QUALITY ASSURANCE

- A. Qualifications of Installers:
  - 1. Provide at least one person, who shall be present at all times, during the execution of each part of the work of this Section and who shall be thoroughly familiar with the materials and methods.
  - 2. Applicators shall have installation experience of the specific materials for a minimum period of five (5) years.

## 1.05 PRODUCT HANDLING

- A. Store in dry area.
- B. Protect insulation from physical damage and from becoming wet or soiled. Comply with manufacturers recommendations for handling, storage and protection during installation.

## 1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

## 1.07 SEQUENCING

- A. Sequence work to ensure fireproofing, firestopping, and other barrier materials are in place before beginning work of this section.

## **PART 2 - PRODUCTS**

### 2.01 MANUFACTURERS:

- A. Extruded-Polystyrene Insulation
  - 1. Owens-Corning.
  - 2. Dow Chemical.
  - 3. Tenneco Foam Products.
  - 4. UC Industries/Owens Corning.

### 2.02 BUILDING INSULATION

- A. Verify that the insulation is acceptable to the roof system specified in Section 07411, and is compatible with the roof warranty.
- B. Insulation installed in concealed locations surface with the following burning characteristics:
  - 1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
  - 2. Furnish in widths required to fit around panel clips.
  - 3. Surface Burning Characteristics: Provide units with flame spread ratings of 25 and smoke developed ratings of 50 or less per ASTM E-84.
- C. R-value: R 5 minimum aged value.
- D. Thickness per Drawings.



## **PART 3 - EXECUTION**

### **3.01 INSPECTION AND PREPARATION**

- A. Installer must examine substrates and conditions under which insulation work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Clean substrates of substances harmful to insulation or vapor barriers, including removal of projections which might puncture vapor barriers.

### **3.02 INSTALLATION**

- A. General:
  - 1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
  - 2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
- B. Adhesive: Gun grade, mastic type, compatible with insulation and substrate; bond strength as required by board system manufacturer.

### **3.03 CLEAN UP**

- A. Sweep up debris daily. Remove excess materials and debris and dispose of in a legal manner.

**END OF SECTION**

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## SECTION 07411

### METAL ROOFING PANELS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. .

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: Maximum air infiltration rate of 0.009 cubic feet per minute per square foot at a pressure differential of 6.24 pounds per square foot when tested in accord with ASTM E1680.
- B. Water Penetration: No uncontrollable water leakage at a pressure differential of 6.24 pounds per square foot when tested in accord with ASTM E1646.
- C. Wind Uplift: Comply with Underwriter's Laboratories Test Method 580, Class 90 Rating.
- D. Conform to requirements of the International Building Code.
- E. Design metal roofing panels for attachment with concealed clip fasteners. Exposed fasteners are permitted only to control expansion, and at panel end splices.
- F. Spacing of clip fasteners established by the manufacturer to accommodate both positive and negative design loads, while allowing for expansion and contraction of the entire roofing system resulting from variations in temperature.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: Manufacturer's standard catalog information for the metal roofing panels, accessories, and other products. Identify material specifications, structural properties, and gauge thicknesses.
- C. Shop Drawings: Show layout of roofing panels, joint and anchorage details, perimeter flashing and trim details, openings, dimensions, accessories, and other construction details.
- D. Qualifications of Installing Contractor and Job Foreman
- E. Manufacturer's recommended installation instructions.

- F. Manufacturer's standard color samples. Owners' Representative will select color from the available colors.

## 1.05 QUALITY ASSURANCE

### A. Installer Qualifications

- 1. Installing Contractor:
  - a. Minimum 5 years experience in roofing panel projects of similar nature.
  - b. Either directly employed by the metal roofing manufacturer or certified by the metal roofing manufacturer to install roofing panels.
- 2. Job Foreman:
  - a. Trained by the roofing manufacturer in the installation of the metal roofing panel system.
  - b. Minimum 10 projects of similar nature.

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, handle, and protect metal roofing panels to prevent corrosion, deformation, and other damage.
- B. During storage, stack packaged bundles of metal roofing panels on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
- C. Handle panel bundles with non-marring slings.
- D. Do not install damaged metal roofing panels.

## 1.07 WARRANTY

- A. Provide watertightness and panel finish warranties.
  - 1. Warranties shall be from the manufacturer of the metal roofing panels and shall warrant the total system.
  - 2. Warranties shall cover the installation for a period of 20 years and shall not be pro-rated.
  - 3. Watertightness Warranty: Warranty shall state that manufacturer agrees to repair or replace metal roofing system including roofing panels, trim, flashings, and penetrations that fail to maintain watertightness.
  - 4. Panel Finish Warranty: Warranty shall state that manufacturer agrees to repair the finish or replace metal roofing panels that show evidence of deterioration, loss of integrity and color retention, including cracking, flaking, blistering, and chalking.
  - 5. Warranty shall be signed by the manufacturer and the Certified Installation Contractor.
- B. Warranty shall become effective on the date of project acceptance by the Owner.

## **PART 2 - PRODUCTS**

### **2.01 METAL ROOFING PANELS**

- A. Manufacturers:
  - 1. ACS Building Products, Skyline Roofing.
  - 2. Equivalent as manufactured by one of the following, or equal:
    - a. AEP-Span, Division of ASC Profiles.
    - b. ATAS International, Inc.
- B. Materials and Properties
  - 1. Form metal roofing panels from steel sheet conforming to ASTM A792, Grade 33.
  - 2. Galvanized in accordance with ASTM A792, AZ50, thickness 1.6 mils.
  - 3. Profile: 1 inch high integral standing seams at 16 inch centers.
- C. Structural Properties
  - 1. Minimum Thickness: 24 gage.
  - 2. Minimum Yield Strength: 50,000 pounds per square inch.
- D. Fabrication: Factory formed in continuous lengths.
- E. Finish
  - 1. General: Apply coatings either before or after forming and fabricating panels.
  - 2. Fluoropolymer Coating: Two-coat, thermo-cured, full-strength 70 percent "Kynar 500" coating consisting of a primer with a minimum dry film thickness of 0.15 mils and a finish coat with a minimum 0.75-mil dry film thickness for a total dry film thickness of not less than 0.9 mil. In addition, the coating shall provide a 30 percent reflective gloss when tested in accordance with ASTM D23.
  - 3. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D659; and without fading in excess of 5 NBS units.

### **2.02 MISCELLANEOUS MATERIALS**

- A. Gutters: Fabricated from the same material and same color as the roof panels.
- B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Materials:
    - a. Exterior Applications: Use aluminum, corrosion-resistant steel, or stainless steel fasteners.
    - b. Interior Applications: Use galvanized or cadmium-plated fasteners.
  2. Provide exposed fasteners with heads matching color of roof panel by means of plastic caps or factory-applied coating.
  3. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
  4. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
- C. Felts: Asphalt-saturated organic felts conforming to the requirements of ASTM D2626, 40 lbs.
- D. Accessories: Provide components required for a complete roof panel system, including trim, copings, fascias, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.
1. Closure Strips: Provide steel closures to match roof panel profile, prefinished to match roof color. Provide closures where indicated or necessary to ensure weathertight construction.
  2. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
  3. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the roof manufacturer.
  4. Clips:
    - a. Provide UL listed clip designed to allow panels to thermally expand and contract and provide  $\pm 1$  inch of thermal movement. Clip shall incorporate a self-centering feature to allow 1" of movement in both directions along panel length.
    - b. Clip shall be designed to meet positive and negative pressures as calculated per local building code.
- E. Ice and Water Shield: Bituminous resin modified with synthetic resins membrane, 40 mils thick with release film to maintain self-adhesive qualities and required accessories similar to Jiffy Seal Ice and Water Guard (Summer Grade) as manufactured by Proteco Wrap Company.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Prior to beginning installation of the metal roofing panels, check supporting substrate for correct installation and suitability for installation of the panels.

### **3.02 UNDERLAYMENT**

- A. Prior to installing metal roofing, install a continuous ice and water shield along ridges, eaves, valley, gutters, and all roof penetrations. Cover ice and water shield with one ply of felt over board insulation and install slip sheets prior to installing metal roofing panels over felts.

### **3.03 ROOFING PANEL INSTALLATION**

- A. Install the metal roofing panels over the roof sheathing indicated on the Drawings.
- B. Install metal roofing panels in accordance with the manufacturer's instructions and requirements in this Section.
- C. Prior to installing roofing panels, apply one ply of felt on the structural roof deck. Install felt beginning from the lower edge and with at least 3-inch side laps and 4-inch end laps.
- D. Place individual metal roofing panels on supporting surface with panel seams vertically oriented. Overlap panels a minimum of 5 inches with overlap away from prevailing wind direction. Adjust to final position without warps or deflections and with ends accurately aligned before being permanently fastened.
- E. Fully engage interlocking seams.
- F. Cut and neatly fit metal roofing panels and accessories around openings and other work projecting through or adjacent to the panel. Torch cutting is prohibited. Debur cut edges and touch up with paint. Flash as necessary to make watertight.
- G. Accessories: Install components required for a complete roof panel system, including trim, copings, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, closure strips, and similar items.
- H. Joint Sealers: Install gaskets, joint fillers, and sealants where required for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.
- I. Standing Seam Roof Panel System: Fasten roof panels to supports with concealed clip in accordance with the manufacturer's instructions. Arrange hold-down clips to allow for positive load of 40 pounds per square foot and negative load to meet UL I-90.
- J. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4-inch in 20-foot distance on level/plumb/slope and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

- K. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated on the Drawings.

#### 3.04 GUTTERS

- A. Install gutters with positive drainage, 1/4-inch per foot.
- B. Install such that gutter is leaktight at gutter section joints, downspout connections, and at ends.

#### 3.05 TOUCH-UP

- A. Upon completion of installation of metal roofing panels, inspect the installation with the Owner's Representative to locate areas where the finish has been damaged or where the installation does not meet the requirements of the roofing panel manufacturer.
- B. Touch up damaged coating surfaces with touch-up paint provided by the manufacturer. Follow the manufacturer's instructions to minimize color irregularities.

**END OF SECTION**



## SECTION 07600

### FLASHING AND SHEET METAL

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Installation of flashing, gutters and downspouts.

##### 1.02 CONDITIONS

- A. General Notes on the Drawings are part of these Specifications.

##### 1.03 REFERENCED SECTIONS

- A. The following Section is referenced in this Section:
  - 1. Section 01330 – Submittals
  - 2. Section 07900 – Sealants

##### 1.04 SUBMITTALS

- A. Shop drawings showing the flashing profile, material and gauge. Gutter and roof flashings shall show interface detail with roof panels.
- B. Fastener product data.

##### 1.05 REFERENCE PUBLICATIONS

- A. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publication in effect at the time of the bid shall govern.
- B. Perform work in accordance with the following:
  - 1. 2014 Oregon Structural Specialty Code (OSSC) and local building code requirements.
  - 2. NRCA (National Roofing Contractors Association) - Roofing Manual.
  - 3. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) - Architectural Sheet Metal Manual.

##### 1.06 STORAGE AND HANDLING

- A. Store galvanized metal under dry conditions in such a manner as to prevent twisting, bending, or abrasion, and to provide ventilation.

## **PART 2 - PRODUCTS**

### **2.01 SHEET MATERIALS**

- A. Flashing: Zinc-aluminum coated steel; 24 gauge core steel unless noted otherwise, with AZ-50 coating per ASTM A924/A792.
  - 1. Gutters and downspouts: 20 gauge zinc-aluminum coated steel conforming to ASTM A924/A792. Gutters shall be 6 inch by 6 inch cross section. Downspouts shall be 3 inch by 4 inch cross section. Gutters and downspouts shall be shop pre-coated with Kynar 500 coating of selected color. Color and style to be selected by the Owner from manufacturer's list of standard colors and styles.
  - 2. Opening, roof and edge flashings: 22 gauge zinc-aluminum coated steel conforming to ASTM A924/A792. Match profile on the Drawings. Flashings shall be primed on all surfaces prior to installation.
- B. Solder
  - 1. Solder for sheet metal shall be Grade A conforming to ASTM B32, composed of 50 percent pig lead and 50 percent block tin, warranted pure.
  - 2. No remelted or reworked solder shall be used.
- C. Straps
  - 1. Steel straps and miscellaneous fastenings, where required, shall conform to ASTM A366, ASTM A415, or ASTM A425, commercial quality mild steel.
  - 2. Straps and other fastenings shall be fabricated as detailed and shall be hot dip galvanized after fabrication in accordance with ASTM A123 or ASTM A153 as applicable.
  - 3.

### **2.02 ACCESSORIES**

- A. Fasteners: Corrosion resistant in the same material and finish as flashing metal.
  - 1. Where sheet metal is built in over roofing materials or other sheet metal, use nails with 1-inch tinned discs.
  - 2. Rivets shall be tinned soft iron rivets. Sheet metal screws shall be Parker "Kalon" type, or approved equal, of proper size and material to suit conditions.
  - 3. Where wood nailers are provided, use galvanized or stainless steel wood screws as applicable.
- B. Concrete and Masonry Anchors
  - 1. Where anchors are not included in the concrete or masonry construction, anchors shall be Phillips "Red Head" masonry anchors as manufactured by Phillips Drill Company, "Wej-It" concrete anchors as manufactured by

Wej-It Expansion Products, Inc., or approved equal, of the sizes and types noted on drawings or as required.

- C. Sealant: Silicone specified in Section 07900.
- D. Cleats and Stiffeners: As required to make all sections rigid.
- E. Exterior wall penetrations above grade
  - 1. Quickflash plumbing and electrical flashing panels, or equal

## 2.03 FABRICATION

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop-fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Form components true to shape, accurate in size, square, and free from distortion or defeats. Form pieces in longest practical lengths.
- C. Hem exposed edges on underside 1/2"; miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4" and hemmed to form drip.
- D. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- E. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- F. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- G. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with elastomeric sealant concealed within joints.
- H. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- I. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

## 2.04 ROOF DRAINAGE SHEET METAL FABRICATIONS

### A. Hanging Gutters

1. Fabricate to cross-section indicated complete with end pieces, outlet tubes, and other accessories, as required. Fabricate in minimum 20' long sections.
2. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness.
3. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
4. Expansion Joints: Built in.

## PART 3 - EXECUTION

### 3.01 EXAMINATION AND PREPARATION

- A. Verify roof openings, curbs, or vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify base flashing is in place, sealed, and secure.

### 3.02 INSTALLATION

#### A. Workmanship

1. Finish sheet metal straight and true, with miters and joints accurately fitted.
2. Exposed work shall be free of dents.
3. Reinforce corners, and waterproof seams.
4. Ample provision shall be made for expansion and contraction in all sheet metal assembly, and shall be provided by slip joints.
5. In long runs, provide slip joints a minimum of every 20 feet. In runs less than 20 feet, provide one slip joint.
6. Provide reinforcement as required.
7. Isolate dissimilar metals and protect from contact with butyl sealer or a heavy coating of bitumastic paint.
8. Protect all surfaces of sheet metal in contact with green concrete, mortar, treated wood, redwood, cedar, and oak with a coating of bitumastic paint.
9. Provide waterproof washers wherever required fasteners penetrate flashings.
10. Exposed fasteners will not be permitted for any portion of this work.

#### B. Soldering

1. Edges of sheet metal shall be pre-tinned before soldering is begun.

2. Soldering shall be done slowly with heavy, well-heated, properly tinned coppers to heat thoroughly the seam and completely sweat the solder through the full width of the seam.
  3. Ample solder shall be used, and the seam shall show not less than one full inch of evenly flowed solder.
  4. Soldering shall follow immediately after application of flux.
  5. Upon completion of soldering, neutralize flux and thoroughly clean surfaces.
- C. Joints
1. In general, joints shall be locked, but where impractical, lap, rivet, and solder joints.
  2. Turn all lock joints on exposed surfaces in the direction of flow.
  3. All joints and miters shall be soldered.
  4. Exposed edges shall be folded, beaded or returned; no raw edges will be permitted.
- D. Install roof jack systems in accordance with SMACNA details and instructions.

### 3.03 PIPE JACKS AND ROOF PENETRATION SYSTEMS

- A. Install in accordance with manufacturer's written directions.
- B. Apply caulking/sealant approved by system manufacturer at stainless steel pipe/clamp connection before tightening clamp.

### 3.04 EXTERIOR WALL PLUMBING AND ELECTRICAL PENETRATIONS

- A. Plumbing
1. Select one- or two-piece flashing panel as required for specific pipe sizes.
  2. Push flashing panel over pipe with label facing to exterior to form weatherproof seal around pipe and secure to wall. Install one- and two-piece flashing in accordance with manufacturer's instructions.
- B. Electrical
1. Select flashing panel required for specific electrical boxes. Follow system manufacturer's installation instructions.
  2. Push flashing panel over electrical box with label facing to exterior to form weatherproof seal around box.
  3. Secure flashing panels to walls with corrosion resistant fasteners.

### 3.05 CLEAN UP

- A. Remove excess materials and debris from site and dispose of in a legal manner
- B. Install starter and edge strips, and cleats.

- C. Fit components tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.
- E. Attach downspouts to the masonry using masonry anchors.
- F. Attach gutters per manufacturer's recommendations.

**END OF SECTION**

## SECTION 07900

### SEALANTS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Caulking in the work to provide a positive barrier against the penetration of air and moisture at joints between items where caulking is essential to the continued integrity of the barrier or to finish construction.
- B. Such caulking will normally be performed under the work of various sections of these specifications but shall be performed in strict accordance with the provisions of this section.
- C. All sealants shall be installed prior to application of paints and waterproof coatings.

##### 1.02 REFERENCED SECTION

- A. The following Sections are referenced in this section
  - 1. Section 01330 – Submittals
  - 2. Section 01999 – Reference Forms

##### 1.03 REFERENCES

- A. SWRI (Sealant, Waterproofing and Restoration Institute) – Sealant and Caulking Guide Specifications.
- B. ASTM C834 – Standard Specification for Latex Sealing Compounds.
- C. ASTM C919 – Standard Practice for Use of Sealants in Acoustical Applications.
- D. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.

##### 1.04 SUBMITTALS

- A. Comply with section 01330.
- B. Within 35 days after the award of contract and before products are ordered for the project, submit to the Architect the manufacturer's standard product information, U.L. listings and installation requirements for review and approval.
- C. Certification
  - 1. Upon completion of the work of each part of this section, applicator or installer shall furnish a certificate that the material or system has been applied or installed as specified to meet sound rating, fire resistance ratings, thickness requirements, etc., and manufacturer's application or installation requirements and that the material is applicable for the intended use.
  - 2. Complete the Manufacturer's Installation Certification of Section 01999.

- D. Material Safety Data Sheets.
- E. Samples
  - 1. Samples of all exposed caulking and sealants are required for Architect's approval. Unless directed otherwise, apply samples in 6 inch runs in actual joints at the job site.
  - 2. The samples shall show the materials, workmanship, bond, and color of the caulking work throughout the project and shall match that of the approved sample joint.
- F. Product Data
  - 1. Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- G. Sealant Colors: Submit two samples illustrating colors for selection.

#### 1.05 QUALITY ASSURANCE

- A. Qualifications of applicators:
  - 1. Installation of caulking shall be performed only by workmen thoroughly skilled and specially trained in the techniques to apply caulking, and who are completely familiar with the written recommendations of the manufacturer of the caulking material used.
  - 2. Indication of lack of skill on the part of caulking installers shall be sufficient grounds for the Architect to reject installed caulking and to require its immediate removal and complete re-caulking at no additional cost to the Owner.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Inspection prior to installation: Applicator and/or sealant representative must provide a written statement prior to installation of the sealant that the areas to be sealed are acceptable. All corrections should be done before those areas are sealed.
- D. Perform work in accordance with SWRI requirements and as modified by sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- E. Perform acoustical sealant application work in accordance with ASTM C919.
- F. Maintain one copy of each document on site.

#### 1.06 PRODUCT HANDLING

- A. Storage
  - 1. Store all caulking materials and equipment under conditions recommended by its manufacturer.



2. Do not use materials stored for a period of time exceeding the maximum recommended shelf life of the material.
- B. Protection: Use all means necessary to protect caulking materials before, during and after installation and to protect the installed work and materials of other trades.
- C. Handling: Comply with manufacturer's recommendations for proper handling and protection of sealant material.
- D. Repairs: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

#### 1.07 COORDINATION

- A. Coordinate the work with all sections referencing this section.

#### 1.08 JOB CONDITIONS

- A. Schedule operations so that working joints are most likely to be normal size. Apply materials within manufacturer recommended surfaces and ambient temperature ranges.

#### 1.09 WARRANTY

- A. Include coverage for installed sealants accessories which fail to achieve airtight seal; watertight seal, and exhibit loss of adhesion or cohesion, or do not cure.
- B. Warranty:
  1. Materials -10 years vertical, 5 years horizontal.
  2. Installation - Two (2) years
  3. Complete the Extended Warranty Form in Section 01999.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS

- A. All materials, unless otherwise specifically approved by the Architect, shall be a single or plural component, compatible with substrates, non-sagging or self-leveling and non-staining type in neutral color or other color approved by the architect where exposed to view, and shall be one of the following or an equal approved by the architect from manufacturer's standard colors, unless otherwise specified for this project.

#### 2.02 SEALANTS

- A. Silicone
  1. One-part, conforming to ASTM C920, Type S, Grade NS, Class 25 for construction joints, Chem-Calk1200 Bostik, Inc., Pecora 860, Pecora Corp., Dow Corning #795, General Electric Silpruf #2000 or equal.

2. One-part conforming to ASTM C920-87, Type S, Grade NS, Class 25, for glazing details, Chem-Calk 1200 Bostik, Inc., Pecora 860, Pecora Corp Dow Corning #999, General Electric #4000 or #2000 or equal.
- B. Polyurethane
1. One-part, gun-grade sealant conforming to ASTM C920 Type S, Grade NS, Uses: expansion and control joints in metal curtain wall, perimeter of door and window framing; Chem Calk 900 series by Bostic Inc., Dyna Trol I-XL by Pecora Corp. SikaFlex 1-A or 15 L-M, or equal
  2. Two-part, gun-grade sealant conforming to ASTM C920, Type M, Grade M, SikaFlex 2C-NS or equal.
  3. Two-part, self-leveling sealant conforming to ASTM C920, Type M, Grade P, 2C or equal. For Hard Traffic use: Chem Calk 555-SL, SikaFlex 7G.
- C. Interior Sealant: Acrylic Latex, one-part, gun-grade, paintable conforming to ASTM C834, Chem Calk 600 series or Pecora AC-20 plus silicone or equal.
- D. Backer rod: All filler material shall be new and clean with no oils and non-staining. Shall be made of polyethylene foam, completely compatible with the caulking material and as recommended by the caulking manufacturer for the materials, joint conditions and use.

### 2.03 EQUIPMENT

- A. All equipment shall be only such equipment as is specifically recommended by the manufacturer of the caulking material being installed.

### 2.04 MIXING

- A. Follow manufacturer's mixing instructions for mixing ratios, temperature limitations and length of mixing times.

## PART 3 - EXECUTION

### 3.01 SURFACE CONDITIONS

- A. Inspection:
1. Prior to caulking, carefully inspect the surfaces to which caulking is to be applied and verify that they are clean, sound, and free from deleterious material which might adversely affect the bond.
  2. Verify that caulking may be installed in accordance with the manufacturer's recommendations.
- B. Corrections:
1. Clean all surfaces as necessary.
  2. In the event of discrepancy, immediately notify the Architect.

3. Do not proceed with installation of caulking in areas of discrepancy until all such discrepancies have been resolved.

### 3.02 CHOICE OF CAULKING MATERIAL

- A. Use only that caulking material which is best suited to the installation and is so recommended by the caulking material manufacturer.

### 3.03 PREPARATION AND INSTALLATION

- A. Joint Design: Size of joint shall be calculated to allow for anticipated movement to be within the capabilities of the approved sealant. Unless otherwise required by sealant manufacturer's printed recommendations, use backing material to control sealant depths as follows:
  1. Minimum Width: Not less than 1/4" wide.
  2. Minimum Depth: Not less than 1/4" deep.
  3. Maximum Movement: The width of the joint shall be wide enough to allow the sealant to work within its limitations.
  4. Width/Depth Ratio: The depth of the sealant should be no greater than the width. As a general rule the width should be twice the depth. If joint width is over 1/2 inch, caulking shall remain 1/2-inch thick across joint.
- B. Joint Cleaning: Clean all joints thoroughly, and blow out or vacuum loose particles from joints. Material in contact with sealant shall be dry, fully cured, and free of laitance, loose aggregate, form release agents, curing compounds, water repellants, paint, and other surface treatments. Surfaces with protective coatings shall be cleaned to remove protective coatings or oil deposits. Joints in masonry and concrete work shall not be sealed until substrate has cured a minimum of 12 days minimum.
- C. Primers: Primer shall be provided on metal, masonry, concrete, and wood surfaces, and other surfaces as recommended by the sealant manufacturer. Primer shall not be applied to surfaces which will be exposed after caulking is completed.
- D. Joint Backing: Backing shall be installed in all joints to receive sealant. Backing shall be sized to require 20% to 50% compression upon insertion, and placed in accordance with "Joint Design" paragraph. In joints not of sufficient depth to allow backing, install bond breaking tape at back of joint. Avoid lengthwise stretching of backing material.
  1. Backing material shall be a resilient type such as Soft-Backer Rod closed cell backer rod, as recommended by the manufacturer. Oakum or other types of absorptive materials shall not be used as a backing material. When closed cell backing is used, care must be exercised to avoid puncturing of the skin opening up the cell structure.
  2. Install closed cell rod 24 hours prior to application of sealant to allow out gassing of rod.

### 3.04 APPLICATION

- A. Application of sealant shall commence immediately after joints are cleaned, primed and backed.
- B. Work in vertical surfaces shall be done with standard hand-caulking guns or power actuated caulking guns.
- C. The sealant shall be extruded through nozzles of such diameter as to allow a full bead of materials to run into joint, and not to exceed width of joint.
- D. Force sealant into joint by tooling to insure full contact with side-walls and backing.

### 3.05 JOINT FINISHING

- A. Neatly tool joints to slightly concave surface using methods recommended by sealant manufacturers.
- B. Repair any air pockets exposed by tooling.
- C. Tool so as to compress material and improve adhesion to surface joints.
- D. At horizontal traffic joints, tool joints 1/8" below finish grades.

### 3.06 CLEAN - UP

- A. All surfaces adjacent to the sealant shall be cleaned of all excess sealant or primer and left in neat condition subject to the approval of the Architect.

### 3.07 SCHEDULE

- A. Polyurethane: Concrete, aluminum, wood and hollow metal to masonry.
- B. Silicone: Glass to Glass, Metal to Aluminum, and other as approved by material manufacture and City.
- C. Acrylic Latex: Interior Use Only for finish work. Paint, etc.

**END OF SECTION**

## SECTION 08115

### HOLLOW METAL DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Galvanized hollow metal doors and frames.
- B. Custom galvanized hollow metal frames at arched openings.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 08700 – Door Hardware

##### 1.03 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

##### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, acoustic ratings and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.
  - 7. Details of accessories.
  - 8. Details of moldings, removable stops, and glazing.

##### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
  - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide 1/4-inch space between each stacked door to permit air circulation.

## 1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.08 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Provide reinforcing and coordinate with hardware in Section 08700.

## 1.09 WARRANTY

- A. Manufacturer's Limited Warranty: Five (5) years from date of supply, covering material and workmanship

## **PART 2 - PRODUCTS**

### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Amweld Building Products, LLC.
  - 2. Benchmark; a division of Therma-Tru Corporation.
  - 3. Ceco Door Products; an Assa Abloy Group company.
  - 4. Curries Company; an Assa Abloy Group company.
  - 5. Fleming Door Products Ltd.; an Assa Abloy Group company.
  - 6. Security Metal Products Corp.
  - 7. Steelcraft; an Ingersoll-Rand company.

8. Ambico Limited.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Frame Anchors: ASTM A591/A591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- F. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  - 1. Design: Seamless.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
    - a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than R-7 when tested according to ASTM C1363.
      - 1) Locations: Exterior doors and interior doors.
  - 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
  - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch thick, end closures or channels of same material as face sheets.
  - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

- B. Exterior Doors: Face sheets fabricated from galvanized steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. SDI /ANSI A250.4 Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless).
- C. Galvanized in accordance with ASTM A653, A60.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

#### 2.04 STANDARD AND CUSTOM HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from galvanized steel sheet.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as full profile welded unless otherwise indicated.
  - 3. Frames shall be galvanized in accordance with ASTM A653, A60.
  - 4. Frames: Level 3: 0.053-inch thick (16 gauge) steel sheet.
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
- D. Frame Anchors: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.053-inch-thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
- E. Arched and Custom Frames: Fabricate as shown on the drawings. Fully weld arch to door / louver frame head and grind welds smooth.

#### 2.05 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.



2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  3. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08700 Section.
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

## 2.06 STEEL FINISHES

- A. Factory-Applied Paint Finish: Manufacturer's standard grey shop primer, complying with ANSI/SDI A250.3 for performance and acceptance criteria.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

### **3.03 INSTALLATION**

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding

- face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
- b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
  - c. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - d. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  3. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors Fit: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch .
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

### 3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, bent, dented or otherwise unacceptable. The City shall be the sole determinate as to the acceptable level of repairs before an item is replaced.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Damaged Galvanized-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

### END OF SECTION

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## SECTION 08385

### METAL ACCESS HATCHES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Aluminum and Type 316 stainless steel access hatches, as indicated on the drawings.
- B. Type: Single-leaf or double-leaf gasketed hatches suitable for installation in a corrosive environment designed to permit surface water from the hatch leaf and frame to drain to the underlying channel or chamber, and include secondary fall through protection.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section:
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Comply with Section 01330 and include the following information:
  - 1. Certification specified herein.
  - 2. Manufacturer's standard catalog information, drawings, specifications and accessories.
  - 3. Storage, handling and installation instructions.
  - 4. Shop drawings containing the following information.
    - a. Elevation and plan view of each hatch.
    - b. Details of safety grates and/or safety nets
    - c. Detail of frame, including surface drainage system.
    - d. Detail of lifting mechanisms.
    - e. Detail of hold open arms and guides.
- B. Manufacturer's Certificates of Compliance attesting that aluminum and stainless steel access doors meet the specified requirements.

##### 1.04 PERFORMANCE REQUIREMENTS

- A. Structural Design:
  - 1. Traffic Loading Requirements: Design vault door leaf(s) with 1/4-inch aluminum or stainless steel diamond plate pattern plate, reinforced to withstand an AASHTO H-20-44 load with a maximum deflection of 1/150

of the span. Access hatch shall also comply with ASTM C1802-14 load level 4 (off street) loading from manufacture.

- B. Operation: Smooth and easy opening and closing with controlled operation throughout the entire arc of opening and closing, regardless of ambient temperature. Provide lifting mechanism that retards downward motion of the cover when closing to prevent quick closing and slamming. Lift assist of door leaf(s) shall not exceed 30 lbs lifting weight at any point in the opening of access doors and shall retard downward motion.
- C. Fall-Through Protection:
  - 1. Unless otherwise indicated, each access opening shall have a permanently installed fall through protection safety grate system that provides continuous safety assurance in both closed and open positions. Safety grates shall be aluminum and grade 6061 T6 aluminum material. Safety grates shall be powder coated safety orange color for visual awareness and shall include a staple for ability to lockout/tagout each safety grate independently while in the closed position.
- D. Hardware: All hardware on access door shall be Type 316 stainless steel including fasteners, hold open arms and guides, brackets, slam lock, and strike plate, hinges and pins.
- E. Hatch Schedule: See plans for hatch sizes and loading requirements.

## 1.05 QUALITY ASSURANCE

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. USF Fabrication,
- B. Bilco
- C. Halliday Products, Inc.,
- D. or equal

### 2.02 MATERIALS

- A. Furnish access hatches as follows:
  - 1. Door:
    - a. Aluminum, ASTM B221, alloy 5086
    - b. Type 316 stainless steel
  - 2. Frame:
    - a. Extruded Aluminum, ASTM B221, alloy 6063-T5
    - b. Type 316 stainless steel
  - 3. Gasket: EPDM or neoprene. 11mm bulb type compressible gasket

4. Springs, brackets, hinges, hold-open arms, hardware: Type 316 stainless steel
5. Fall Protection:
  - a. Grate: 6061-T6 Aluminum
  - b. Safety Net: High strength polyester

## 2.03 UTILITY VAULT DOOR

- A. Sizes and Design Loading Requirements: As indicated on the Drawings. Sizes indicated reflect the clear opening required for each vault door.
- B. Vault Door
  1. Double leaf or single leaf as indicated on the Drawings.
  2. Provide each leaf with a minimum of two compression spring lifting mechanisms designed to prevent the entry of dirt and foreign matter into compression spring housing.
  3. Provide a recessed locking mechanism and flush lifting handles.
  4. Leafs: Diamond pattern, 1/4-inch thickness. Reinforce as necessary to comply with design loading requirements.
- C. Hatch Hinges
  1. Designed to pivot so the cover does not protrude into the channel frame
  2. Specifically designed for horizontal installation
  3. Through bolted to the covers with tamperproof Type 316 stainless steel lock bolts and locknuts
- D. Lifting Mechanisms
  1. Compression spring-type mechanism with telescoping tube
  2. Provide automatic hold-open arms with release handles
  3. Attach lower tube of lifting mechanism to a flanged support shoe fastened to a formed 1/4-inch gusset support plate.
- E. Locking Mechanisms:
  1. Exterior: Provide removable turn/lift handle with spring loaded ball detent to open the cover. Protect latch release by a flush, gasketed, removable screw plug
  2. Interior: Provide Type 316 stainless steel snap lock with fixed handle mounted on the underside of the cover.
- F. Frame:
  1. 1/4-inch thickness, with a perimeter anchor flange with anchor tabs around the perimeter.

2. Provide a 1-1/2-inch threaded drainage coupling in the corner of the channel frame.
3. Provide an EPDM bulb type odor reduction gasket to reduce odors escaping from below the door.

## 2.04 FALL PROTECTION

### A. Safety Grates:

1. Underlying aluminum safety grates sized 4"x6" to allow visual inspection of the confined space while providing fall-through protection.
2. Designed to withstand a live load of 300 lb/ft<sup>2</sup> with a maximum deflection of 1/150 of the span
3. Fabricated from aluminum flat bars.
4. Safety grate(s) shall be hinged and each safety grate shall include a 316SS hold open arm with red vinyl grip to insure safety grate locks into 90 degree open position when in use. Safety grate must also be supplied with hasp for option of padlocking safety grate in closed position when not in use.
5. Paint safety grates safety orange

### B. Safety Nets:

1. Underlying safety net to allow inspection of the confined space while providing fall-through protection
2. Tested and certified to meet the current OSHA standard 1926.502 (c) (4) (i) drop test
3. Provide Type 316 stainless steel hardware, hooks, and anchors
4. Provide with a permanently attached metal tag with the following information:
  - a. Net manufacturers name
  - b. Identification of net material
  - c. Date of manufacture
  - d. Date of prototype test
  - e. Name of testing agency
  - f. Serial number

## 2.05 CABLE TRAY

- A. Provide cable tray system as shown on the Drawings that is integral with the access hatch, and by the same manufacturer. Any cable tray system that is not integral (which is not specifically designed to connect to the hatch frame) will not be approved as equal.
- B. The access hatch frame shall be partitioned to allow for seamless integration of the cable tray.



- C. Provide with angled “slide plate” for uninhibited cable entry into the wet well.
- D. The cable tray shall include provisions designed by the manufacturer to allow the hatch and cable tray to be shipped separately, to minimize the risk of damage or bending during shipment, and then field connected together prior to top slab concrete placement.
- E. The cable tray width shall be as shown on the drawings with an internal cable partition and a minimum depth as shown on the drawings
- F. Provide cable tray that is designed to withstand an H-20 highway load with a maximum deflection of 1/150 of the span.

## 2.06 FINISHES

- A. Aluminum hatches:
  - 1. Exposed surfaces: Mill Finish
- B. Stainless Steel hatches:
  - 1. Exposed surfaces: Mill Finish

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install in strict accordance with the manufacturer’s instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work
  - 1. Test units for proper function and adjust until proper function is achieved.
  - 2. Repair finishes damaged during installation.
  - 3. Restore finishes so no evidence remains of corrective work.
- B. Install vault door with frame set level and flush with the surrounding surface.
- C. Coat the exterior surfaces of the aluminum door frames with a bituminous paint in areas where the aluminum frame will be in contact with concrete.
- D. Connect a 1-1/2-inch diameter drain pipe to the drainage coupling on the hatch frame and route the drain pipe to the nearest drain.
- E. Clean exposed surfaces using methods acceptable to the manufacturer that will not damage the finish

**END OF SECTION**

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**SECTION 08700**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Furnishing all items of finish hardware as hereinafter specified or obviously necessary for all swinging doors. Except items, which are specifically excluded from this section of the specification or of unique hardware, specified in the same sections as the doors and frames on which they are installed.

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 09900 – Architectural Paint

1.03 REFERENCES

- A. Standards
  - 1. ANSI A156.1 – Butts and Hinges
  - 2. ANSI A156.3 – Exit Devices
  - 3. ANSI A156.4 – Door Controls – Door Closers
  - 4. ANSI A156.13 – Mortise Locks and Latches
  - 5. ANSI A156.18 – Material and Finishes
  - 6. ASTM E283 – Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors
  - 7. Door and Hardware Institute (DHI) - A115 Series
    - a. RL - Recommended Locations for Builders Hardware for Standard Steel Doors and Frames.
- B. Codes
  - 1. 2013 Oregon Structural Specialty Code (OSSC)

1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data
  - 1. Submit manufacturer's product data for each item of door hardware, installation instructions, and maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

2. Organize schedule into "Hardware Sets" with an index of doors and heading, indicating complete designations of every item required for each door or opening. Include the following information:
  - a. Type, style, function, size, quantity and finish of each hardware item.
  - b. Name, part number and manufacturer of each item.
  - c. Fastenings and other pertinent information.
  - d. Location of hardware set cross referenced to indications on drawings both on floor plans and in door schedule.
  - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - f. Mounting locations for hardware.
  - g. Door and frame sizes and materials.
  - h. Submit manufacture's technical data and installation instructions for the electronic hardware.
  - i. Catalog cuts.
  - j. Door Index.
  - k. Degree of swing and hand of door
- C. Where templates are required, furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware.
- D. Electronic Hardware Systems
  1. Provide complete wiring diagrams prepared by an authorized factory employee for each opening requiring electronic hardware.
  2. Provide complete operational descriptions of electronic components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval.
  3. Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval.
  4. Prior to installation of electronic hardware, arrange conference between supplier, installers and related trades to review materials, procedures and coordinating related work.
  5. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the Contractor to bear the cost of providing a complete and working system.

E. Operations and Maintenance Manuals

1. Upon completion of construction and building turnover, furnish two (2) complete maintenance manuals to the owner. Manuals to include the following items:
  - a. Approved hardware schedule, catalog cuts and keying schedule.
  - b. Hardware installation and adjustment instructions.
  - c. Manufacturer's written warranty information.
  - d. Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.

1.05 QUALITY ASSURANCE

A. Substitutions

1. All substitution requests must be submitted before bidding and within the procedures and time frame as outlined in Section 01330. Approval of products is at the discretion of the City.

B. Supplier Qualifications

1. A recognized architectural door hardware supplier who has maintained an office and has been furnishing hardware in the project's vicinity for a period of at least two (2) years.
2. Hardware supplier shall have office and warehouse facilities to accommodate this project.
3. Hardware supplier shall have in his employment at least one (1) Architectural Hardware Consultant (AHC) who is available at reasonable times during business hours for consultation about the project's hardware and requirements to the City.
4. Hardware supplier must be an authorized factory distributor of all products specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

A. Marking and Packaging

1. Properly package and mark items according to the approved hardware schedule, complete with necessary screws and accessories, instructions and installation templates for spotting mortising tools.
2. Contractor shall check deliveries against accepted list and provide receipt for them, after which he is responsible for storage and care. Any shortage or damaged good shall be made without cost to the owner.
3. Packaging of door hardware is the responsibility of the supplier. As hardware supplier receives material from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set and

door numbers to match the approved hardware schedule. Two or more identical sets may be packed in same container.

B. Delivery

1. The supplier shall deliver all hardware to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor.
2. Inventory door hardware jointly with representatives of hardware supplier and hardware installer/contractor until each is satisfied that count is correct.
3. No keys, other than construction master keys and/or temporary keys are to be packed in boxes with the locks.
4. At time of hardware delivery, door openings supplier in conjunction with the contractor shall check in all hardware and set up a hardware storage room.

C. Storage

1. Provide secure lock-up for door hardware delivered to the Project, but not yet installed.
2. Control handling and installation of hardware items that are not immediately replaceable so that completion of work will not be delayed by hardware losses both before and after installation.

1.07 WARRANTY

- A. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
1. Mortise locksets: Seven (7) years
  2. Exit Devices: Five (5) years
  3. Door closers: Ten (10) years
  4. Alarm Lock (no equal) Lockset hardware: Unlimited Lifetime

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

- A. Only manufacturers as listed below shall be accepted. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) from a single manufacturer.

2.02 MATERIALS

- A. Screws and Fasteners

1. Furnish necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position in the appropriate manner for long life under hard use.
2. Where necessary, furnish fasteners with toggle bolts, expansion shields, sex bolts, and other anchors according to the material to which the hardware is to be applied and according to the recommendations of the hardware manufacturer.
3. Provide fasteners, which harmonize with the hardware as to finish and material.
4. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

B. Hanging Devices

1. Hinges

- a. Provide butt hinges of the five-knuckle, full mortise type, having two or four ball or iolite bearing as noted, conforming to ANSI A156.1, with NRP (non-removable pin) stainless steel pins.
- b. Provide 3 hinges per leaf for door up to 86" high, one additional butt hinge for each additional 30" of height, or fraction thereof.
- c. Hinge size: Door 1-3/4" in thickness to 38" in width shall be provided with 4-1/2" x4" butt hinges provided with at least two ball or iolite bearing; wider and heavier doors with 5"x4-1/2" extra heavy butt hinges provided with four ball or iolite bearing.

C. Specified Manufacturer: McKinney, Stanley, or Equal

D. Keying

1. All locks and cylinders shall be construction master-keyed. All locks and cylinders to be master-keyed or grandmaster-keyed as directed by the Owner.
2. The factory shall key all locks and cylinders.
3. Furnish the following key amounts:
  - a. Four (4) change keys per lock
  - b. Four (4) construction/temporary keys
4. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging.

E. Locking Devices

1. Keypad Mortise Locksets

- a. Alarm Lock, Model 3500PD compatible with Owner's existing security system.
- b. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified.
- c. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum.
- d. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body.
- e. The lockset shall be 2 3/4" backset with a one-piece 3/4" anti-friction stainless steel latchbolt.
- f. The deadbolt shall be a full 1" throw made of stainless steel and have 2 hardened steel roller inserts.
- g. Provide an interior lever handle with trim plate that allows the door to be opened from the interior in a single action. To insure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs and shall be the product of one manufacturer.

2. Lockset Strikes

- a. Strikes shall be non-handed and available with curved lip, full lip or ASA type strikes as required.
- b. Provide strikes with lip-length required to accommodate jamb and/or trim detail and projection.

3. Padlocks:

- a. All padlocks shall be provided and installed by the Owner when it takes over the operation of the facility. During construction the contractor is to provide temporary construction padlocks as needed. Contractor is to provide the Owner a minimum of five construction keys for use during the construction period.

F. Door Closers

1. Surface Mounted Closers – Heavy Duty

- a. All door closers shall be ANSI A156.4, Grade 1 Certified. Comply with OSSC Section 905. 3 and Section 1003.3.1.5 for opening force.
- b. All surface closers shall be of full rack and pinion construction.
- c. Closing speed, latching speed and backcheck shall be controlled by key operated valves.
- d. Closers shall be non-handed to meet a variety of door conditions and design requirements.
- e. Closers shall project no more than 2 3/4" from the surface of the door.



- f. All arms shall be finely finished with heavy duty forged steel main arm and closer covers shall be of high impact plastic material of flame retardant grade.
  - g. Adjust closers in accordance with manufacturer's directions for size of door.
  - h. Closers are attached with bolts recommended by the manufacturer.
  - i. Specified Manufacturer: Norton 7500 Series, or Equal
- G. Door Trim and Protective Plates
- 1. Kick plates shall be .050 gauges and two (2) inches less full width of door, or as specified.
  - 2. Push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule.
  - 3. Specified Manufacturer: McKinney, Rockwood, Quality, or Equal
- H. Door Stops and Holders
- 1. Wall Mounted Door Stops
    - a. Provide each door leaf with a door stop.
    - b. Built-in stops in door closers and overhead stops, where called for, shall satisfy the requirements. Provide stops of proper size and height to prevent doors from hitting walls of fixed objects
    - c. Specified Manufacturers: Rockwood, Quality, or Equal
- I. Gasketing and Thresholds
- 1. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled.
  - 2. Provide intumescent seals as required to meet UL-10C Standard for Positive Pressure Fire Tests of Door Assemblies.
  - 3. Air leakage rate of weather-stripping shall not exceed 0.5 cubic feet per minute per linear foot of crack when tested in accordance with ASTM E283 at standard test conditions.
  - 4. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
  - 5. Provide threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA).
  - 6. Specified Manufacturers: McKinney, Pemko, or Equal

## 2.03 FINISHES

- A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Contractor shall ensure that the building is secured and free from weather elements prior to installing interior door hardware. Examine hardware before installation to ensure it is free of defects.

### 3.02 INSTALLATION

- A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
  - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute (DHI.)
- B. Install hardware in accordance with manufacturer's instructions and requirements of AMSI/NFPA 80, and DHI, and best trade practice by an experienced hardware installer. Use the templates provided by the hardware item manufacturer. Care shall be exercised not to mar or damage adjacent work.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Specification Section 09900. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- D. Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.03 KEYPAD LOCKSET

- A. Connect signal wire from lockset to the electrified hinge. Terminate the signal wire in a J-Box adjacent to the door in a location directed by the Owner.

### 3.04 FIELD QUALITY CONTROL

- A. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all

portions of the Work under the Contract, unless the contract Documents give other specific instructions concerning these matters.

- B. Prior to the installation of hardware, manufacturer's representatives for locksets, closers, and exit devices shall arrange and hold a jobsite meeting to instruct the installing contractor's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the City.
- C. The hardware supplier shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.
- D. The manufacturer's representative shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

### 3.05 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
- B. Adjust operation of all doors to meet ADA and OSSC, Section 905.3 and Section 1003.3.1.5 for requirements for opening force.
- C. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area.
- D. Clean operating items as necessary to restore to proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- E. Instruct owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes and usage of any electronic devices.
- F. Clean adjacent surfaces soiled by hardware installation.
- G. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

### 3.06 PROTECTION

- A. Protect all hardware, as it is stored on construction site in a covered and dry place.
- B. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

### 3.07 HARDWARE SCHEDULE

- A. The following schedule is furnished for whatever assistance it may afford the Contractor; do not consider it as entirely inclusive.

- B. Should any particular door or item be omitted in any scheduled hardware heading, provide door or item with hardware same as required for similar purposes.
- C. Hardware supplier is responsible for handing and sizing all products as listed in the hardware heading.
- D. Quantities listed are for each pair of doors, or for each single door.
- E. Manufacturer's Abbreviations:
  - 1. AL – Alarm Lock
  - 2. MC – McKinney
  - 3. NO – Norton
  - 4. PE – Pemko
  - 5. RO – Rockwood
  - 6. SA – Sargent

**HARDWARE SET #1 – Exterior Access Door, Single w/ Exit Bar**

Qty.	Device	Model No.	Finish	Mfr.
3	Hinges	TA2314 4 ½ x 4 ½ NRP	630	MC
1	Keypad Lockset	3500 PD	630	AL
1	Closer	CLP-7500-T	689	NO
2	Kickplate	KP50 12" x 2" LDW CSK HB4E	630	MC
1	Raindrip	MCK346C FFW		MC
1	Weatherstripping	MCKS88BL		MC
1	Door Bottom	MCK345AV		MC
1	Threshold	MCK158A		MC

**END OF SECTION**

## SECTION 09900

### ARCHITECTURAL PAINT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Extent of painting work is indicated on drawings and schedules, and as herein specified. Interior finish materials shall be low or No VOC and comply with State regulations.
- B. Work includes:
  - 1. Finishing of exterior and interior of building, and surfaces throughout project.
  - 2. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
  - 3. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
  - 4. "Exposed" shall mean "not fully encased or furred in."
  - 5. Sealants: Where sealants are required beyond the caulking performed by other trades in connection with surfaces to receive paint coatings, perform flush caulking in strict accordance with the provisions of Section 07900.
  - 6. Anti-graffiti Coating.
- C. Work not included: The following categories of work are not included as part of field-applied finish work.
  - 1. Work covered by Section 09960 applies to all surfaces to be coated unless explicitly stated otherwise herein or on the drawings.
  - 2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) finished mechanical and electrical equipment, including light fixtures, switch gear, and distribution cabinets.
  - 3. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, pipe spaces and duct.
  - 4. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting. Galvanized metal is not considered a finished or pre-finished surface.

5. Integral finishes such unless noted otherwise. Architectural factory finished items include plastic laminate, cabinets, and factory coated siding and roofing.
  6. Labels or signs on doors, equipment and accessories.
- D. Related work described elsewhere: Following categories of work are included under other sections of these specifications.
1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
  2. Unless otherwise specified, shop priming of fabricated components such as architectural doors shop-fabricated or factory built mechanical and electrical equipment or accessories is included under other sections of these specifications.
  3. Mechanical and Electrical work: Painting of mechanical and electrical work is specified in Divisions 15 and 16 respectively and on Architectural elevations, plans and sections.

#### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
1. Section 01330 – Submittals
  2. Section 01600 – Materials and Equipment
  3. Section 01999 – Reference Forms
  4. Section 07900 – Sealants
  5. Section 09960 – High Performance Coatings

#### 1.03 SUBMITTALS

- A. Comply with section 01330.
- B. Within 35 days after the award of contract and before products are ordered for the project, submit to the City the manufacturer's standard product information, U.L. listings and installation requirements for review and approval.
- C. Certification
1. Upon completion of the work of each part of this section, applicator or installer shall furnish a certificate that the material or system has been applied or installed as specified to meet thickness requirements, and manufacturer's application or installation requirements and that the material is applicable for the intended use.
- D. MSDS data sheet.

#### 1.04 SAMPLES & PRODUCT DATA

- A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Color wheels: submit 2 color wheels or sticks that include the full range of the manufacturer's standard colors. Color wheels will not be returned.
- C. Samples: Prior to beginning work, Submit three samples for City's review of color and texture only. Use representative colors when preparing samples for review. Provide a listing of material and application for each coat of each finish sample. Resubmit samples as requested by City until acceptable sheen, color, and texture is achieved.
- D. The approved samples shall be marked for identification and retained by the City for quality control. All work shall match approved samples.
- E. Submit MSDS to City prior to delivery of materials.

#### 1.05 QUALITY ASSURANCE:

- A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. Qualifications of painters: Use only qualified journeymen painters for the mixing and application of, the acceptance or rejection of painting, no allowance will be made for lack of skill on the part of the painters.
- C. Coordination of work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.
- D. All materials and their application shall comply with local air quality regulations.

#### 1.06 DELIVERY AND STORAGE:

- A. Delivery materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label.
- B. Contractor is solely responsible for maintain a safe environment and the following are minimum requirements. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing where necessary.
  - 2. Keep storage area neat and orderly.
  - 3. Remove oily rags and waste daily.
  - 4. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

- C. Maintain on site MSDS in compliance with OSHA regulations.

#### 1.07 PROJECT/SITE CONDITIONS

- A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.
- B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.
- C. Environmental Control:
  - 1. Contain all paints and solvents. Do not allow them to penetrate the soil.
  - 2. Do not use an area scheduled to be landscaped for storage, mixing, or disposal of paint materials.
  - 3. Dispose of waste material in a legal manner.
  - 4. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
  - 5. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and located within temperature limits specified by paint manufacturer during application and drying periods.
- D. Comply with Section 01600.

#### 1.08 SCAFFOLDING AND PROTECTION

- A. Furnish, maintain and remove all scaffolding, ladders and planks required for this work, and all drop cloths for the protection of concrete walks, floors, pre-finished materials, building fixtures, etc.
- B. Painted and finished surfaces subject to damage or defacement due to other work on the building shall be properly protected and covered.
- C. Contractor shall be responsible for any and all damage to painted work and to that of other work caused by operations under this section.

#### 1.09 WARRANTIES, GUARANTEES

- A. Two years for paints. Complete the Extended Warranty Form in Section 01999.

#### 1.10 EXTRA MATERIALS

- A. Supply 1 gallon of each color, type, and surface texture; store where directed.
- B. Label each container with color, type, texture, room and floor locations, in addition to manufacturer's label.



## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Available manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. Dunn-Edwards
  - 2. Dulux
  - 3. Sherwin Williams
  - 4. Or equal as specified in Section 01330.
- B. The manufacturers' products and numbers listed in the schedule (see Part 3) constitute the standard for the primers and finish coats of the paint systems specified. Products may be rejected without adequate product comparison data to the named Dunn-Edwards products. Comparison data shall include the following at a minimum:
  - 1. VOC content
  - 2. Solids by volume and weight
  - 3. Percentages of pigment, resins and additives
  - 4. Recommended film thickness
  - 5. Topcoat Adhesion per ASTM D3359
  - 6. Alkali Resistance
  - 7. Impact Resistance per ASTM D2794 (primers)
  - 8. Crosshatch Adhesion per ASTM 59 (primers)

### **2.02 MATERIALS**

- A. Paints
  - 1. Provide ready-mixed, except field catalyzed coatings.
  - 2. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture.
  - 3. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.
- B. Accessory Materials
  - 1. Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.

- C. Colors
  - 1. Shall be selected from color chip samples provided by manufacturer of paint system approved for use.
  - 2. Color Selections shall be made by the City from the samples provided.
  - 3. Match approved samples for color, texture and coverage.
- D. Use interior paints and coatings that comply with the limits for VOC content per the 2013 CBS Nonresidential Mandatory Measures Table 5.504.4.3. Only a limited list is provided for convenience.
  - 1. Flat Paints and Coatings: 50 grams/Liter.
  - 2. Nonflat Paints and Coatings: 100 grams/Liter.
  - 3. Floor Coatings: 100 grams/Liter.
  - 4. Stains: 250 grams/Liter.
  - 5. Primers, Sealers, and Undercoaters: 100 grams/Liter.
  - 6. Zinc-Rich Industrial Maintenance Primers: 340 grams/Liter.
  - 7. Pretreatment Wash Primers: 420 grams/Liter.
  - 8. Rust Preventative Coatings: 250 grams/Liter.

### 2.03 MIXES

- A. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

### 2.04 ANTI-GRAFFITI COATING

- A. Coating System for Exterior Face Brick and Exterior Vertical Concrete surfaces
  - 1. System S-2– Clear RTV Silicone Rubber Water Repellent
    - a. Allow new masonry surfaces to cure 28 days. Surfaces shall be power-wash cleaned per SSPC-SP12/NACE No. 5 (LPWC).
    - b. Repellent: Field applied one-component clear RTV Silicone. Product: Sherwin-Williams Anti-Graffiti Coating; Tnemec Series 626V Dur-A-Pell GS, Dumond Anti-Graffiti or equal applied in one saturating flood coat, allowing for 4” to 6” rundown, following manufacturer’s instructions and recommended spread rate for the appropriate substrate.

## PART 3 - EXECUTION

### 3.01 PREPARATION OF SURFACES

- A. No painting or finishing shall be started until the surfaces to be painted or finished are in proper condition in every respect. Surfaces that cannot be properly prepared

by the painter for finishing shall not be painted or finished until they are rectified unless instructed otherwise by the City.

- B. New concrete, masonry, and plaster shall be thoroughly dried before painting.
- C. Holes, cracks and other minor imperfections in concrete and plaster surfaces to be painted shall be suitably primed and patched with a compound recommended by the manufacturer of the paint to be applied to these surfaces, and all areas to be painted shall be brought to true, even surfaces.
- D. Surfaces to be painted shall be clean and free of dirt, dust, and any other substance which might interfere with the functioning of the painting system All surfaces to be painted shall be in proper condition to accept, and assure the proper adhesion and functioning of, the particular painting system or coating specified.
- E. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the City in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
- F. All steel and ferrous metal surfaces to be painted will be primed before installation as specified in applicable sections. Bolts, welds, and places where prime coat has been damaged shall be wire brushed to remove all loose paint, rust, and scale and then given one (1) coat of Ferrous Metal Primer.
- G. Galvanized surfaces to be painted shall first be acid etched with "Galvawash" or other approved acid wash for galvanized surfaces and then primed with one (1) coat of Galvanized Metal Primer.
- H. Remove hardware, accessories, machined surfaces, light fixtures and similar items in place and not to be painted or provide surface applied protection.
- I. Surfaces which cannot be prepared or painted as specified shall be immediately brought to the attention of the City in writing.
- J. Painted Concrete surfaces: Remove all soil, efflorescence, excess mortar, etc. Use "dry" cleaning method where possible. If wet cleaning is necessary, allow adequate time for drying. All cracks, bee holes and voids shall be filled. Test surfaces with moisture meter properly calibrated for specific substrate.

### 3.02 WORKMANSHIP AND APPLICATION

- A. All painting shall be done by skilled and experienced mechanics, working under the supervision of a capable foreman. All workmanship shall be of the highest quality. All materials shall be applied in accordance with the manufacturer's directions, and materials shall be thinned only for proper workability and in compliance with the manufacturer's specifications. All material shall be evenly brushed or smoothly flowed on without runs or sagging, and free from drops, ridges, laps, and brush marks. Ensure that all coats are thoroughly dry before applying succeeding coats. Sand surfaces between coats as necessary to produce a smooth finish.

- B. Painting shall include all exposed surfaces of every member required to be painted. Parts to be painted, inaccessible after installation, shall be painted before installation. Priming shall include all sides, edges and cut ends.
- C. Finish coats of paint shall not be applied on the interior of the building until the building is completely closed-in, with windows and doors in place and glazed, until all interior wet and dust-producing work is complete and dry and until the heating and ventilating system is in operation.
- D. Completed work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

### 3.03 CLEAN-UP AND PROTECTION

- A. Clean-up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
- B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. Protection: Protect work of other trades, 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 City.
- D. 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.
- E. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

### 3.04 PAINTING - INTERIOR

- A. Hardware and fixtures: Hardware, hardware accessories, plates, lighting fixtures, and similar items in place shall be removed prior to painting and replaced upon completion of each space.

### 3.05 PAINT SYSTEMS (PRODUCTS LISTED ARE DUNN-EDWARDS UNLESS NOTED OTHERWISE)

- A. Paint Application Schedule
  - 1. Concrete, Nontraffic Vertical Surfaces:
    - a. Primer: one coat; EFF-Stop Select
    - b. Elastomeric: Two coats over primer; Endurlastic 10
  - 2. Steel:
    - a. Primer: one coat over properly prepared steel: UltraShield DTM Gray Primer Ultrashield
    - b. Semi-gloss, Acrylic: Two coats over waterborne galvanized-metal primer: Ultrashield DTM

3. Galvanized Metal:
  - a. Galvanized metal pre-wash: one coat over clean metal.
  - b. Primer: One coat; UltraShield DTM Gray Primer.
  - c. Semi-gloss, Acrylic: Two coats over waterborne galvanized-metal primer; Ultrashield DTM
4. Aluminum:
  - a. Primer: one coat over properly prepared surface; Ultrashield DTM Gray Primer.
  - b. Semi-gloss, Acrylic: Two coats over primer; Ultrashield DTM
5. Wood:
  - a. Primer: one coat over new wood surfaces; EZ-Prime Premium.
  - b. Flat exterior acrylic enamel: Two coats over primer; Versawall.

### 3.06 ANTI-GRAFFITI COATING

- A. Apply in accordance with manufacturer's instructions on the exterior vertical concrete and masonry surfaces of the Electrical Building.
- B. Masonry mortar and concrete surfaces shall be cured a minimum of 56 days prior to application.
- C. Remove curing sealers prior to application.
- D. Protect horizontal concrete surfaces during coating application.

### 3.07 CLEANUP AND CLEANING

- A. Upon completion of the painting work, Contractor shall remove from the premises and dispose of all scaffolding and equipment, surplus material, empty containers and other debris resulting from his operations.
- B. The building and surrounding areas shall be left clean and neat in all respects.
- C. Remove excess materials and debris and dispose of off-site in a legal manner.

**END OF SECTION**

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## SECTION 09960

### HIGH PERFORMANCE COATINGS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Field-applied, high performance coatings and requirements for surface preparation.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. The following categories of work are not included as part of field-applied finish work.
  - 1. Factory-Finished Items: Unless otherwise indicated, do not include field applied coatings when factory-finishing or installer-finishing is specified within the specific specification Section for that item.
    - a. Examples include, but are not limited to, finished mechanical and electrical equipment such as pumps, engines, light fixtures, electrical switchgear enclosures, and power distribution cabinets.
  - 2. Concealed Surfaces: Unless otherwise indicated, field applied coatings are not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas.
    - a. Examples include, but are not limited to, spaces above suspended ceilings, foundation spaces, furred areas, and pipe chases.
- B. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under specific specification Sections for structural steel, metal fabrications, hollow metal work and similar items.

##### 1.04 GOVERNING STANDARDS AND RECOMMENDED PRACTICES

- A. Standards and recommended practices listed in this Article govern the Work unless otherwise specified.
- B. ASTM – American Society for Testing and Materials
  - 1. ASTM D3960, Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
  - 2. ASTM D4940, Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives

3. ASTM D5402, Standard Practice For Assessing the Solvent Resistance of Organic Coating Using Solvent Rubs
  4. ASTM D6386, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
- C. ANSI/AWWA
1. ANSI/AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
- D. NSF International – National Science Foundation
1. NSF 61, Listing of Certified Drinking Water System Components – Health Effects
- E. SSPC – The Society for Protective Coatings
1. SSPC- Vol. 1, Steel Structures Painting Manual, Good Painting Practice
  2. SSPC- Vol. 2, Steel Structures Painting Manual, Systems and Specifications
  3. SSPC-SP1, Solvent Cleaning
  4. SSPC-SP2, Hand Tool Cleaning
  5. SSPC-SP3, Power Tool Cleaning
  6. SSPC-SP6 Commercial Blast Cleaning
  7. SSPC-SP7 Brush-Off Blast Cleaning
  8. SSPC-SP10 Near White Blast Cleaning
  9. SSPC-SP5 White Metal Blast Cleaning
  10. SSPC-SP11, Power Tool Cleaning to Bare Metal
  11. SSPC-SP13, Surface Preparation of Concrete
  12. SSPC-SP15, Commercial Grade Power Tool Cleaning
  13. SSPC-Guide 12, Illumination of Industrial Painting Projects
  14. SSPC-PA1, Shop, Field and Maintenance Painting
  15. SSPC-PA2, Measurement of Dry Coating Thickness with Magnetic Gauges
  16. SSPC-PA, Guide 3 Guide to Safety in Paint Application
  17. SSPC-AB1, Mineral and Slag Abrasives
  18. SSPC-VIS 1, 02-12 Reference Photographs, Dry Abrasive Blast Cleaning
  19. SSPC-VIS 3, 93-04 Visual Standards for Power and Hand-Tool Cleaned Steel
- F. NACE International – National Association of Corrosion Engineers International
1. Joint NACE/SSPC-SP5/5 NACE #1 White Metal Blast



2. Joint NACE/SSPC-SP10/NACE #2 Near White Metal Blast
  3. Joint NACE/SSPC-SP6/NACE #3 Commercial Blast
  4. Joint NACE/SSPC-SP7/NACE #4 Brush-off Blast
  5. Joint NACE/SSPC-SP12/NACE #5 Surface Preparation and Cleaning of Metals by Water Jetting Prior to Recoating
  6. Joint NACE/SSPC-SP13/NACE #6 Surface Preparation of Concrete
  7. NACE RPO178 Appendix C - Degrees of Surface Finishing of Welds
  8. NACE RPO287 Field Measurement of Surface Profile
  9. NACE SPO188 Discontinuity (Holiday) Testing of Protective Coatings
- G. NAPF – National Association of Pipe Fabricators
1. NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe
  2. NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings

#### 1.05 DEFINITIONS

- A. Paint: Coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- B. Stripe Coat: A layer of coating material applied by brush along edges and over welds to minimize edge breakdown.

#### 1.06 PERFORMANCE REQUIREMENTS

- A. Apply coatings that are specifically formulated for application in wastewater applications.
- B. Compatibility of Coating System Components: Apply coating materials for each specified coating system, including primer, intermediate coat, finish coats, produced by the same manufacturer. Use thinners, cleaners and other additives recommended by the coating manufacturer for the specified system.
- C. Coating materials for interior potable water contact surfaces.
  1. Must appear in the current ANSI/NSF Standard 61 "Listing of Certified Drinking Water System Components Health Effects", as published by NSF International (NSF), or United Laboratories (UL).
  2. Comply with regulations and applicable requirements of local, State and federal air quality and health regulatory agencies.
- D. Use only coatings that are free of asbestos, lead, cadmium, and chromate.
- E. Volatile Organic Content (VOC) of Applied Coatings
  1. Comply with air quality regulations mandated by jurisdictional agencies.
  2. Determine VOC concentrations in accordance with ASTM D3960.

3. If the specified products are not available in formulations that meet applicable VOC limits, supply alternative products of equivalent quality and function that comply with VOC regulations in effect at the time.

F. Shop Applied Coatings

1. Except as otherwise specified, prime coats may be shop applied or field applied.
  - a. Shop Applied Primer: Compatible with the specified coating system and applied at the minimum dry film thickness (DFT) recommended by the manufacturer.
2. Repair damaged, deteriorated, and failed finish coatings that have been shop-applied to items delivered to the project site.
  - a. Items requiring extensive repairs: Remove failed coating system and re-apply new coating system. Repair may be undertaken in field or item may be shipped back to factory.
  - b. Items requiring spot repairs: Remove coating from area surrounding damage, exposing bare substrate. Re-apply and touch up the prime coat and finish coats to achieve the specified film thickness and continuity.

## 1.07 SUBMITTALS

A. Comply Section 01330

B. Product Data

1. Coating manufacturer's technical data on product and recommended use. Include the brand name and series number of coatings to be used.
2. Coating manufacturer's surface preparation criteria, including recommended surface profile range after abrasive blasting.
3. Coating manufacturer's product data sheets that include application instructions, equipment recommendation, temperature and humidity limitations, pot life and induction requirements, drying and curing times, and recoat cycle times. Provide maximum and minimum material and substrate temperatures for proper application. Provide product VOC information.
4. Contractor's written program for over spray prevention.
5. Coating manufacturer's Material Safety Data Sheets (MSDS) for all Product to be used on the project, including solvents, additives, cleaners and thinners.

C. Submittals for Abrasive Blasting

1. Abrasive supplier's certification that the abrasive blast material to be provided complies with the State of Oregon Environmental Protection Agency, Air Resources Board and Air Quality Management District requirements for dry outdoor blasting.

2. Abrasive blast cleaning and application equipment list and complete procedures for its use.
- D. Contractor's safety program to be employed on this project which complies with the current requirements of Occupational Safety and Health Administration (OHSA) and this Specification.
- E. Quality Assurance Certifications
  1. Coating Manufacturer's experience certification.
  2. Coating Applicator's qualifications certification.

## 1.08 QUALITY ASSURANCE

- A. Coatings Manufacturer Qualifications
  1. Specialize in the manufacture of high performance coatings used in wastewater environments with a minimum of 10 years successful experience.
- B. Coatings Applicator Qualifications
  1. Coating Applicator shall be a qualified participant of the coatings manufacturer's "Approved Applicator" program.
    - a. Coating Applicator's personnel shall receive training from the Coatings Manufacturer in proper surface preparation, coating application, and testing for each specific product.
  2. Minimum of five (5) years experience and successful history in the application of similar products on comparable projects. Substantiate this requirement by furnishing a written list of projects, references, and phone number of contacts.
  3. Coatings Applicator Personnel
    - a. Provide a supervisor at the work site during surface preparation and coating operations.
    - b. Provide personnel trained and qualified to perform work to industry standards of practice and safety.
- C. Regulatory Requirements
  1. Abrasive Blasting: Comply with the regulations of the Environmental Protection Agency and state Air Quality Management District requirements for dry outdoor blasting.
  2. Coatings: Comply with regulations of jurisdictional governing agencies by using coatings that do not exceed permissible volatile organic compound limits and coatings that do not contain lead.
- D. Pre-Construction Conference
  1. Schedule pre-construction conference with the Construction Manager.

2. Conduct a pre-construction conference with the Construction Manager, Contractor, Inspector, Coating Manufacturer, and Coating Applicator.
3. Topics for discussion include:
  - a. Site conditions.
  - b. Coating materials and manufacturer's application recommendations.
  - c. Surface preparation prior to abrasive blast cleaning.
  - d. Specification compliance of blast abrasives and surface profile requirements.
  - e. Schedule of field surface preparation and coating application, and order of the work.
  - f. List of equipment and procedures for cleaning, blasting, coating application, ventilation and dehumidification.
  - g. Safety programs and the enforcement to be used during the course of the work.
  - h. Weather limitations for acceptable work.
  - i. Inspection facilities and equipment to be provided.
  - j. Inspector's authority.
  - k. Procedures for over-spray prevention.

#### 1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING.

##### A. Delivery

1. Deliver coating products in original sealed containers identified with labels indicating manufacturer; product name and number; color, batch or lot number; and date of manufacture.
2. Note the date of manufacture and apply coatings prior to the expiration of the recommended storage life. Coating materials exceeding storage life will be rejected.
3. Factory Coated Items: Protect coated surfaces from damage during shipping and handling.

##### B. Storage

1. Store coating materials in a protective enclosure to protect from weather and excessive heat or cold.
2. Coatings stored at above or below manufacturers recommendations will be rejected.
3. Comply with state and local requirements for storage of flammable materials.

#### 1.10 PROJECT CONDITIONS

- A. Do not apply coatings when surface moisture, surface temperature, relative humidity, or other environmental conditions exceeds manufacturer's specified limits.

- B. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and the ambient temperature is within temperature limits specified by paint manufacturer during application and drying periods.
- C. Provide fans, heaters, dehumidifiers, or other devices to prevent formation of condensate on surfaces.
- D. When necessary to maintain progress, erect temporary tents or enclosures and provide adequate ventilation and/or heating systems to maintain the environment within the temporary enclosure minimum and maximum temperatures.

#### 1.11 ENVIRONMENTAL CONTROL

- A. Carefully contain paints and solvents. Do not allow them to penetrate the soil.
- B. Utilize drop cloths to protect walkways, floors, pre-finished materials, building fixtures, and other similar items. Contractor is responsible for damage caused by coating application.
- C. Dispose of waste material in a legal manner.

#### 1.12 SCAFFOLDING AND PROTECTION

- A. Furnish, maintain and remove scaffolding, ladders, planks required for application of coatings.

#### 1.13 EXTRA MATERIALS

- A. Supply 1 gallon of each color, type, and surface texture. Store where directed.
- B. Label each container with color, type, texture, room and floor locations, in addition to manufacturer's label.

#### 1.14 CONSISTENCY OF MATERIALS

- A. Each coating system (i.e. E-1, E-4, U-1, etc) shall have only one product used for the finish coat to ensure consistency in appearance throughout the project.

### **PART 2 - PRODUCTS**

#### 2.01 MANUFACTURERS

- A. Products identified for each coating system are the product names from specific manufacturers. Coatings products from other manufacturers and of equal or higher quality and performance may also be acceptable.
  - 1. Requests for Substitution of Alternative Coatings Products:
    - a. Include the full name of each product, descriptive literature, test data, data on past performance, manufacturer's instruction for use, generic type, and its nonvolatile content by volume.
    - b. Demonstrate product and performance is equivalent to the specified materials and complete systems.

- c. Demonstrate that the coatings manufacturer has local qualified representation which will provide onsite technical support to resolve field problems with the manufacturer's products, materials or application for the duration of the project.
- B. Requests for substitution of alternative coating products that decreases the specified dry-film thickness or the number of coats to be applied, or which changes the generic type of coating specified, will not be considered.

## 2.02 COATING SYSTEM DESIGNATIONS

- A. Coating System Designations: The following designations are used in this Section:
  - 1. A: Architectural industrial building coating systems.
  - 2. E: Epoxy-based coating system.
  - 3. F: Fusion-bonded Epoxy-based system.
  - 4. M: Mastic-based coating system.
  - 5. U: Urethane-based coating system.
  - 6. UI: Urethane-based coating system designed for Immersion.

## 2.03 COATING SYSTEMS FOR DUCTILE IRON OR STEEL

- A. Coating Systems for Steel – Severe Service (Non-Potable)
  - 1. System UI-5 Urethane-based coating system (designed for Immersion) – One Prime/Two Finish Coats:
    - a. Surface preparation: Abrasive blasted in compliance with SSPC-SP 10/NACE No. 2 Near White Metal Blast Cleaning. Obtain an anchor pattern between 1.5 and 2.0 mils.
    - b. Primer: Single coat, shop- or field-applied, two-component Micaceous Iron Oxide Immersion Grade Urethane. Products: Sherwin Williams Cor-Cote HB; Tnemec 446; or equal applied at 5.0 to 10.0 dry mils.
    - c. Stripe Coat: Field-applied, two-component Micaceous Iron Oxide Immersion Grade Urethane. Products: Sherwin-Williams Cor-Cote HB; Tnemec 446; or equal applied at 5.0 dry mils to all welds and sharp edges per SSPC-PA 1.
    - d. Finish Coat: Single coat, field-applied two-component Micaceous Iron Oxide Immersion Grade Urethane. Products: Sherwin-Williams Cor-Cote HB; Tnemec 446; or equal applied at 5.0 to 10.0 dry mils.
  - 2. System E-3 High Solids Epoxy – One Prime/One Finish Coats
    - a. Surface Preparation for Ductile Iron Pipe: Abrasive blasted in compliance with NAPF 500-03-04

- b. Surface preparation for Cast Ductile Iron Fittings: blast clean #2 in compliance with NAFB 500-03-05
  - c. Surface Preparation for steel: Abrasive blasted in compliance with SSPC-SP 10/NACE No. 2 Near White Metal Blast Cleaning. Obtain an anchor pattern between 1.5 and 2.0 mils.
  - d. Primer: Single coat, shop- or field-applied, two-component polyamide epoxy. Products: Sherwin-Williams Macropoxy 646FC; Tnemec 66 series; or equal applied at 5.0 to 6.0 dry mils.
  - e. Stripe Coat: Field-applied, two-component polyamide epoxy. Products: Sherwin-Williams Macropoxy 646FC; Tnemec 66 Series; or equal applied at 5.0 dry mils to welds and sharp edges per SSPC-PA 1.
  - f. Finish Coat: Field-applied, two-component polyamide epoxy. Products: Sherwin-Williams Macropoxy 646 FC; Tnemec 66 Series; or equal applied at 4.0 to 6.0 dry mils.
- B. Coating Systems for Steel or Ductile Iron – High H<sub>2</sub>S Exposure Inside the Wastewater Wetwell
- 1. System E-4 100% Solids Epoxy:
    - a. Surface Preparation for Ductile Iron Pipe: Abrasive blasted in compliance with NAPF 500-03-04
    - b. Surface preparation for Cast Ductile Iron Fittings: blasted in compliance with NAFB 500-03-05
    - c. Surface Preparation for steel: Abrasive blasted in compliance with SSPC-SP 5/NACE No. 1 White Metal Blast Cleaning. Obtain an anchor pattern between 3.0 and 4.0 mils.
    - d. Stripe Coat: Field-applied, two-component polyamine epoxy. Product: Sherwin-Williams Cor-Cote SC B62-450; Tnemec Series 435 Perma-Glaze at 15.0 to 20.0 dry mils to all welds and sharp edges per SSPC-PA 1. Stripe Coat shall be followed immediately by Finish Coat application; “wet on wet”.
    - e. Finish Coat: Field applied, two-component polyamine epoxy. Product: Sherwin-Williams Cor-Cote SC B62-450; Tnemec Series 435 Perma-Glaze; applied pinhole free at 15.0 to 20 dry mils in one coat.
- C. Coating Systems for Steel – Exterior Exposure
- 1. System U-1 Bare Steel – Acrylic Urethane:
    - a. Surface Preparation: Abrasive blasted in compliance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
    - b. Primer: Single coat, shop- or field-applied, two-component polyamide epoxy. Products: Sherwin-Williams Macropoxy 646FC; Tnemec Series 66; or equal applied at 4.0 to 6.0 dry mils.

- c. Intermediate Coat: Field applied two-component polyamide epoxy. Products: Sherwin-Williams Macropoxy 646 FC; Tnemec Series 66; or equal applied at 4.0 to 6.0 dry mils.
- d. Stripe Coat: Field-applied, two-component polyamide epoxy. Products: Sherwin-Williams Macropoxy 646FC; Tnemec Series 66; or equal applied at 2.0 to 3.0 dry mils to welds and sharp edges per SSPC-PA 1.
- e. Finish Coat: Field-applied, semi-gloss polyurethane. Products: Sherwin-Williams Acrolon 218HS B65-650 series; Tnemec Series 1075-Color Endura-Shield II applied at 3.0 to 5.0 dry mils in one to two coats, or equal.

## 2.04 COATING SYSTEM FOR BURIED SURFACES

### A. Coating System for Buried Ferrous Metal

#### 1. System M-1 Wrapping Tape – Petrolatum Based.

- a. Clean surfaces per SSPC-SP2 Hand Tool and/or SP3 Power Tool Clean.
- b. Prime Paste
  - 1) Field apply as recommended by tape manufacturer.
  - 2) Hand rub or brush all surfaces with priming paste.
  - 3) Liberally apply priming paste to sharp projects such as threads, irregular contours, or badly pitted areas to ensure maximum protection of metal throughout.
- c. Treat irregularly shaped surfaces such as nuts, bolts, flanges and valves per one of the following two methods:
  - 1) Apply recommended mastic by hand in sufficient quantity to build an even contour over entire surface. Ensure that all folds and air pockets within the mastic layer are thoroughly pressed out prior to subsequent application of tape. **Or**
  - 2) Cut and carefully mold an extra layer of tape around all sharp projections, nuts, bolts, etc., before final application of tape to meet specified system thickness.
- d. Tape
  - 1) Spirally wrap with a 55% overlap and sufficient tension and pressure to provide continuous adhesion without stretching the tape.
  - 2) Continuously smooth and seal by hand the edges of tape by hand during wrapping.
  - 3) On vertical applications, begin at bottom and proceed upward, creating a weather board overlap.
- e. Minimum Finished Thickness
  - 1) Smooth contours: 50 mils.



2) Irregular shaped surfaces: 100 mils.

## 2.05 ABRASIVES FOR BLAST CLEANING

- A. Use only new materials that are clean and free of contaminants.
- B. Certified by the local Air Quality Management District for use in dry, open air abrasive blasting.
- C. Comply with all applicable requirements of the local Air Quality Management District.
- D. Purchase only from firms which can accept spent abrasives, then process spent abrasives for recycle or proper disposal.

## PART 3 - EXECUTION

### 3.01 PROTECTION OF THE WORK

- A. Techniques
  - 1. Use coverings or drop cloths to protect floors, concrete, appurtenances, equipment, prepared surfaces and applied coatings or paints.
  - 2. Take precautions to prevent damage or contamination of coated surfaces from personnel entering containment areas or walking near coated surfaces.
  - 3. Exercise care to prevent coating from being spattered onto surfaces that are not to be coated.
  - 4. Recoat surfaces from which such material cannot be removed satisfactorily to produce a finish satisfactory to the Construction Manager.
- B. Where protection is required or provided for coated surfaces, maintain protection until the coating film has properly cured.
- C. Do not handle, work on or otherwise disturb coated areas until the coating has cured to “dry to handle”.

### 3.02 SAFETY AND HEALTH REQUIREMENTS

- A. General
  - 1. Comply with the applicable health and safety requirements of OSHA and the recommendations of the product manufacturer.
  - 2. Provide and require the use of proper personal protective and life saving equipment for all persons visiting or working in or about the project site.
- B. Ventilate work areas to control potential exposure and hazard to workers and employees of the plant.
  - 1. Ventilation System
    - a. Furnish and install in accordance with these specifications.

- b. Modify as directed by the supplier of the equipment, to insure a safe working environment and provide complete removal of all solvent vapors.
    - c. Equipment: Explosion proof, of industrial design, and of adequate capacity to reduce the concentration of air contaminants to the degree that a hazard to workers or employees of the plant does not exist.
    - d. Size ventilation system to maintain air changes within the confined space per OSHA regulations.
  - 2. Remove contaminated air, vapors, and other potential hazardous substances from the confined space.
  - 3. Forced air ventilation during blast cleaning, abrasive removal, coating application, and curing is mandatory in confined spaces.
- C. Confine blasting debris and paint over spray to within the bounds of the site.
  - 1. Prevent adverse offsite consequences from the blasting and coating operations.
  - 2. Complaints received by the Construction Manager regarding potential off site problems will be immediately referred to the Contractor for resolution.
    - a. Immediately halt work and take corrective action required to mitigate such problems.
    - b. Protect site properties and/or correct damage to property caused by blasting or coating operations at no additional cost to the Owner.
- D. Abrasive Blasting
  - 1. Provide and require workers to use approved supplied air protective abrasive blasting hoods.
  - 2. Require workers to wear protective hoods while in the immediate vicinity of the blasting work.
  - 3. During abrasive blasting operations, require the nozzle person(s) to wear U.S. Bureau of Mines approved blasting hoods at all times.
  - 4. Require other personnel in the vicinity of the blasting work, who may be exposed to blasting dust, to wear approved renewable cartridge filter type respirators and plastic safety goggles.
  - 5. Paper dust masks or standard glasses are not acceptable protection.
- E. Coating Application
  - 1. When coatings are applied in confined areas, require all personnel directly exposed to coating vapors to wear OSHA approved air supplied hoods.
  - 2. Paper dust masks or standard glasses are not acceptable protection.
  - 3. During the mixing and application of coatings and paints, prohibit all flames, welding and smoking within fifty (50) feet of the work area.

4. Post "No Smoking" signs in appropriate places to warn visitors and workers of the no smoking area.
- F. Illumination
1. Provide spark proof artificial lighting for all work in confined spaces.
  2. Equip light bulbs with a protective cage to prevent breakage.
  3. For lighting fixtures and bulbs, comply with the requirements of Section 70 of the National Fire Protection Association (NFPA), "National Electric Code", for the applicable atmosphere.
  4. For lighting and other electrical systems, provide ground fault type, complying with NFPA 70.
  5. As directed by the Construction Manager, provide additional illumination: to fully illuminate all areas to be inspected. Level of illumination: As determined by the Construction Manager and as specified.
  6. Provide a minimum of 50 foot candles of illumination during all surface preparation and coatings application. Comply with SSPC – Guide 12.
- G. Ground all blasting, spray and air hoses to prevent accumulation of static electric charges. Use heavy duty industrial insulated electrical cords with twist lock type connectors.
- H. Abrasive Blasting Nozzles
1. Equip with "deadman" emergency shut off switches. Keep switches properly maintained and in working order whenever abrasive blasting is in progress.
  2. Wrap abrasive blast hose connections with duct tape prior to pressurizing.
    - a. Visually inspect taped connections for leaks at the start and at the conclusion of blast cleaning operations.
    - b. Immediately repair leaking connections to prevent further damage to the equipment or injury to personnel.
- I. Solvents
1. The solvents used with the specified protective coatings are explosive at low concentrations and are highly toxic to humans.
  2. Because of toxicity, keep the maximum allowable concentration of vapor below the maximum safe concentration level as defined by OSHA.
  3. In addition, never exceed Lower Explosive Limit in the confined space.
  4. Comply with all regulations, manufacturer's recommendations, and directives from the Owner, related to safety of personnel and the handling of the coating materials.

- J. Fire Extinguishers
  - 1. Keep a minimum of two (2) ten pound (10-lb) ABC type fire extinguishers present in the work area whenever work is proceeding.
  - 2. Train all personnel in the use of this type of fire extinguisher.
- K. Noise
  - 1. Whenever the occupational noise exposure exceeds the maximum allowable sound level as set forth by OSHA regulations, the regional Air Pollution Control District and/or the City of Corvallis, provide and require the use of approved ear protection devices.
  - 2. General maximum sound levels for the project are defined as those which will not affect routine facility or neighborhood activities.
  - 3. Whenever levels are objectionable, or exceed these limits, adjust operations to reduce noise levels, as directed by the Construction Manager or the local agency of jurisdiction.
- L. Ladders, Scaffolding and Rigging
  - 1. Design for their intended use.
  - 2. Comply with all requirements of OSHA regulations.
  - 3. Erect where requested by the Construction Manager to facilitate inspection and move to the locations requested by the Construction Manager.
  - 4. Equip scaffolding with proper "outriggers", cross bracing, handrails, ladders, and OSHA approved and tested planking.
- M. Follow carefully the manufacturer's recommendations, precautions, and warnings regarding the handling and use of specified cleaning and coating materials.
  - 1. Coating materials may be irritating to the skin and eyes, and may cause an allergic reaction in certain persons.
  - 2. When handling and mixing coatings and paints, require workers to wear proper protective clothing and equipment, including gloves, respirators and eye protection.
  - 3. Identify flammability, toxicity, allergenic properties, and any other characteristic requiring field precautions and follow specific safety practices recommended by manufacturer.
- N. Remove spent abrasives and other debris. Comply with requirements of all regulatory agencies for handling and disposing of such wastes.

### 3.03 CONDITION OF EQUIPMENT

- A. Use coating equipment designed for application of the material specified and maintain in good working condition at all times.
  - 1. Equip compressors with suitable traps and filters to remove water, dust and oils from the air.

2. Conduct blotter or white cloth tests in the presence of the Construction Manager at each start-up period or as deemed necessary by the Construction Manager.
  3. Verify cleanliness of compressed air supply daily, or as deemed necessary by the Construction Manager.
    - a. Direct a stream of air, without abrasive, from the blast nozzle onto a white blotter or cloth for twenty (20) seconds.
    - b. If oil or water appears on the blotter or cloth, blow down all traps and separators until two (2) subsequent twenty (20) second tests show no further oil or water.
    - c. Use a compressed air system capable of delivering a continuous nozzle pressure to achieve the required surface cleanliness and profile, typically 90 pounds per square inch (psi) minimum to each nozzle in operation.
- B. Compressed Supplied Breathing Air
1. For respiratory protection devices, meet Compressed Gas Association, Inc. Specification G-7 for Grade D breathing air.
  2. Design and locate breathing air compressors to prevent entry of contaminated air into the air supply system.
  3. Equip oil lubricated compressors with an in line air purification system that includes air-purifying absorbent beds and filters that remove water, dust particles, odors, oil, and other hydrocarbons. Also include carbon monoxide sensor and alarm.
  4. Provide written certification that the breathing air supplied by the compressors has been tested and the air complies with Specification G-7 Grade D.

### 3.04 LIMITATIONS ON ABRASIVE BLAST CLEANING

- A. Do not blast clean when conditions would not permit the subsequent application of coating.
- B. Prepare surfaces to acceptable limits of good painting practice, after completion of surface preparation and before corrosion or recontamination occurs.
- C. Surfaces prepared under temperature and humidity control may use an extended recoat window but only after surface preparation re inspection confirms the specified cleanliness.
- D. In the event that a cleaned surface colors, oxidizes, or becomes moist, blast clean again and secure inspection/approval from Construction Manager before applying the coating.

### 3.05 ABRASIVE BLAST CLEANING

- A. Use dry method field abrasive blast cleaning for steel surfaces. Maintain dust emissions below the legal limit and below a level which would create a nuisance.
- B. Prior to abrasive blasting, remove all weld splatter by mechanical means. Comply with NACE Weld Designation D, per RP0178-95.
- C. Pre-clean per SSPC-SP1 and as approved by Construction Manager prior to abrasive blasting.
  - 1. Clean surfaces until free of dirt, mildew, grinding/welding/cutting debris and visible contaminants.
  - 2. Keep surface clean and dry prior to the abrasive blasting operation.
  - 3. Keep surface temperature 5 degrees above the dew point.
- D. After completion of blast cleaning work, sweep, collect, and remove all debris and waste materials from the work area as specified. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and create a nuisance or hazard.
- E. Use the maximum particle size recommended by the manufacturer to produce the specified surface profile, as recommended by the manufacturer, subject to approval of the Construction Manager.
- F. Evaluation of surface preparation will be based upon comparison with the latest revisions of the "Visual Standard for Abrasive Blast Cleaned Steel Surfaces", Steel Structures Painting Council (SSPC) VIS 1 02 -12.
- G. Perform blast cleaning from rolling scaffolds only within confines of interior perimeter of scaffold.
  - 1. Reaching beyond limits of perimeter will be allowed only if blast nozzle is maintained in a position, which will produce a profile acceptable to the Construction Manager.
  - 2. Proper position for the blast nozzle is a perpendicular angle to the flat surface of the work to be blasted.
- H. During abrasive blasting and cleaning operations, do not expose existing and new, previously placed coatings to abrasion from blast cleaning operations.
  - 1. Program and coordinate cleaning and coating operations so that dust, dirt, grit, etc., will not damage or fall upon wet or newly coated surfaces.
  - 2. Restore any damaged coatings to their specified condition.
- I. Interior Remedial Work
  - 1. Perform by spot blast cleaning the defective areas.
  - 2. Thoroughly abrade or scarify coating adjacent to the defective area to ensure the repair coating being applied will have satisfactory adhesion to the completely cured existing coating.

3. Upon completion of the repair work, check repaired areas within holiday detector and perform additional repair work as required.
- J. Do not distribute spent abrasives on the job site or surrounding properties.
1. Clean, remove from site, and legally dispose of spent abrasives and other debris.
  2. Comply with the requirements of all regulatory agencies for handling and disposing of such wastes.
- K. After blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and/or vacuuming to remove residue from blasting.

### 3.06 LIMITATIONS ON THE APPLICATION OF COATINGS

- A. Do not apply any coating outside the limits recommended by the manufacturer without written approval by the Construction Manager.
- B. Weather Condition Restrictions
1. Do not apply coating when the surrounding air temperature or the temperature of the surface to be painted is below forty five (45) degrees F or in excess of one hundred and twenty (120) degrees F.
  2. Do not apply any coating when the temperature of the material to be applied is less than fifty (50) degrees F or more than one hundred (100) degrees F.
  3. Do not apply any coating to wet, moist, or damp surfaces, or during snowy, rainy, foggy, or misty conditions, or when the relative humidity exceeds eighty five (85) percent, or when the ambient air temperature is less than five (5) degrees F above the dew point.
  4. Do not apply any coating when it is expected that the relative humidity will exceed eighty five (85) percent or that the ambient air temperature will drop below forty five (45) degrees F within eight (8) hours after the application of the coating.
  5. Do not apply any coating when the surface temperature is expected to drop to less than 5 degrees F above the dew point within eight hours after application of coating.
  6. Do not apply any coating when wind speed exceeds fifteen (15) miles per hour in the immediate coating area.
- C. The Construction Manager may require the Contractor to roll the coatings if high winds create the potential for damage to surrounding property by airborne paint particles. This does not reduce the Contractor's responsibility for any damage to property caused by blast cleaning or painting operations.
1. If above conditions are prevalent, delay or postpone the coating application work until conditions are favorable.

2. Anticipate dew or moisture condensation and if such conditions are prevalent, delay coating work until midmorning to be certain that the surfaces are dry.
  3. Complete each day's coating work in time to permit the film sufficient drying time, per manufacturer's recommendations, and prior to subjecting coatings to potentially damaging climatic conditions.
- D. The Construction Manager may utilize psychrometers and other measuring gauges at the work site to monitor climatic conditions. Repair coatings damaged by a change in climatic conditions. As directed by the Construction Manager, restore coating to specified requirements at no cost to the Owner.

### 3.07 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Contact the Construction Manager to schedule inspection and approval of prepared surfaces prior to each application of coating materials.
1. The Construction Manager may order the removal of any coatings applied by the Contractor prior to inspection and approval.
  2. If so ordered by the Construction Manager, remove coatings, prepare surfaces, schedule inspection, obtain approval, and reapply coating. Perform work at no additional cost to the Owner.
- B. After blast cleaning and prior to application of coatings and paintings, clean the surfaces to be coated by air blowing with clean dry air, dusting, sweeping, or vacuuming to remove any residue from blasting as directed by the Owner.
- C. Remove and reapply any coating applied to an improperly prepared surface. Perform this work to the satisfaction of the Construction Manager and at no additional cost to the Owner.
- D. Follow the recommendations of the coating material manufacturer including the selection of application equipment, thinners, mixing, drying time, temperature and humidity of application, and safety precautions. Address any conflicts between coating manufacturer's recommendations and requirements in this specification at the Pre-Construction Conference meeting and resolve at that time.
- E. Properly cure and clean any surface which will receive subsequent coating layers. Remove over spray from previous coats, dirt or dust accumulation, or scuff marks from worker traffic.
- F. Comply with SSPC PA-1 for all coating and painting application work.
- G. Stir and strain as required, and keep coating materials at a uniform consistency during application.
- H. Use a different shade or tint (or as selected by Construction Manager) on succeeding coating or painting applications to indicate coverage.
1. Apply each coating evenly, free of sags, runs, and other evidence of poor workmanship.
  2. Produce finished surfaces free from holidays, defects, or blemishes.



I. Difficult Surfaces

1. Includes all interior steel surfaces, all welds, sharp edges, nuts, bolts irregular surfaces.
2. Other difficult surfaces include, but are not limited to, welds, roof lap seams, nuts, bolts, ends and flanges of rafters, or other irregular shapes.
3. To insure complete coverage, brush coat the specified material per SSPC-PA 1, 6.6 Striping, 7.4.6 Application Method (Brush).
4. Brush coating in multiple directions to insure penetration and coverage.

J. Thinners

1. Do not use thinners unless recommended by the coating manufacturer.
2. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material.
3. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics.
4. Materials thinned to achieve proper application characteristics must still meet the specified minimum dry film thickness.
5. Do not use any coatings which have been so severely modified or thinned that their application would cause established VOC limits to be exceeded. Contractor is responsible for any fines, costs, required remedies, or legal action and costs which may result from exceeding VOC limits.

K. Spraying

1. Hold the spray nozzle perpendicular and sufficiently close to surfaces being coated to avoid excessive evaporation of volatile constituent and loss of material into the air or the bridging of cracks and crevices.
2. Use a spray technique that will result in a film free of fog, spatter or over spray.
3. Reaching beyond limits of scaffold perimeter will not be permitted.
4. Remove all over spray as directed by the Construction Manager.
5. Approval of Contractor's over spray prevention procedures and Construction Manager's presence on project site does not free Contractor from responsibility for over spray.
6. Obtain Construction Manager's approval of procedures will be required prior to start of spray operations.

L. Drying Time

1. Strictly observe manufacturer's printed instructions for drying time between coats and time between applications of coats.
2. If the recommended minimum or maximum recoat time is violated, prepare the surface as directed by the coating manufacturer.

- M. Dry Film Thickness
  - 1. Apply coating systems within the specified minimum/maximum range dry-film thickness as measured from above the peaks of the surface profile.
  - 2. Measure per SSPC-PA-2 and correct for the magnetic effect of the surface profile.
- N. Cleaning Cast Iron
  - 1. Clean per SSPC-SP1 by thorough scrubbing with stiff bristle brushes soaked in solvent.
  - 2. Brush-off blast cleaning may be necessary in order to provide a minimum surface profile of 1.5 mils.
  - 3. Once a 1.5 mil profile (or greater) is verified, hand or power tool clean (reference SSPC-SP2/SP3) but do not use cleaning tools that burnish or smooth the natural roughness (profile) of the cast iron surface.
  - 4. Remove any dust or other contaminants remaining after hand or power tool cleaning with dry, oil free compressed air or by vacuum cleaning.
  - 5. It is not the intent to remove the annealing.
  - 6. If the cast iron has bituminous coating, trace amounts may remain in the pours of the cast iron.
- O. Do not break down kits. Do not mix partial kits.
- P. Produce coating termination and transition details per manufacturer's recommendations.

### 3.08 FIELD QUALITY CONTROL

- A. Inspection
  - 1. Materials and work are subject to inspection by the Construction Manager. Unless otherwise noted herein, the Owner will pay the cost of 3rd party inspection.
  - 2. The Construction Manager may perform inspection of the surface preparation, abrasive blast cleaning, and application of the coating and painting systems.
  - 3. Provide inspection equipment including that which may be operated by the Construction Manager. The Construction Manager may elect to use his own equipment.
  - 4. Use quality assurance procedures and practices to monitor each phase of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specified may be utilized if they meet appropriate professional standards and are approved by the Construction Manager.

5. Owner’s use of a third party to inspect the work does not reduce or alter Contractor’s responsibility for the quality control, and quality assurance, or other requirements of the contract.
6. Work performed in the absence of the Construction Manger’s inspection is at the risk of the Contractor.
  - a. After written notice from the Construction Manager, the Contractor may be required to remove and replace the uninspected work.
  - b. The entire cost of removal and replacement of uninspected work, including the cost of any materials furnished by the Owner and used in the work thus removed, is the responsibility of the Contractor, regardless of whether or not the work removed is found to be defective.
7. Provide, as a minimum, 200 foot candles of illumination for all inspection. Comply with SSPC – Guide 12.

### 3.09 FINISH SCHEDULE

- A. Specific coating systems, colors and finishes for rooms, galleries, piping, equipment, and other items which are painted or have other finishes are specified in the following coating systems schedule.
- B. After approval of coatings, submit samples of the specified colors to the Construction Manager for final color approval using the appropriate finish coating.
- C. Unless otherwise specified in the coating system schedule, the word “interior” means the inside of a building or structure and the word “exterior” means outside exposure to weather elements.
- D. If surfaces are not specified in the LOCATION SPECIFIC FINISH SCHEDULE, finish according to the following GENERAL FINISH SCHEDULE:

### 3.10 GENERAL FINISH SCHEDULE

SURFACE		SYSTEM	COLOR
A.	Equipment and Metal Appurtenances		
1.	Equipment, equipment supports, mounting stands, utility stations, non-immersed, non-stainless, non-ferrous metals, unless otherwise specified.	—	—
	a. Exterior	U-1	See Note 1
2.	Equipment, immersed or high spray, unless otherwise specified.	—	—
	a. Non-potable	UI-5	See Note 1
3.	Existing equipment not damaged or modified by work in this contract	Uncoated	—
4.	Existing equipment damaged or modified by work in this contract	—	—
	a. Exterior	U-1	Match existing

SURFACE		SYSTEM	COLOR
5.	Electrical switchgear panels, unit substations, motor control centers, power transformers, distribution centers and relay panels; interior and exterior	See Division 16	See Division 16
6.	Instrumentation panels, graphic indicating panels, indicating and transmitting field panels, unless stainless steel; interior or exterior	See Division 16	See Division 16
7.	Existing electrical and instrumentation panels not damaged by work in this contract	Uncoated	—
8.	Existing electrical and instrumentation panels damaged by work in this contract	—	—
a.	Exterior	U-1	Match Existing
<b>B. Concrete, Grout, Masonry, and Plaster</b>			
1.	Structural concrete, exposed	Uncoated	—
2.	Structural concrete, buried, immersed, non-corrosive environment, unless otherwise specified	Uncoated	—
3.	Interior walls of manholes	Uncoated	-
<b>C. Other</b>			
1.	Equipment and appurtenances which are made of fiberglass, plastic, rubber, including flexible hose, conduit, and plastic coated tubing, expect as specified	Uncoated	—
2.	Buried, sleeve-type couplings, flanged pipe, couplings, valves, pipe restraint harness connecting rods, mechanical and electrical penetrations not encased in concrete, except as specified	M-1	See Note 1
3.	Equipment and appearances in below grade vaults with coating not specified in equipment specifications	E-3	—
D.	Aluminum surfaces in contact with concrete.	UI-5	See Note 1
1.	Owner to select from manufacturer's color charts		

### 3.11 LOCATION SPECIFIC FINISH SCHEDULE

SURFACE		SYSTEM	COLOR
<b>A. Lift Station</b>			
1.	Pumps below top slab	FF	
2.	Discharge Piping, Valves, Pipe Supports in Wetwell, and Valve Vault	E-4	See Note 1
3.	Aluminum Hatches	Uncoated	--
4.	Aluminum in contact with concrete	UI-5	-
5.	Stainless Steel components	Uncoated	--
FF = Factory Finish			
1.	Owner to select colors from manufacturer's color charts		

### 3.12 EXCLUSIONS

- A. Do not prepare or coat the following items or surfaces:
  - 1. Mortar coated pipe and fittings
  - 2. Sacrificial anodes and support wires
  - 3. Copper, brass
  - 4. Name Plates
  - 5. Fiberglass items
- B. Where surfaces specified as "not to be coated" are damaged, coated or otherwise do not comply with these Specifications, clean, repair or otherwise restore such surfaces to the satisfaction of the Construction Manager, at no additional cost to the Owner.

### 3.13 VENTILATION

- A. General Requirements
  - 1. Use forced air ventilation at all times to effectively remove solvents for proper drying of coats on the interior containment structures.
  - 2. Remove solvent vapors released during application and from the deposited film using explosion proof exhaust blowers, suction fans, or as an integral part of the dehumidification equipment.
  - 3. Duct exhaust blowers or suction fans should be ducted to or from the bottom of the structure.

### 3.14 FINAL CURE (INTERIOR LININGS)

- A. Follow manufacturer's recommendations, as approved by the Construction Manager.
  - 1. Minimum Cure Time: Seven (7) days (168 hours) at a temperature of 70 degrees F at a relative humidity of 50%.
  - 2. Do not provide less than minimum cure time, unless recommended in writing by the manufacturer and approved by the Construction Manager.
- B. After completion of curing cycle, test the applied coating via a "solvent" or "hardness test".
  - 1. Verify to the Construction Manager that adequate curing has been achieved.
  - 2. Perform "solvent" tests or "hardness" tests, including the solvent and number of double-rubs, recommended by coating manufacturer.
- C. Solvent Wipe Test
  - 1. Verify completion of the final cure.
  - 2. Use a rubbing a cloth saturated with solvent as recommended by manufacturer on the area to be tested.

3. If the area tested becomes tacky, the coating is not fully cured.
  - a. Extend the curing period until the coating is fully cured to the satisfaction of the Construction Manager.
  - b. Test per ASTM D5402.
- D. If final cure has not been attained, based on tests described above, extend the curing time until applied coating passes the “double rub solvent test” per manufacturer’s instructions.

### 3.15 INSPECTION AND TESTING

- A. Perform inspection and testing as specified. Include additional inspection, sampling and testing work that the Construction Manager may require to verify compliance with these Specifications.
- B. Notify the Construction Manager three (3) working days in advance of any field operations involving abrasive blast cleaning or coating applications.
- C. Assistance to Construction Manager
  1. Coordinate work with the inspection, sampling and testing requirements of the Construction Manager
  2. Assist the Construction Manager as required for the performance of duties.
  3. Provide all lighting and scaffolding to enable the Construction Manager to perform inspection and testing.
  4. Provide the level of illumination and scaffolding locations for inspection purposes as directed by the Construction Manager.
  5. Furnish Construction Manager with safety equipment and devices during abrasive blast cleaning, coating and painting operations. Provide a helmet with continuous fresh air supply for observation during cleaning operations and coating application.
- D. The Construction Manager will perform such tests as are required to help ensure compliance with all phases of the surface preparation, and application of the coating systems. Provide test equipment including, but not be limited to the following: SSPC surface preparation standards; surface profile test tape; micrometer; abrasive sieve test; ultraviolet lamp; sling psychrometer; mirror; certified thickness calibration plates; magnetic type dry film thickness gage; and a nondestructive holiday detector.
- E. Inspection by the Construction Manager does not relieve the Contractor of the responsibility of compliance with all the requirements of these specifications.
  1. In cases of dispute concerning surface profiles, film thickness, film continuity (holidays), etc., the Construction Manager’s measurements and tests shall be final. Abide by the Construction Manager’s decisions and directives.

2. Correct deficiencies in the continuity of the coating, or painting film or in the dry film thickness by applying additional coats as required, at the sole expense of the Contractor.
- F. The Construction Manager will determine the degree and surface profile of the field blast cleaned surface per test method NACE RP0287. Perform additional blast cleaning over areas not conforming to the specified degree of surface preparation and surface profile.
- G. Perform tests on surfaces of abrasively blast-cleaned steel to detect oil and other contaminants which might be deposited on surfaces as a result of abrasive blasting operations. This may include chemical tests or ultraviolet (black light) tests, as required.
- H. Perform all mixing, thinning, application and holiday detection of coatings in the presence of the Construction Manager.
- I. The Construction Manager may completely inspect each application of coating to determine thickness and integrity.
1. Each coating application will be checked and deficiencies marked.
  2. After observing specified recoat time apply additional coating materials over areas not having the specified minimum dry film thickness and areas having any holidays or pinholes.
  3. After correction of deficiencies, the Construction Manager will re inspect those areas to determine the acceptability of the additional coating.
  4. Each coating application must be one hundred (100) percent to the satisfaction of the Construction Manager prior to proceeding with successive coating applications.
- J. Dry Film Thickness Measurement
1. Use an approved magnetic type non destructive dry film thickness gauge.
  2. Determine that the specified dry film thickness has been obtained.
  3. Measure specified dry film thickness' above the peaks of the surface profile.
  4. Perform as many dry film thickness measurements, as described in SSPC–PA2, as required to verify compliance with this specification. Use a Type II Constant Pressure Probe Dry Film Thickness Gauge.
- K. Furnish calibrated inspection devices in good working condition for detection of holidays and measurement of dry film thickness.
1. Calibrate and operated per manufacturer's instructions.
  2. Furnish U.S. Department of Commerce; National Bureau of Standards certified thickness calibrated plates to test the accuracy of dry film thickness gauges and certified instrumentation to test the accuracy of holiday detectors.

3. Keep dry film thickness gauges and holiday detectors available onsite at all times until final acceptance of the application.
- L. Construction Manager may elect to furnish inspection devices and render decisions based solely upon test results from these devices.
- M. For coating film continuity detection tests on interior structure coated surfaces with 20 mils or less dry film thickness, use a non destructive holiday detector.
1. Provide personnel to operate coating film continuity detection devices under the direction of the Construction Manager.
  2. Operate inspection devices per the manufacture's recommendations in accordance with NACE SPO188.
- N. Test the coating integrity of the interior surfaces below the overflow line.
1. Mark all pinholes and repair manufacturer's written recommendations, or as directed by the Construction Manager; and then retest.
  2. Holidays or other irregularities are not permitted in the completed coating system.
  3. During the testing, keep the detecting blade in continuous contact with the coated surface.
  4. Do not proceed with holiday detection until the completed coating system has been cured per the manufacturer's recommendations.
- O. Upon completion of the epoxy application to the interior structure surfaces, retest for holidays those areas of the lower shell which may have been subjected to abrasive blast rebound from the floor, repaired as noted herein. Repair areas as required and retest.
- P. Measure anchor profile for prepared surfaces using a non destructive instrument such as a Testex Press O Film System.
- Q. The Construction Manager will verify completion of the final cure of the interior lining using a solvent wipe test.
1. Solvent wipe test: Consists of rubbing a solvent saturated rag on the area to be tested per ASTM D5402, using solvent recommended by manufacturer.
  2. If any coating material is removed or the surface being tested becomes tacky, the coating is not fully cured. Extend curing time and if required continue dehumidification until the coating is fully cured.
- R. The Construction Manager may suspend the work if the cleaning and coating operations of the Contractor are creating a localized condition detrimental to facility operation, personnel or adjacent property. In the event of an intermittent or emergency suspension of the work by the Construction Manager, correct deficiencies immediately.
- S. Prepare, sign, and submit to the Construction Manager daily inspection reports.



T. Nonconformance Reports

1. When a nonconformance report is required, prepare, sign, and submit to the Construction Manager within one working day from the time that it is written.
2. After confirming that all non-conforming work has been corrected and/or the coating work is in compliance with this specification, prepare and submit a conformance verification report shall be completed for the specific item or area.
3. This report must be signed by the Inspector.

3.16 FINAL CLEANUP

- A. Leave all areas in a neat and presentable condition.
- B. Remove rubbish, construction debris and waste, surplus construction materials, scaffolding, tools, equipment, and coating, and thinner containers, and excess coating, and thinners, and other objectionable materials.
- C. Dispose of such materials away from the site of work and in conformance with all applicable codes, ordinances and regulations.
- D. Remove coating spots upon adjacent surfaces.
- E. Clean, repair or refinish all damage to surfaces resulting from the work.

3.17 WARRANTY INSPECTION

- A. Conduct a warranty inspection of all coating and painting work between the period of eleventh (11th) month through eighteenth (18th) month following final acceptance of the Contract work.
- B. The Construction Manager will establish the date for the inspection and will notify the Contractor at least 30 days in advance. The Construction Manager may, by written notice to the Contractor, reschedule the warranty inspection to another date within the eleventh through eighteenth month inspection period, or may cancel the warranty period altogether.
- C. Attendance
  1. Attend the warranty inspection.
  2. Notifying directly involved parties of the date and time of the inspection.
  3. The Construction Manager suggests personnel present at the pre-construction conference be present at this inspection.
- D. Preparation
  1. The Owner will completely drain and hose clean sufficiently for inspection.
  2. Provide (Contractor) suitable lighting, ventilation and scaffolding for the structure inspection.

3. Use SSPC – Guide 12 for Illumination, and provide a minimum of 200 candle foot illumination for inspection.
- E. Inspect visually the entire interior and exterior coating systems to determine whether any repair work is necessary or if a more detailed inspection will be needed.
- F. Inspection Report
1. The Construction Manager will prepare and deliver to the Contractor an Inspection Report.
    - a. The report will cover the warranty inspection, setting forth the number and types of failures observed, the percentage of the surface area where failure has occurred, and the names of the persons making the inspections.
    - b. Color photographs illustrating each type of failure will be included in the report.
    - c. A coating system failure is defined as any location where coatings have peeled off, bubbled, or cracked, and any location where rusting is evident.
    - d. Upon completion of inspection and receipt of Inspection Report, the Construction Manager will establish a date for the Contractor to proceed with remedial work.
- G. Commence repairs on the date established by the Construction Manager and completed within one month (thirty days).
1. Repair all coating system failures.
    - a. Remove the deteriorated coating, clean the surface and recoat with the same coating system in strict accordance with the specification and manufacturer's recommendations, to the satisfaction of the Construction Manager.
    - b. If the area of failure exceeds twenty five (25) percent of the area of a portion of the structures surface, then remove the entire coating system and recoat that surface. All costs for warranty inspection are the responsibility of the Contractor. Additional inspection and all costs for repair are the responsibility of the Contractor.
- H. If the Contractor fails to complete the remedial work to the satisfaction of the Construction Manager, the Owner may elect to perform the remedial work. The Contractor is liable for actual cost of all such remedial work, plus 20% for Owner's administrative cost.
- I. Perform final cleanup in accordance with this Section.

**END OF SECTION**

## SECTION 09972

### HOT DIP ZINC COATING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Application of zinc coating to steel using the hot dip method.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Manufacturer's product data showing conformance to the specified product.
- C. Narrative description of method for application of zinc coating.
- D. Coating applicator's Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements of ASTM A123 or A153, as applicable.
- E. Source quality control procedures.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Zinc Coating Material: In accordance with ASTM A153.
- B. Zinc Dust-Zinc Oxide Coating: Conform to MILSPEC DOD-P-21035. Manufactured by Z.R.C. Chemical Products Co., Galvicon Co., or equal.

##### 2.02 FABRICATION REQUIREMENTS

- A. Fabrication practices for products to be galvanized: In accordance with applicable portions of ASTM A143, A384 and A385.

#### PART 3 - EXECUTION

##### 3.01 APPLICATION

- A. Galvanize steel members, fabrications and assemblies after fabrication and in accordance with ASTM A123.
- B. Unless otherwise specified, steel items weighing 100 pounds or less shall be hot-dip zinc coated.
- C. Galvanize bolts and nuts in accordance with ASTM A153.

### 3.02 COATING REQUIREMENTS

- A. Coating Thickness: Coating Grade 35 in accordance with ASTM A123, Table 2.

### 3.03 REPAIR OF DEFECTIVE GALVANIZED COATING

#### A. Damaged Zinc Coating:

1. Clean substrate surface, then repaired with zinc dust-zinc oxide coating in accordance with ASTM A780. Apply in accordance with instructions published by the manufacturer of the zinc dust-zinc oxide coating.
2. Coating Thickness: Apply multiple coats to achieve a dry film thickness of 8 mils.

- B. Items not physically damaged, but which have insufficient or deteriorating zinc coatings, and items damaged in shipment or prior to installation, shall be removed from the project site for repair by the hot-dip zinc coating method.

**END OF SECTION**

## SECTION 11000

### GENERAL REQUIREMENTS FOR EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. General requirements applicable to mechanical equipment and systems.
- B. Ensure mechanical equipment meets the requirements of this Section in addition to the specific requirements of the individual equipment specification Sections.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 01610 – Seismic Anchorage and Bracing
  - 3. Section 01999 – Reference Forms
  - 4. Section 09960 – High Performance Coatings
  - 5. Section 09972 – Hot Dip Zinc Coating

##### 1.03 GENERAL REQUIREMENTS

- A. Equipment shall be of new construction and comply with the following requirements:
  - 1. Designed for all stresses that may occur during fabrication, transportation, erection, and during continuous or intermittent operations.
  - 2. Adequately anchored, leveled, aligned, and ready for operation without binding or overloading of critical components or motors.
  - 3. Installed with necessary appurtenances required for proper operation and installation in a neat and workmanlike manner.
  - 4. Tested by factory trained service mechanics or engineers.

##### 1.04 UNIT RESPONSIBILITY

- A. Equipment systems shall be assembled as a unit by a single manufacturer responsible for the entire unit.
  - 1. Responsibility extends to selecting components of the system to assure compatibility, proper operation, and compliance with specified performance requirements.
  - 2. Unit responsibility does not relieve Contractor of responsibility to Owner for performance of the Work.

## 1.05 QUALITY ASSURANCE

### A. Arrangement

1. The arrangement of equipment shown on the Drawings is based upon information available at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer.
2. Some features of the illustrated equipment installation may require revision to meet actual equipment installation requirements.
3. Structural supports, foundations, connected piping, and valves shown may have to be altered to accommodate the equipment provided. Additional payment will not be made for such revisions and alterations.

B. Balance: Fully assemble all rotating elements in motors, pumps, blowers and centrifugal compressors before performing static and dynamic balance. Where specified, submit balancing reports, demonstrating compliance with this requirement.

## 1.06 SUBMITTALS

A. Comply with Section 01330.

B. General: Provide separate submittals for each equipment item or group of related equipment items.

C. Equipment Anchorage: Submit anchor bolt sizing calculations.

D. Bearing Life Calculations: Submit bearing L-10 life calculations in accordance with AFBMA requirements.

## 1.07 OPERATION AND MAINTENANCE MANUALS

A. Furnish operation and maintenance manuals for each equipment system in accordance with the Division 1 requirements.

## 1.08 PROTECTION DURING SHIPMENT

A. Shipping: Ship equipment in sealed, weather-tight, enclosed conveyances, and protected against damaging stresses during transport and handling.

B. Bearing Housings: Wrap or otherwise seal to prevent contamination by grit and dirt, and tape closed ventilation and other types of openings.

C. Repair any damaged materials to conform to the requirements of the Contract before the assembly is incorporated into the Work. The Contractor shall bear the costs arising out of dismantling, inspection, repair, and reassembly.

## PART 2 - PRODUCTS

### 2.01 PIPING CONNECTIONS ON EQUIPMENT

- A. Flanges on Equipment: Conform to dimensions and drilling specified in ANSI B16.1, Class 125 unless otherwise required by Division 15 pipe specifications or the Drawings.
- B. Pipe Flanges: Conform to dimensions and drilling specified in AWWA C207, Class D, 125 lb flanges provided on connection pipe.
- C. Threaded Flanges: Flat faced with standard taper pipe thread conforming to ANSI B1.20.1.
- D. Pipe Threads: Conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.
- E. Flange Assembly Bolts and Nuts
  - 1. Above Grade or Submerged Conditions:
    - a. Type 316 stainless steel.
  - 2. Buried:
    - a. High strength, low alloy steel in accordance with AWWA C111.
    - b. Hot dipped galvanized in accordance with Section 09972.

### 2.02 BEARINGS

- A. Service: Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified.
- B. Rating
  - 1. L-10 Rating Life: Minimum 50,000 hours unless otherwise specified. Determine rating life using the maximum equipment operating speed.
  - 2. Determine rating in accordance with the latest revisions of AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings.
  - 3. Where individual equipment Sections specify higher bearing life ratings, those requirements supersede the minimum bearing life specified above.
- C. Grease Lubricated Bearings
  - 1. Fit with easily accessible grease supply, flush, drain and relief fittings, except those bearings specified to be factory sealed and lubricated.
  - 2. Extend non-accessible grease fittings to an easily accessible location using 1/4-inch diameter stainless steel tubing as an extension tube.
  - 3. Grease supply fittings: Standard hydraulic Alemite or Zerk type.

- D. Oil Lubricated Bearings
  - 1. Equip with either a pressure lubricating system or a separate oil reservoir type system.
  - 2. Size oil lubrication systems to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60°C.
  - 3. Equip with a filler pipe and an external level indicator gage.
- E. Incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature, or install appropriate shielding on bearings that are accessible to touch.
- F. Bearing Isolators
  - 1. Provide for bearing where the shaft exits the bearing housing.
  - 2. Motor Bearings: Provide Inpro/Seal style VBX vapor blocking isolators.
  - 3. Gears: Provide Inpro/Seal “Double Runner” bearing isolator for shafts exiting the gear casing.
  - 4. Pumps, Blowers and Compressors: Provide Inpro/Seal style VBX blocking bearing isolators where shafts exit casings/housings.
  - 5. Pillow Block Bearings: Provide Inpro/Seal “Pop-In” style bearing isolators.

## 2.03 DRIVE COMPONENTS

- A. V-Belt Drives
  - 1. Design with sliding base or other suitable tension adjustment.
  - 2. Design with service factor of at least 1.6 at maximum speed.
  - 3. Statically balance sheaves. In addition, dynamically balance sheaves that will operate at peripheral speed of more than 5,500 feet per minute.
  - 4. Belts: Provide anti-static belts when explosion-proof equipment or environment is specified.
- B. Gear Reducers
  - 1. Provide drives with nominal input horsepower rating equal to or greater than the nameplate horsepower of the drive motor.
  - 2. Provide gear drives manufactured in accordance with AGMA Class II service requirements.

## 2.04 SHAFT COUPLINGS

- A. Type and Rating: Non-lubricated, designed for a minimum of 50,000 hours operating life.
- B. Equipment with a driver greater than ½ horsepower, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two



shafts connected by a flexible coupling which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsional vibrations.

- C. Provide couplings recommended by the coupling manufacturer for the specific application, considering horsepower, speed of rotation, and type of service.
- D. Install couplings in conformance to the manufacturer's instructions.

## 2.05 GUARDS AND CAUTION SIGNS

- A. Guards: Enclose exposed moving parts with guards that meet the requirements of federal and state OSHA requirements. Enclose drive shafts to at least 7 feet above floors or operating platforms.
- B. Materials
  - 1. Fabricate guards of 14 gauge steel and expanded metal screen to provide visual inspection of moving parts without removal of the guard.
  - 2. Galvanize after fabrication and paint with the equipment.
  - 3. Fasteners: Type 304 stainless steel.

## 2.06 PRESSURE TAPS AND GAUGES

- A. Pressure Taps and Gauges: Unless otherwise indicated, provide on the discharge and suction sides of pumps, blowers and compressors.
- B. Pressure Gauges: 4-1/2-inch size, range as specified, stainless steel case, liquid filled, safety glass, weather proof, bronze tube and brass socket, industrial grade stainless steel movement with brass hairspring, 1.5% accuracy, and 1/2-inch NPT lower connection. Supply with 1/2-inch brass gauge cock.

## 2.07 NAMEPLATES AND LIFTING EYES

- A. Nameplates: Provide on each item of equipment with the specified equipment name or abbreviation and equipment number. Engrave or stamp on stainless steel and fastened to the equipment in an accessible location with stainless steel screws or drive pins.
- B. Lifting Eyes: Provide on all equipment weighing over 80 lbs.

## 2.08 SPARE PARTS AND LUBRICANTS

- A. Spare Parts: Provide for each item of mechanical, electrical, and instrumentation equipment a supply of spare parts and special tools required for the starting, testing, adjustments, and initial operation. Pack spare parts required by individual equipment specifications:
  - 1. Pack spare parts with individual weights less than 50 pounds in a heavily constructed painted wood box with hinged cover and a locking clasp.
  - 2. Provide a typed inventory of spare parts stapled to the underside of the cover.

3. Tag and wrap each part in a waterproof container. Spare bearings shall be encapsulated in an airtight plastic film.
- B. Lubricants: Provide for each item of mechanical equipment of the type recommended by the equipment manufacturer a supply of the lubricant for startup, testing, and initial operation.
1. Provide a list showing the required lubricants for each item of mechanical equipment. List estimated quantity of lubricant needed for a full year's operation, assuming the equipment will operate continuously.
  2. Lubricants shall be products of the Owner's current lubricant supplier.
  3. Limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types.

## 2.09 ANCHOR BOLTS

- A. Size anchor bolts and concrete anchors for equipment in accordance with Section 01610.

## 2.10 FACTORY APPLIED COATINGS

- A. Ship each item of equipment to the site of the work with a shop applied prime coating prepared in accordance with the requirements of Section 09960 and compatible with the finish coatings.
- B. Finish Painting of Motors: Factory-apply finish coats using manufacturer's standard coating, unless otherwise specified in Section 09960.

## 2.11 SPECIAL TOOLS AND ACCESSORIES

- A. Furnish with each piece of equipment all tools, instruments, or accessories of a special nature that are required to assemble, disassemble, maintain, or repair any item of equipment.
1. Tag and mark each piece indicating their service and the piece of equipment for which their use is intended.
  2. Include a list and description or pictorial representation of all special tools required for a given piece of equipment for insertion into the equipment operation and maintenance manual.

## 2.12 FASTENERS AND DIELECTRIC ISOLATION

- A. Fasteners for Aluminum: Stainless steel.
- B. Isolate steel surfaces, other than stainless steel, from aluminum with stainless steel, neoprene, non-metallic washers or other acceptable material.
- C. Dissimilar Metals: Protect from galvanic corrosion by means of pressure tapes, coatings, or isolators.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install, align and test each item of equipment within the tolerances recommended by the equipment manufacturer.
- B. When specified in individual Sections, install and test equipment under the direction of installation engineers who have been factory trained by the equipment manufacturer.
- C. Perform all work in accordance with manufacturer's recommendations.

### **3.02 QUALITY CONTROL**

- A. Test equipment in accordance with the individual equipment Section.
- B. Furnish written certification from the equipment manufacturers that each item has been installed, aligned, and tested correctly and that the installation meets the manufacturer's requirements for efficient, trouble-free operation. Utilize Manufacturer's Installation Certification form provided in Section 01999.
- C. Equipment manufacturer's certification shall not be construed as relieving the Contractor of his overall responsibility for this portion of the work.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

**SECTION 11002**  
**EQUIPMENT MOUNTING**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Equipment mounting requirements, including fabricated steel equipment bases, concrete equipment pads, supports, anchorage, and accessories.

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 05501 – Anchor Bolts and Anchoring Devices
  - 3. Section 09600 – High Performance Coatings

1.03 QUALITY ASSURANCE

- A. Provide supports, anchorage, and equipment mounts that are sized and designed to resist the calculated forces and that are in accordance with the manufacturer's recommendations, the current Oregon Structural Specialty Code (OSSC), and industry standards requirements.

1.04 DESIGN REQUIREMENTS

- A. Design equipment mounts and anchorages to resist the minimum lateral force required by the latest edition of the OSSC, the manufacturer of the equipment, or a lateral seismic force of 60% of the operating weight of the equipment, whichever is greater.
- B. Equipment anchor bolt sizes shown on the Drawings are the minimum required size.
- C. Equipment anchorage design and calculations shall be prepared and signed by a civil or structural engineer currently registered in the state where equipment is installed.

1.05 MOUNTING REQUIREMENTS

- A. Mount equipment and driver on a common fabricated steel baseplate with ample rigidity to support equipment and maintain shaft alignment without excessive deflection.
- B. Mount equipment baseplates on concrete equipment pads.

1.06 SUBMITTALS

- A. Comply with Section 01330.

- B. Shop Drawings: Provide drawings of equipment bases and anchorage details.
- C. Anchorage Calculations: Submit stamped and signed anchor bolt sizing calculations.

## **PART 2 - PRODUCTS**

### **2.01 ANCHOR BOLTS AND CONCRETE ANCHORS**

- A. Provide anchor bolts and concrete anchors in accordance with Section 05501.

### **2.02 CONCRETE EQUIPMENT PADS**

- A. Construct concrete pedestals at least 6 inches wider and longer than the steel or cast base so that the distance between the anchor bolts and the edge of concrete is at least 3 inches.
- B. Unless otherwise shown or specified, all conduits, piping connections, drains, etc. shall be enclosed by the concrete base.
- C. Shape concrete pedestals to drain away from the base.
- D. Allow concrete to cure 14 days or until the concrete has cured to 75 percent of its specified compressive strength before placing equipment on the concrete pedestal.
- E. Do not start equipment placed on the concrete pedestal until the concrete has cured for 28 days or to 100 percent of its specified compressive strength.

### **2.03 STRUCTURAL STEEL EQUIPMENT BASES**

- A. Provide structural steel bases with thickened steel pads for doweling.
  - 1. Fabricate equipment base using continuous welds to seal seams and contact edges between steel members.
  - 2. Grind welds smooth.
- B. Design equipment bases with perimeter steel beams, intermediate stiffeners and baseplate.
  - 1. Provide perimeter steel beams with minimum depth equal to 1/10th of the longest dimension of the base.
  - 2. Beam depth need not exceed 14 inches provided that the baseplate deflection is kept within acceptable limits to minimize misalignment, as determined by the manufacturer.
- C. Provide grout holes for the bases of equipment where vibration isolation is not specified.
- D. Provide minimum 1-inch thick steel mounting baseplate for equipment with drivers 20 horsepower and larger.
- E. Shop-apply prime coat prepared in accordance with the requirements of Section 09960 and compatible with the finish coatings

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Connect piping to equipment with flexible connections and/or expansion joints such that the intended use of these joints is maintained in the piping system.
- B. Coordinate the location of electrical conduit and piping penetrations within the concrete pad and equipment base.
  - 1. Stub-up penetrations on the same side of the equipment as required for connection to the equipment.
  - 2. Locate equipment drains for proper drainage away from equipment.

### **3.02 EQUIPMENT MOUNTING**

- A. Mount equipment on equipment baseplates using stainless steel shims so that equipment and driver are level in both directions and mounted within machined areas on baseplate. Do not use wedges to obtain level and alignment.
- B. Utilize templates for placement of anchor bolts prior to placing concrete for equipment pad.
- C. Apply a non-seize or non-galling compound on the threads of anchor bolts and concrete anchors.

### **3.03 SHAFT ALIGNMENT**

- A. After the complete unit has been installed on the equipment pad and leveled, check the factory shaft alignment by disassembling coupling and measuring angular and parallel orientations.
- B. Use reverse-indicator dial or laser type alignment equipment to align shafts to within the manufacturer's required tolerance. Allow for thermal expansion, spacer coupling length and other factors that affect proper shaft alignment.

### **3.04 GROUTING EQUIPMENT BASES**

- A. After alignment has been completed, tighten anchor bolts and grout between equipment base and equipment pad. Use non-shrink and non-ferrous grout no less than 7/8 inch and no more than 1-5/8-inches thick.
- B. Allow 48 hours for grout to harden and then remove jacking screws. Re-check torque on anchor bolts and re-check shaft alignment, making corrections as necessary.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION



## SECTION 11288

### FABRICATED STAINLESS STEEL SLIDE GATES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Specifications for slide gates fabricated from stainless steel and electric gate actuators.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  1. Section 01330 – Submittals
  2. Section 01782 – Operations and Maintenance Information
  3. Section 01999 – Reference Forms
  4. Section 05501 – Anchor Bolts and Anchoring Devices
  5. Section 15110.3 – Powered Valve Operators and Operator Appurtenances

##### 1.03 DEFINITIONS

- A. Design Head (Seating or Unseating): The hydrostatic head representing the differential pressure that the gate is to be designed to withstand and for which the actuator is sized to accommodate. Design head is measured to the center of the gate.
- B. Seal: Resilient material attached to the slide plate or the gate frame that function to prevent leakage.
- C. Seat: The horizontal and vertical bearing surfaces that support the slide plate that function to prevent leakage.
- D. Slenderness Ratio (L/R): The ratio of maximum unsupported stem length to stem cross-section radius of gyration.
- E. Self-contained: The arrangement of gate actuator, supported by the gate frame, such that the operating thrust loads are not applied to the gate assembly.
- F. EPDM: Ethylene propylene diene monomer.
- G. RMS: Root Mean Square.
- H. UHMWPE: Ultra high molecular weight polyethylene.

##### 1.04 PERFORMANCE REQUIREMENTS

- A. Reference Standard: Provide slide gates conforming to AWWA C 561.
- B. Slide gates mounted directly to concrete walls: Design for installation without the use of a wall thimble embedded in the concrete.

- C. Allowable Leakage Limits
  - 1. Seating and Unseating Head Installations: Leakage not to exceed 0.10 gallons per minute per foot of seating perimeter.
- D. Sizing Criteria for Gate Actuators: In accordance with AWWA C561.

#### 1.05 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: Submit manufacturer's standard catalog data, descriptive literature, parts list and specifications describing system components.
- C. Shop Drawings
  - 1. Certified drawings indicating principal dimensions, general construction of the assembly and materials of construction.
  - 2. Detailed structural, mechanical, and [electrical] drawings showing equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.
  - 3. Mounting details for each type of mounting configuration used.
  - 4. External utility requirements such as air, water, power, and drain for each component.
  - 5. Mounting details and connections to gate actuator.
  - 6. Power and control wiring diagrams, including wiring terminal numbers.
  - 7. Contractor's field performance test procedures.
- D. Design Data:
  - 1. Gate opening and closing thrust forces that will be transmitted to the support structure with operator at extreme positions and load.
  - 2. Gate operator and stem sizing calculations for each gate and service condition. Show equations used and identify variables and design factors.
  - 3. Calculated gate deflection under maximum specified hydraulic loading condition.
- E. Test Reports: Submit results of factory leakage test.
- F. Installation Instructions: Submit manufacturer's instructions, requirements and detailed drawings for installation of slide gates and actuators.
- G. Certificate of Unit Responsibility (Section 01999).
- H. Operation and Maintenance Data: Prepare and submit in accordance with Section 01782.

## 1.06 QUALITY ASSURANCE

- A. Qualifications of Slide Gate Manufacturer: Minimum of 5 years full time experience in manufacturing fabricated slide gates in compliance with AWWA C561.
- B. Unit Responsibility: The Contractor shall require the equipment manufacturer to assume unit responsibility of all items specified in this section.

## 1.07 DELIVERY, STORAGE AND HANDLING

- A. Handle and store in accordance with the manufacturer's recommendations. Avoid warping gate frame and maintain tolerances between seating faces.
- B. Self-contained Slide Gates: Ship as a fully assembled unit, complete and ready for installation, except electric actuators and hydraulic cylinders shall be shipped separately and installed in the field.
- C. Ship slide gates that are not in a self-contained arrangement in components and assemble in the field. Pack gate stems in sturdy wood crates and bolt slide plates and frames securely to wood skids to protect unit and to provide safe handling. Package and ship actuator separately.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: One of the following or equal:
  - 1. Golden Harvest, Inc.
  - 2. Waterman Valve, LLC.
  - 3. H. Fontaine, Ltd.
  - 4. Hydro Gate LLC.

### 2.02 MATERIALS

- A. Slide Gates Structural Members: Thimble, Frame, Slide Plate, Guides and Yoke: ASTM A240 or ASTM A276, Type 304L/316L Stainless Steel.
- B. Lift Nut: ASTM B584 bronze.
- C. Flush-Bottom Sill: Extruded or molded neoprene. Reclaimed rubber as described in ASTM D2000 shall not be used.
- D. Flush-Bottom Sill Retainer: Stainless Steel ASTM A276.
- E. Actuator Pedestal or Gear Housing: Stainless Steel ASTM A36/ A36M.
- F. Gears: Steel, AISI 8620, AISI 4340 or AISI 1010.
- G. Thrust Nut
  - 1. Rising Stem Type Slide Gates: ASTM A276, Type 304/316 stainless steel, or ASTM B584 bronze.

- 2. Non-rising Stem Type Slide Gates: ASTM B584 bronze.
- H. Seat: UHMWPE in accordance with ASTM D4020
- I. Seals: Neoprene per ASTM D2000 G2BC615
- J. Stems and Stem Couplers: ASTM A276 Type 304/316 Stainless Steel.
- K. Stem Guide Bushings: Cast/Extruded UHMWPE ASTM D4020, or bronze bushed.
- L. Bolts, Studs, Fasteners and Anchor Bolts: ASTM A276 Type 304/316 Stainless Steel. Adhesive anchors per Section 05501.

## 2.03 FABRICATED SLIDE GATES

- A. Designed and fabricated in accordance with AWWA C561.
- B. Slide Plate
  - 1. Comprised of a single flat stainless steel plate reinforced as required to meet the specified design criteria for deflection and leakage. Maximum deflection shall not exceed  $L/720$  at the design head condition.
- C. Slide Plate Guides
  - 1. Comprised of structural members welded to form a rigid, one-piece frame designed to mount directly on a concrete wall or within a channel.
    - a. Slide Gate-2 shall be supplied with a field bolt-on horizontal invert member designed for installing around a live 18-in diameter HDPE pipe. Invert shall be flanged with an 1/8" gasket for bolting to the vertical guide rails.
  - 2. Vertical Guides:
    - a. Self-contained Gates: Design to extend in one continuous piece from the gate invert to form posts for supporting the yoke. Size vertical guides to retain the slide plate and to withstand forces generated by the gate operating mechanism.
    - b. Guide Slot Depth: Provide per Manufacturer's recommendations, with the necessary calculations.
    - c. Guide Slot Liners: Incorporate replaceable UHMWPE bearing strips on both sides of the guide slot.
- D. Seals
  - 1. Gate shall be supplied with resilient J-seals attached to the gate frame.
  - 2. Seals shall be fully adjustable and maintainable without removing any portion of the gate frame or UHMW guide seats from the wall or frame.
- E. Yoke
  - 1. Formed by structural members welded to the vertical guides.
  - 2. Location Relative to Operating Floor:
    - a. Minimum Height of Yoke: 3 feet above the operating floor.

- b. Maximum Height of Yoke: High enough above the operating floor to allow the bottom of the upward acting slide plate to be raised above the maximum water surface elevation when the gate is in the full up position.

F. Stem and Stem Guides

- 1. Diameter as required to meet specified sizing criteria, minimum 1.25-inch diameter. Length suitable to extend at least 2 inches above the stop collar and visible through the clear stem cover when the gate is in the closed position.
- 2. Rising Stem Gates: Threads shall be rolled type threads with RMS surface roughness of 16 micro-inches or less.
- 3. Provide adjustable stop collar.
  - a. Upward Opening Gates: Located at closed gate position.
  - b. Downward Opening Gates: Locate to prevent the loss of the slide from the guides.
- 4. Use stem couplers with internal threads when stems are made up of more than one section. Hold coupler in place with bolts or with key and keyway.
- 5. Stem Guides: Shall be supplied with UHMW bushings and adjustable in two directions to properly align stem.
  - a. Anchor bolts for stem guide brackets: Type 304/316 stainless steel.
- 6. Stem Cover:
  - a. Clear plastic and UV resistant with vent hole, drain and top cap in compliance with AWWA C561
  - b. Place open and closed labels at appropriate locations with adhesive tape and graduations at 1-inch intervals.

2.04 SLIDE GATE OPERATORS

- A. Manual Gate Operators: Provide handwheel type operators meeting requirements of AWWA C561 pertaining to manual lifting devices.
  - 1. Handwheel Type Operators: Non-geared.
  - 2. Hand Crank Operators:
    - a. Geared type designed to allow operation of gate under the specified design hydraulic head condition with a maximum effort of 40 pound pull on the handwheel or handcrank .
    - b. Enclose gears and bearings in a weatherproof housing with pressure fittings for grease lubrication.
    - c. Crank Handles: Removable from the operator.
- B. Powered Gate Actuators: In accordance with Section 15110.3.

## 2.05 FABRICATION

### A. Shop Fabrication

#### 1. Workmanship:

- a. Conform to design dimensions with bolt holes accurately drilled to match mounting pattern.
- b. Free from defects, burrs, grease and dirt.

#### 2. Tolerances: Within 1/8-inch of square, flatness and dimensional tolerances.

#### 3. Welding: In accordance with AWS D1.6. Welds free of slag, weld splatter and discoloration from heat.

## 2.06 SOURCE QUALITY CONTROL

### A. Tests: Perform leakage test under the specified hydrostatic design conditions. Measure and report leakage.

### B. Verification of Operation: Operate slide gate from fully closed to fully open to verify proper operation.

## 2.07 SPARE PARTS

### A. Provide one set of spare bronze stem stop nuts and stem nuts for each gate

## **PART 3 - EXECUTION**

## 3.01 INSTALLATION

### A. Install slide gates in accordance with the manufacturer's instructions.

### B. Accurately place anchor bolts using the anchor locations shown on the manufacturer's certified drawings.

### C. Gate Mounting: Plumb, shimmed as necessary, and accurately aligned.

## 3.02 FIELD QUALITY CONTROL

### A. Conduct functional testing on each gate in compliance with AWWA C561. If necessary, adjust, align or modify units for proper operation and re-test.

### B. Corrective Actions: Replace or repair to eliminate defects, deficiencies and irregularities.

## 3.03 MANUFACTURER'S FIELD SERVICES

### A. Manufacturer's Field Services

#### 1. Provide field inspection of installed slide gates to confirm proper installation and to conduct functional testing. Provide Manufacturer's Certificate of Proper Installation.

#### 2. Assist Contractor in undertaking field leakage tests, when such tests are specified.

3. Provide instruction to Owner's operations and maintenance personnel consisting of one, 4-hour training session.

B. Schedule and Timing

1. Schedule site attendance by manufacturer's representative when appropriate based on the progress of the work.
2. Timing: Minimum time spent at the project site, not including travel time:
  - a. 1 day for inspection and functional testing.
  - b. 1 day for training of Owner's personnel.

- C. Reports: Submit certification that gates have been installed in accordance with the manufacturer's instructions and properly operate.

### 3.04 SCHEDULE

A. Slide Gate Schedule.

Gate Tag Number	Gate Type	Gate Opening Width x Height (inches)	Mounting Arrangement <sup>(a)</sup>	Opening Direction <sup>(b)</sup>	Design Head (feet)		Actuator Type <sup>(c)</sup>	Leakage Testing Requirements		Notes
					Seating	Un-seating		Factory	Field	
Gate 1	Self-contained	36 x 36	WM	U	5	5	EM	yes	yes	open-close
Gate 2	Self-contained	30 x 30	WM	U	5	5	EM	yes	yes	open-close *Invert to be of bolt-on design.

<sup>(a)</sup> Mounting Arrangement: WM = wall mount, C-E = in-channel with embedded frame, C-S = in-channel with surface mounted frame  
<sup>(b)</sup> Opening Direction: U = opens in an upward direction, D = opens in a downward direction  
<sup>(c)</sup> Actuator Type: HW = handwheel, HC = hand crank, EM = electric motor driven, HP = hydraulic powered (refer to Section 15110.3 for powered actuators)

**END OF SECTION**

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## SECTION 11342

### SUBMERSIBLE SUMP PUMPS FOR UTILITY STRUCTURES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Light duty submersible sump pumps for utility structures.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 01782 – Operation and Maintenance Information

##### 1.03 TYPE

- A. Submersible, centrifugal nonclog type with integral float switch for operational control.

##### 1.04 PERFORMANCE REQUIREMENTS

- A. Minimum Capacity Rating: 40 gallons per minute at 18 feet of head.
- B. Maximum Pump Operating Speed: 1,750 revolutions per minute.
- C. Solids Handling Capacity, Maximum Sphere Size: 2 inches.
- D. Minimum Size of Discharge Port: 2 inches diameter.

##### 1.05 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: Manufacturer's data including materials of construction and equipment weight.
- C. Pump performance curves.
- D. Motor data.
- E. Control panel wiring diagram.
- F. Operation and Maintenance Data: Applicable operating and maintenance information specified in Section 01782.

#### PART 2 - PRODUCTS

##### 2.01 SUBMERSIBLE PUMPS

- A. Manufacturers: One of the following or equal:
  - 1. Zoeller Pump Company.

2. Meyers Pump.

2.02 MATERIALS

- A. Pump and Motor Housing: Cast iron, ASTM A48.
- B. Impeller: Cast iron, ASTM A48.
- C. Shaft: Type 303 or Type 416 stainless steel.
- D. Nuts and Bolts: Stainless steel, ASTM A276, Type 304.

2.03 PUMP COMPONENTS

- A. Impeller: Statically and dynamically balanced.
- B. Bearings: Permanently lubricated ball type.
- C. Pump and Motor Casing:
- D. Designed to allow removal of rotating parts from the motor end of the pumps.
- E. Machine mating surfaces where watertight sealing is required and fit with nitrile O-rings.
- F. Design pump volute with threaded, vertical discharge.

2.04 MOTOR AND CABLE

- A. Motor:
  - 1. Performance Requirements:
    - a. Voltage and Phase: 115 volt or 230 volt, single phase.
    - b. Motor Rating: ½ horsepower
  - 2. Size motor for non-overloading condition over the entire pump curve.
  - 3. Housing: Suitable for extended submergence with the windings in a sealed environment.
  - 4. Oil filled with built-in automatic reset overload protection.
- B. Power Cable and Control Cable
  - 1. Heavy-duty, water resistant cable, suitable for extended submergence.
  - 2. Cable Entry at Motor Housing: Sealed and able to prevent water from leaking into the motor due to capillary action.
  - 3. Length: Sufficient to connect to the plug outlet indicated on the Drawings.

2.05 CONTROLS

- A. Operation: Control starting and stopping of the pump by a float switch mounted on the pump.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Installed in accordance with the manufacturer's instructions.

### **3.02 TESTING**

- A. Test for proper operation and capacity over a 2-hour period.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

## SECTION 11347

### SUBMERSIBLE WASTEWATER PUMPS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Submersible pumps complete with motor, discharge elbow, guide rails and brackets, lifting cables, pump disconnect panel and pump disconnect stand.
- B. Provide heavy-duty, submersible, vertical shaft, centrifugal non-clog type, suitable for pumping fluids containing sewage solids.
- C. Equipment List and Number:
  - 1. Pump P-1
  - 2. Pump P-2
  - 3. Pump P-3

##### 1.02 REFERENCED SECTION

- A. The following Sections are referenced in this Section:
  - 1. Section 01330 – Submittals
  - 2. Section 01450 – Quality Control and Inspection
  - 3. Section 01600 – Materials and Equipment
  - 4. Section 01782 – Operations and Maintenance Information
  - 5. Section 01820 – Training
  - 6. Section 01825 – Equipment and Systems Testing
  - 7. Section 01999 – Reference Forms
  - 8. Section 05501 – Anchor Bolts and Anchoring Devices
  - 9. Section 11000 – General Requirements for Equipment
  - 10. Section 11002 – Equipment Mounting
  - 11. Section 13420 – Instruments
  - 12. Section 16447 – Low Voltage Motor Control Center

##### 1.03 DEFINITIONS

- A. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.
- B. Rated Condition: The guaranteed, maximum speed, continuous-duty operating condition with one pump operating.

- C. TDH: Total Dynamic Head (ft).
- D. NPSH: Net Positive Suction Head (ft).

#### 1.04 DESIGN REQUIREMENTS

##### A. Design Criteria

1. Design for continuous operation under submerged, partially submerged or totally dry conditions without damage to the pump and motor.
2. Design specifically to pump raw wastewater containing solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications
3. Design to operate without clogging or fouling caused by material in the pumped fluid at any operating condition within the range of service specified.
4. Design to operate without cavitation and the motor and pump combination shall operate within the manufacturer's allowable limits of vibration over the full range of operating conditions.
5. Design for continuous submergence without loss of watertight integrity to a depth of 65 feet.
6. Design so motor and rotating parts are removable from the motor end of pumps.
7. Provide capability to operate at shutoff head for durations up to 30 seconds without overloading or damage.
8. All components of the pumping units shall be balanced, coordinated and be totally compatible.
9. Design, manufacture and install component parts of each pumping unit such that they do not interact on each other to produce unacceptable vibrations, stresses or undesirable conditions.
10. Design each complete pumping unit to operate without overload on any component at any point within the specified operating range. The torque requirements for the pump shall not exceed the torque requirements of the motor at any operating point specified herein.
11. Backspin: Design all components of the pumping units to safely withstand forces resulting from flow reversals, at speeds up to 150 percent of maximum speed. The component parts of the pumping units shall not interact on each other to produce unacceptable vibrations, stresses, or undesirable conditions when reverse rotation occurs.
12. Operation at speeds greater than the motor's nominal 60 HZ rating to achieve the rated condition shall not be permitted.

13. Comply with the following:

Parameter	P-1, P-2, P-3
Nominal Discharge Diameter, inches	16
VFD	Yes
Maximum Nominal Motor Speed, rpm	705
Motor	
Horsepower, Maximum	135
Voltage/Cycle/Phase	460/60/3
Service Factor	1.15
Insulation Rating	Class H
Enclosure	FM Explosion Proof

B. Operating Conditions

1. Pumps will operate as individual units. A narrative operating description is provided in Division 16
2. Pumps shall be suitable for long-term operation under constant or variable speed operation as conditions require, under the following conditions:
  - a. Ambient Environment: Municipal Wastewater Wet Well Interior
  - b. Ambient Temperature: 20-115°F.
  - c. Ambient Relative Humidity: 30-80%
  - d. Altitude: 200 feet
3. The fluid to be pumped is anticipated to range between 35°F and 80°F. The pumped fluid is unscreened wastewater containing solids consisting of grit and organic material

1.05 PUMP PERFORMANCE REQUIREMENTS

- A. Provide pumps that meet the performance requirements specified below. The specified discharge heads include static lift and friction losses in piping systems external to the pump.
- B. Provide continuously rising head/flow curve with no flat areas or reversals that will cause operating problems with variable frequency drive applications.
- C. Provide stable performance, free from damaging cavitation, vibration, and noise in the operating head range.
- D. Do not exceed the motor rating at any point on the pump curve and do not consider service factor for purposes of motor overload.

E. Comply with the following:

Equipment Numbers	P-1, P-2, P-3
Maximum Speed Operation	
Condition A <sup>(a, b, c)</sup>	
Capacity, gpm	6250
Total head, feet	54
Minimum Total Efficiency, %	76
Condition B <sup>(b,c)</sup>	
Capacity, gpm	9150
Total head, feet	38
Minimum Total Efficiency, %	72
<p>a) Condition A shall be taken as the rated, continuous-duty operating condition. Performance at the rated condition shall be guaranteed in accordance with tolerances set forth in the Test Standards of the Hydraulic Institute Level 1B, except that any increase in head or capacity or both which results in a power requirement greater than the pump motor's nameplate rating will be cause for rejection.</p> <p>b) Total head in the above tabulation is exclusive of the pump inlet and internal losses.</p> <p>c) The manufacturer shall design for continuous operation at the most severe duty point within the range of operating conditions specified.</p>	

1.06 SUBMITTALS

- A. Comply with Section 01330.
- B. Include a copy of the contract document control diagrams and process and instrumentation diagrams that apply to the equipment in this Section.
  - 1. Mark to show specific changes necessary for the equipment proposed in the submittal.
  - 2. If no changes are required, mark the drawing or drawings “No Changes Required”.
  - 3. Failure to comply with this paragraph is sufficient cause to reject the entire submittal.
- C. Product Data: Submit manufacturer’s standard catalog data, descriptive literature, parts list and specifications describing system components.
- D. Include the following:
  - 1. Manufacturer's data including make, model, materials of construction and equipment weights.
  - 2. Complete design drawings for the pump disconnect panel (PDP) and the PDP equipment stand, including interior & exterior elevations, schematics and complete list of the bill of materials. The PDP drawings shall include a detail drawing identifying every conduit, cable, receptacles and any other devices shown to scale entering the bottom of the PDP to ensure they have all been accounted for and that they have the proper and necessary working clearances.



3. Performance curves developed for the specified operating conditions showing relationship between flow, head, efficiency, speed, horsepower, and NPSH requirements over the manufacturer's recommended range of operation. Indicate separately the head, capacity, break horsepower, overall efficiency, minimum submergence required at the guarantee point, and limits recommended for stable operation. Plot NPSH required on the same performance curve.
  4. Construction details and materials of construction.
  5. Fully dimensioned shop drawings with cross sectional views of all equipment showing details of construction. Include outline and cut-away drawings.
  6. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including motor specifications.
  7. Factory finish system and surface preparation.
  8. Equipment mounting submittal information specified in Section 11002.
  9. Documentation of ISO 9001 compliance.
  10. Power and control wiring diagrams, including terminals and numbers. Include a copy of the contract document wiring diagrams, with addenda updates, that apply to the equipment in this section marked to show specific changes necessary for the supplied equipment. If no changes are required, the drawing shall be marked "no changes required."
  11. Detailed installation instructions including leveling, alignment, and grouting
  12. Calculations, sealed by a professional engineer licensed in the State of Oregon, to substantiate guide rail sizing, pump supports, and anchor bolts to meet design strength requirements, including seismic and hydraulic flow.
  13. Bearing Life Calculations: Submit bearing L-10 life calculations in accordance with AFBMA requirements.
  14. Certificate stating that the pump, motor, and power and control cables are UL or FM approved.
  15. Certificates: Submit certification that pump manufacturer has no objections to clearances from the wet well floor to the pump bells indicated on the Drawings.
  16. Certified Mill Certificates per ISO 9000 for materials of construction used in the manufacture of the pumps and motors.
  17. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
- E. Deferred Submittals:
1. Anchor bolt design calculations and details as specified in Section 05501.

2. Submit operating and maintenance (O&M) information as specified in Section 01782 a minimum of 10 days before equipment shipment.
  3. Submit factory test reports as specified in Paragraph 2.06 and receive approval prior to equipment shipment. Include factory test results in final O&M manual.
  4. Submit forms required following startup and training. Include forms in final O&M manual. Refer to PART 3 below.
  5. A written report on the field test results and installation certification, as specified in Paragraph 3.03.B below
- F. Complete and submit the following forms from Section 01999:
1. Motor Data Form.
  2. Unit Responsibility Form. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.
  3. Extended Warranty Forms.

#### 1.07 QUALITY ASSURANCE

- A. Unit Responsibility: Assign unit responsibility, as specified in Section 11000, to the pump manufacturer for the equipment specified in this section. Submit a Unit Responsibility Certificate (Section 01999). The manufacturer shall be responsible for selection and purchase of the pumps and all system components supplied under this contract, and shall assume unit responsibility and certify that the components provide a functional unit suitable for the specified performance.
- B. ISO 9001 Quality System
  1. Compliance by pump manufacturer is required.
  2. Submit documentation of compliance prepared by independent certification agency approved by International Organization for Standardization.
  3. Do not ship equipment before compliance documentation review has been completed by Owner.
- C. Provide pumps from a single manufacturer.
- D. Qualifications: The pump manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years. In addition, the pump manufacturer shall have an authorized service representative within 150 miles of the project site. The service representative shall have been in operation for not less than the last 5 years servicing similar submersible pumping equipment.

#### 1.08 PRODUCT DELIVERY, STORAGE, & HANDLING

- A. Comply with Section 01600.

- B. Packing and Shipping: Ship pumping units to the site in enclosed containers in a manner designed to protect the pumping units against damaging stress caused by sudden acceleration or deceleration. The exposed ends of the submersible cable shall be wrapped to prevent water intrusion.

#### 1.09 WARRANTY

- A. Require the pump manufacturer to warrant the units against defects in materials and workmanship. Warranty period shall begin after testing and final acceptance of pumps.
  - 1. Length: Five (5) years from date of acceptance by the Owner or 10,000 hours under the specified uses and with normal operation and service.
  - 2. Complete the Extended Warranty Form in Section 01999.
- B. Provide as a minimum, 100% full payment coverage for parts and labor:
  - 1. Length: Eighteen (18) months from date of acceptance by the Owner or 3,000 hours of operation.
  - 2. Complete the Extended Warranty Form in Section 01999
- C. Guaranteed Performance: If equipment fails to meet specified performance requirements as determined by factory testing required herein, Owner may, at the Owner's option, require the equipment to be modified or replaced with equipment that does meet the specified requirements. All changes necessary to meet the specified performance requirements shall be made at no cost to the Owner.

### **PART 2 - PRODUCTS**

#### 2.01 MANUFACTURERS

- A. Flygt Model NP 3400/746

#### 2.02 MATERIALS

- A. Pump and Motor Casing: Grey Cast iron, ASTM A48, Class 35B.
- B. Discharge Elbow: Grey Cast iron, ASTM A48, Class 35B.
- C. Impeller: High Chrome White Cast Iron, ASTM A532, Alloy IIIA
- D. Pump Shaft: Stainless steel, AISI 431.
- E. Fasteners: Stainless steel, ASTM A276, Type 316.
- F. Insert Ring: Grey Cast iron, ASTM A48, Class 35B
- G. Lower Ring Seal: Tungsten-carbide both faces.
- H. Upper Ring Seal: Tungsten-carbide both faces for each pump.
- I. Cast iron pipe, flanges, and fittings: ANSI B16.1 and B16.5.
- J. Pump Discharge Connection: Cast iron.
- K. Externals Bolts and Nuts: Stainless steel, ASTM A276, Type 316.

- L. Guide Bar Brackets: Stainless steel, ASTM A276, Type 316.
- M. Anchor Bolts: Stainless steel, ASTM A276, Type 316.
- N. Guide Rails, Lifting Chain and Hook Assemblies: Stainless steel, ASTM A276, Type 316.

## 2.03 PUMP COMPONENTS

### A. General Requirements

1. Machine all mating surfaces where watertight sealing is required and fit with nitrile O-rings.
2. Equip pumps with dynamically balanced nonclog impellers designed to pass coarse solids and stringy materials.
3. Design pumps to automatically connect to the discharge piping when lowered into place on the discharge connections.
  - a. Make pumps easily removable for inspection or service, requiring no bolts, nuts, or other fastening to be removed for this purpose, and no need for personnel to enter pump wet well.
  - b. Pumps shall be fitted with stainless steel cable of adequate strength and length to permit raising pumps for inspection and removal.
  - c. Seal pump to the discharge connections by a simple linear downward motion of the pump, with the entire weight of the pumping unit guided to and pressing tightly against the discharge connections.
  - d. Do not permit any portion of the pump to bear directly on the floor of the sump.
  - e. Do not require rotary motion of the pump for sealing.
  - f. Provide nonadjustable guide bars, to steer the pump into proper contact with the discharge elbow. Do not require guide bars to bear the weight of the pump.

### B. Pump Casing

1. Design working pressure shall be a minimum of 110 percent of shutoff head.
2. Design casing to withstand 5 minute hydrostatic pressure test at 150% of shut off head.
3. Surfaces of all water passages smooth and free all pits and projections which might cause undesirable turbulence.
4. Machine and fit critical mating surfaces where watertight sealing is required with Nitrile or Viton rubber O-rings.
5. Accomplish sealing by controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

6. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal.
  7. Do not use secondary sealing compounds, elliptical O-rings, grease or other devices.
- C. Volute/Suction Cover
1. The pump volute shall be a single piece non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller.
  2. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s).
- D. Bearings
1. Support pump shafts on two bearings.
    - a. Upper bearing: Single row ball bearing.
    - b. Lower bearing: Two-row angular contact ball bearing or single row deep groove bearing.
  2. Heavy-duty, oil lubricated or permanently greased lubricated type double shielded and factory sealed.
  3. Designed for an L-10 rating life of at least 100,000 hours in accordance with Section 11000.
  4. Equip the lower bearing housing with a leakage sensor switch with a normally open contact. The leakage sensor, a mechanical float switch or conductivity probe located in the stator housing or seal chamber, shall energize electrical circuit to enable an alarm circuit for external alarm prior to the liquid level reaching the stator end coils. Pump shall not be stopped.
- E. Impeller
1. Provide nonclogging design capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications.
  2. The impeller shall be dynamically balanced, semi-open, multi-vane design, back-swept, screw-shaped non-clog design.
  3. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge.
  4. The impeller(s) vanes shall have leading edges that are hardened to Rc 60
  5. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater.
  6. Impellers shall be locked to the shaft, held by an impeller bolt, and shall be coated with alkyd resin primer. Fit between the impeller and the shaft shall be a sliding fit with a tamper-lock bushing pressed by a screw which is threaded into the end of the shaft, or a slip fit onto the shaft and drive key

and fastened to the shaft by an impeller nut having cover for protection from pumped fluid.

F. Pump and Motor Shaft

1. Design pump and motor shaft of sufficient size to transmit full driver output.
2. Shaft shall be solid continuous with pump shaft being a continuation of the motor shaft.
3. Pump and motor shaft shall be completely isolated from pumped liquid for both pumps.

G. Mechanical Seals

1. Provide with tandem double mechanical seals running in an oil reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate, composed of two separate lapped face seals. Seal lubricant shall be FDA approved non-toxic.
  - a. For the lower seal unit, between the pump and oil chamber, provide one stationary and one positively driven, rotating tungsten-carbide or silicon-carbide ring, with each pair of rings held in contact by a separate spring.
  - b. For the upper seal unit, between the oil sump and the motor housing, provide one stationary tungsten-carbide or silicon-carbide ring and one positively driven tungsten-carbide or rotating carbon ring.
  - c. Ceramic and carbon seals are not acceptable.
  - d. Hold each seal interface in contact by its own spring system.
  - e. Conventional double mechanical seals with a single or a double spring between the rotating faces, or that require constant differential pressure to affect sealing and are subject to opening and penetration by pumping forces, are not acceptable. Make submersible pumps capable of continuous submergence without loss of watertight integrity to a depth of 65 feet.
  - f. The seal system shall not rely upon the pumped media for lubrication.
2. For each pump, provide an oil chamber for the shaft sealing system.
  - a. Design oil chamber to assure that air is left in the oil chamber, to absorb the expansion of the oil due to temperature variations.
  - b. Provide drain and inspection plug with positive anti-leak seal which is easily accessible from the outside.

H. Cable Entry Seal

1. Design to preclude specific torque requirements to insure a watertight and submersible seal.
2. Provide a single cylindrical elastomer grommet having a close tolerance fit against the cable outside diameter and the entry inside diameter and

compressed by the entry body containing a strain relief function, separate from the function of sealing the cable.

3. Provide for ease of changing the cable when necessary using the same entry seal.
4. Separate the cable entry junction chamber and motor by a stator lead sealing gland or terminal board, which isolates the motor interior from foreign material gaining access through the pump top.
5. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

#### I. Motors

1. Squirrel-cage induction, shell type design, housed in an air-filled, watertight chamber, NEMA B type.
2. Rating: Explosion-proof, as defined by Factory Mutual (FM).
3. Insulate stator winding and stator leads with moisture resistant Class F insulation, rated for a temperature of 155°C.
  - a. The stator shall be insulated by the trickle impregnation method resulting in a winding fill factor of 95%.
  - b. Dip and bake the stator three times in Class H varnish and heat-shrink fit into the stator housing.
  - c. The use of bolts, pins, or other fastening requiring penetration of the stator housing is not acceptable.
4. Designed for continuous duty, capable of sustaining a minimum of 10 starts per hour.
5. Limit temperature rise of the motor to that specified in NEMA MG-1 for Class B insulating materials when operating continuously under load.
6. Explosion-proof motors, where specified: UL listed in accordance with UL 674 doe Class 1, Group C and D hazardous atmospheres.
7. Hermetically seal the junction chamber, containing the terminal board, from the motor.
8. The motor shall be able to operate dry without damage while pumping under load.
9. Brake horsepower required of the driven equipment under the most severe operating conditions: Shall not exceed the rated nameplate horsepower of the motor when operating at its rate service factor, nor shall it exceed the rated nameplate horsepower of the motor when operated at specific conditions at a service factor of 1.15. The “most severe operating conditions” include the full possible range of normal operating conditions but shall not include unusual conditions such as equipment failure.
10. Motor housing shall be ASTM A48 cast iron and equipped with a lifting bail to which the lifting chain shall be attached.

11. The lifting bail shall be series 300 stainless steel.
12. Cast aluminum rotor bars and short circuit rings.
13. Hermetically seal the junction chamber containing the terminal board, from the motor by an elastomer, O-ring seal.
14. Make connection between the cable conductors and stator leads with threaded compression type binding posts permanently affixed to a terminal board.
15. Wire nuts or crimping type connection devices are not acceptable.
16. Service factor: A minimum of 1.15.
17. Voltage tolerance: Plus or minus 10%.
18. Design motor for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.
19. Provide a performance chart showing curves for torque, current, power factor, input/output KW and efficiency. Include in chart data on starting and no-load characteristics.
20. Motor horsepower: Adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through “run out” operating point.
21. Provide FM or UL listed motor designed for N.E.C. area classification shown on Drawings.
22. Make connection between the cable conductors and stator leads with threaded compressed type binding post permanently affixed to a terminal board.
23. Design each motor to withstand a reverse over-speed of 150 percent of rated synchronous speed.
24. Cable
  - a. Size according to NEC and ICEA standards and be UL or FM rated
  - b. Continuous, nonwicking submersible electrical cable with the correct number of conductors sized in accordance with NFPA 70.
  - c. Make shall be of a neoprene or protolon synthetic rubber-jacketed, type SPC, suitable for submersible pump applications in wastewater and heavy mechanical stresses.
  - d. Include a ground check conductor with each signal cable.
  - e. Cables containing wicking fillers are not acceptable.
  - f. Provide sufficient length to reach the junction box.
  - g. Supply extra cable at the pump to allow the pump with its suction pipe attached to be lifted vertically disconnecting the electrical service at the pump.
  - h. Supply separate cables for power and control wiring.



- i. Provide cable strain relief supports to support each cable from the hatch frame. Stainless steel Kellums grips and stainless steel hooks shall be provided for each of the pump's cables.
- j. Cabling capable of continuous submergence underwater without loss of watertight integrity to a depth of at least 65 feet.

25. Leakage Sensor

- a. Provide to detect water in the stator chamber. Locate moisture sensor in the motor housing/seal chamber.
- b. Locate temperature sensor in the motor windings.
- c. Sensors shall be wired via motor make-up box and manufacturers cable to remotely mounted interposing controllers.
- d. Controller(s) shall monitor moisture and temperature sensors, converting signals to contact type alarm outputs for remote alarming. Outputs shall be relay type contact rated 120 volt, 5 amp minimum suitable for direct connection to a programmable logic controller. A separate contact shall be provided to alarm each system. Two sets of form C contact relay outputs shall be provided for use by Owner. Sensor system shall incorporate 2 to 4 wires and NEMA 1 panels.
- e. When leakage sensor is activated, stop the motor and send an alarm.
- f. Operate on 120VAC.
- g. Use of voltage sensitive solid state sensors and trip temperature above 125°C (260° F) is not allowed.

J. Variable Frequency Drive

- 1. Each pump motor will be controlled via an Allen Bradley Powerflex 755 drive located in the Motor Control Center (MCC) which will be supplied as an integral component of the MCC and as specified under Section 16447.

K. Control and Status Monitoring unit

- 1. The thermal switches and float switches shall be connected to a Flygt Mini-CAS, or equal, control and status monitoring unit.
- 2. The submersible Wastewater Pump manufacturer shall provide the complete Flygt MAS711 monitoring and status (MAS) pump monitoring system which includes, but is not limited to the base unit, intrinsically safe barrier, current transformer (CT) and display. These components shall be supplied immediately after the submittals are approved to allow the Owner ample time to get the equipment incorporated into the control panel they are supplying.
- 3. The monitoring unit shall be designed to be mounted in the pump control panel.

L. Pump Name Plate

1. A 316 stainless steel nameplate shall be attached to the pump in a clearly visible, easily accessible location. The nameplate shall be stamped with the following information:
  - a. Manufacturer’s name.
  - b. Manufacturer’s model number.
  - c. Manufacturer’s serial number.
  - d. Nominal speed, rpm.
  - e. Amps, volts, and service factor.
  - f. Motor horsepower.

M. Pump Disconnect Panel (PDP)

1. The Pump Disconnect Panel (PDP) and PDP stand shall be completely fabricated, components and devices installed, and wired in the manufacturer’s facility. All internal wiring shall be completed and tested prior to shipment. All external connections shall be by way of numbered field terminal blocks. Enclosures shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel and to accommodate the conduits, cables, receptacles and other devices entering and exiting the bottom of the PDP.
2. The PDP shall be provided with the intrinsically safe relays (ISR) and Intrinsically safe barriers (ISB) for the instruments listed in the table below:

#	ID #	Instrument Name	Specification Number	Location
1	LE-01	Radar Level Sensor and Display	13420.L01	Diversion Structure
2	LE-02	Radar Level Sensor and Display	13420.L01	Wet Well
3	FIT-01	Magnetic Flow Meter	13420.F50	Pump P-1
4	FIT-02	Magnetic Flow Meter	13420.F50	Pump P-2
5	FIT-03	Magnetic Flow Meter	13420.F50	Pump P-3
6	LSH-01	Float Switch Connection System	13420.F01	Diversion Structure
7	LSH-02, LSL-02	Float Switch Connection System	13420.F01	Wet Well
8	PS-01	Pressure Switch	13420.P43	Valve Vault
9	PS-02	Pressure Switch	13420.P43	Valve Vault
10	PS-03	Pressure Switch	13420.P43	Valve Vault
11	FCV-01	Flow Control Valve	11288	Diversion Structure
12	FCV-02	Flow Control Valve	11288	Diversion Structure
13	MAS-1	Pump P-1 MAS Controller	11347	PDP
14	MAS-2	Pump P-2 MAS Controller	11347	PDP
15	MAS-3	Pump P-3 MAS Controller	11347	PDP
16	N/A	Fail Alarm – Digital Signal	Existing	Overflow Site

#	ID #	Instrument Name	Specification Number	Location
17	N/A	Flood Alarm – Digital Signal	Existing	Overflow Site
18	N/A	Intrusion Alarm – Digital Signal	Existing	Overflow Site
19	N/A	Loss of Echo – Digital Signal	Existing	Overflow Site
20	N/A	Level Sensor – Analog Signal	Existing	Overflow Site

3. Enclosures shall conform with NEMA standards, as well as following requirements. Minimum metal thickness shall be 14-gauge. All welds shall be neatly formed and free of cracks, blow holes, and other irregularities.
4. The Pump Disconnect Panel at the wet well shall allow each of the pumps to be disconnected and removed from the wet well without opening the panel and without the need for an electrician to disconnect wiring, and without affecting the operation of the remaining pumps. The Pump Disconnect Panel shall be provided with a Meltrics disconnect rated receptacle for each pump to match the Meltrics plug on the pump cord.
  - a. The Meltrics plugs and receptacles shall be provided with pilot contacts to prevent the pumps from being energized when any of the plugs for a particular pump are disconnected.

N. Pump Disconnect Panel Enclosure

1. The Pump Disconnect Panel enclosure shall be stainless steel construction, NEMA 4X blind front. All door openings shall be double flanged and gasketed on all four sides to prevent dirt and liquids from entering enclosure.
2. The PDP equipment stand shall be constructed entirely of stainless steel components.
3. As shown on the drawings, the Pump Disconnect Panels shall be provided with one 20-amp GFCI receptacle to be field mounted under the enclosure (inside the disconnect panel stand, as high as possible). While this receptacle is not provided as part of the scope of the disconnect panel enclosure, enclosure layout must account for it to be field mounted after the disconnect panel enclosure is mounted on the disconnect panel stand, and provided with a metallic in-use weather proof receptacle. The manufacturer shall ensure that that the pump disconnect plug/receptacles are located to allow adequate working clearance from the specified panel penetrations for conduits, control cables and the GFCI receptacle.

O. Pump Disconnect Panel Stand

1. A lockable pump disconnect panel stand shall be provided below the disconnect panel near the wet well as shown on the drawings. The disconnect panel stand shall be constructed of 304 stainless steel.
2. The disconnect panel stand shall be the same width and depth as the disconnect panel. The bottom of the disconnect panel shall be mounted a

minimum of 48 inches above the bottom of the control shelter and surrounding grade. The disconnect panel stand shall extend from the bottom of the disconnect panel to the finish grade outside the shelter. The entire front panel of the stand shall be a lockable, hinged door capable of opening 180 degrees, and shall not result in any gaps when the door is closed. The door shall include a padlock hasp.

3. The stand frame shall be constructed using stainless steel tube, angle, or bars. The sides of the stand and the door shall be enclosed with stainless steel expanded mesh or perforated sheets.

## 2.04 ACCESSORIES

### A. Anchor Bolts

1. Comply with Section 05501.
2. Calculations are required.
3. Minimum diameter: 3/4-inch.
4. Type 316 stainless steel

### B. Guide System

1. Provide each pump with a guide rail system to allow easy removal of the pump without entering the wet well.
2. Include dual Type 316 stainless steel guide rails of a size recommended by the pump manufacturer.
3. Systems that employ cables or single guide rails are not allowed.
4. Bolt the discharge connection to the floor and use as a lower attachment for the guide rails.

### C. Lifting Chain

1. Equip pumps with Type 316 stainless steel chain of adequate strength and length to permit raising pumps for inspection and removal.

### D. Spare Parts

1. Provide the following spare parts for each pump model specified:
  - a. 1 one water entry cable with seal
  - b. Any special tools required for seal and for bearing installation/removal.
  - c. One complete set of any special tools required to dismantle pump.
  - d. Comply with Section 11000.

## 2.05 FABRICATION

### A. Factory Finishing

1. Apply manufacturer's standard coating system to the exterior of the pump casing and motor housing.
2. Protect all metallic surfaces coming into contact with wastewater except stainless steel and bronze by the coating system.

## 2.06 SOURCE QUALITY CONTROL

### A. Factory Testing

1. Test each pump for performance at the factory to determine head versus capacity at seven different points, efficiencies, and kilowatt draw required for the operating points that are specified.
2. All tests shall be run in accordance with the American Hydraulic Institute Level 1B Standards.
3. As a minimum, certified curves for pump head, capacity, efficiency, and break horsepower shall be provided.
4. Test logs and curves shall be submitted to the Engineer and shall be certified by an officer of the pump manufacturer as to the reliability of the data under penalty of perjury. Pump manufacturer shall certify NPSH required for each pump.
5. Include the following:
  - a. Hydrostatic test for each pump
  - b. Discharge connection testing
  - c. Check impeller, motor rating and electrical connections compliance with the specifications.
  - d. Test a motor and cable insulation for moisture content or insulation defects.
  - e. Prior to submergence, run each pump to establish correct rotation and mechanical integrity.
  - f. Run each pump for 30 minutes submerged, a minimum of 6 feet under water.
  - g. Run the pump for 30 minutes with the motor exposed to air.
  - h. After completing the operational test described above, repeat the insulation test.
6. Provide written report summarizing results of the tests and stating the tests have successfully been completed.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Align, connect, and install each pump in accordance with the manufacturer's written instructions.
- B. Connect discharge piping without imposing strain to pump flanges.
- C. The wet well prefabricated walls shall be affixed to the insert such that the assembled components are structurally integrated, resulting in a water tight vessel which is capable of withstanding the full hydrostatic head from the exterior of the wet well while the wet well is completely empty.
- D. Certify installation and initial operation of all components on Manufacturer's Installation Certification Form in Section 01999.

### **3.02 FIELD QUALITY CONTROL**

- A. Field quality control and inspections: as specified in Section 01450.
- B. Alignment: Test complete assemblies for correct rotation, proper alignment and connection.
- C. Corrective Actions: Replace or repair work to eliminate defects, deficiencies and irregularities.

### **3.03 MANUFACTURER'S FIELD SERVICES**

- A. Provide field inspection and instruction services by factory-trained service technician of the manufacturer as specified in Sections 01820 and 01825. The technician shall have at least two years' experience in operation and maintenance of the equipment and training. A resume for the technician shall be submitted. Services by a sales representative are not acceptable. Training shall be scheduled three weeks in advance. Training shall be conducted on a separate day from any startup activity.
  - 1. Provide minimum 2 visits of 8 hours, excluding travel time, to inspect and test initial operation, and make necessary adjustments including set-up, configuration and testing of the MAS711 units and displays.
  - 2. Provide minimum 1 visit of 4 hours, excluding travel time, to train operators in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided. Demonstrate the removal and installation of a pumping unit. Lifting equipment will be provided by the Contractor for this work. Include demonstration and training of the MAS711 system, display, configuration and monitoring capabilities.
- B. Complete and submit the following forms in Section 01999:
  - 1. Manufacturer's Installation Certification Form.
  - 2. Manufacturer's Instruction Certification Form.

### 3.04 DEMONSTRATION

- A. Perform a Functional Test in conformance with Section 01825. For the test use potable water supplied from the installed forcemain flushing connection.
- B. Perform an Operational Test in Conformance with Section 01825. For this test divert wastewater from the Riverfront Interceptor for a minimum of 8 hours. After a minimum of 8 hours of pumping wastewater stop diverting from the Riverfront Interceptor and pump a minimum of 500,000 gallons of potable water to flush the forcemain.
- C. Equipment Demonstration: Demonstrate to Owner and Engineer that the installed equipment functions in accordance with the specified requirements.

**END OF SECTION**

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## SECTION 13101

### LIGHTNING PROTECTION FOR RADIO EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes

1. This section includes lightning protection and grounding requirements for the radio equipment.

##### 1.02 SUBMITTALS

###### A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 13101.B01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

###### B. Product Data

1. Lightning arrester
2. Coax cable shield bonding jumper.
3. Antenna support supplemental grounding electrode system.

###### C. Quality Assurance/Control Submittals

1. Pursuant to Section 01330 – Submittal Procedures
2. Manufacturer's Instructions
  - a. Installation instructions for lightning arrester.
  - b. Installation instructions for coax shield bonding jumper.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. Lightning Protection J-Box (13101.B01).**

1. Lightning protection j-box shall be provided as shown on the Drawings.
2. Lightning protection j-box shall be type 304 stainless steel, NEMA 4X construction.
3. Lightning protection j-box door shall be continuous hinged with clamps.
4. Provide Hoffman model A-16H1208SSLP, or approved equal.

#### **B. PVC Conduit and Fittings (13101.P02).**

1. PVC conduit and fittings shall be provided as shown on the Drawings.
2. PVC conduit shall be rated for use with 90° C conductors.
3. PVC conduit shall be listed in accordance with UL651.
4. PVC conduit shall comply with NEMA Specification TC-2.
5. PVC conduit fittings shall be listed in accordance with UL514b.
6. PVC conduit fittings shall comply with NEMA Specification TC-3.
7. PVC conduit and fittings shall include inert modifiers to improve weatherability and minimize heat distortion.
8. PVC conduit and fittings shall be solvent cemented in accordance with instructions from the manufacturer.
9. Provide Carlon type Plus40, or approved equal.

#### **C. Grounding Conductors (13101.C45).**

1. Grounding conductors shall be #2 AWG minimum, stranded, bare copper.

#### **D. Supplemental Ground Rods (13101.R01).**

1. Supplemental ground rods shall be provided as shown on the Drawings.
2. Supplemental ground rods shall be solid copper. Copper electroplated steel ground rods are not acceptable.
3. Supplemental ground rods shall be 5/8-inch diameter minimum.
4. Supplemental ground rods shall be 10-foot length minimum.
5. Supplemental ground rods shall be: bonded to the lightning protection system with #2 AWG minimum, stranded, bare copper wire; bonded to the antenna support base if present; and bonded to the building grounding electrode system per NEC and Section 16060 – Grounding and Bonding.

#### **E. Lightning Arrester (13101.L01).**

1. The Lightning arrester shall be provided by the OWNER.

- F. **Antenna Cable Shield Ground Kit (13101.J01).**
1. The antenna cable shield ground kit shall be provided by the OWNER.
- G. **Copper Bar (13101.B30).**
1. Copper bar shall be provided as shown on the Drawings.
  2. Copper bar shall be drilled and tapped as shown on the Drawings.
  3. Provide 6" long x 3" wide x 1/4" thick copper bus bar.
- H. **Bolts (13101.B14).**
1. Bolts shall be provided as shown on the Drawings.
  2. Provide stainless steel, 3/8" diameter, 3/4" long, UNC threaded bolts.
- I. **Washers (13101.W01).**
1. Washers shall be provided as shown on the Drawings.
  2. Provide stainless steel, sized for use with 3/8" bolts, serrated Belleville type washers.
- J. **Standoff Insulators (13101.S78).**
1. Standoff insulators shall be provided as shown on the Drawings.
  2. Standoff insulators shall be rated for 2,500 lbs tensile strength, 3,000 in-lbs cantilever strength, 25,000 lbs compression strength, and 35 ft-lbs torque strength, minimum.
  3. Standoff insulators shall be UL-recognized in accordance with UL891.
  4. Standoff insulators shall be indoor voltage rated at 3200 volts.
  5. Standoff insulators shall be short time electrical strength rated at 51.4kV.
  6. Provide Rochling Glastic model 1872-1A, or approved equal.
- K. **Carriage Bolts (13101.C24).**
1. Carriage Bolts shall be provided as shown on the Drawings.
  2. Provide stainless steel, 3/8" diameter, 3/4" long, UNC threaded carriage bolts.
- L. **Welded Electrical Connections (13101.C10).**
1. Welded electrical connections shall be provided as shown on the Drawings.
  2. Welded electrical connections shall be made with materials and equipment manufactured by a single manufacturer for that purpose.
  3. Provide Cadweld type LJ for grounding conductor to copper bar connections, or approved equal.
  4. Provide Cadweld type GY for grounding conductor to supplemental ground rod connections, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. Conductors**

1. The grounding conductor shall be routed as indicated on the Drawings, to the building grounding electrode system in a non-metallic raceway and to the supplemental ground rods.

#### **B. Antenna Cable Shield Ground Kit**

1. The shield grounding kit shall be installed by the OWNER in the lightning protection junction box and shall be bonded to the copper bar as indicated in the drawings.
2. The antenna mast shall be bonded to a grounding electrode system as specified in the NEC.
3. Install according to manufacturers recommendations.

#### **C. Lightning Arrester**

1. The OWNER shall install according to the Drawings. The lightning arrester bracket shall be attached directly to the copper bar

#### **D. Lightning Protection J-Box.**

1. Install the lightning protection j-box as indicated on the drawings within 12 inches of finished grade.
2. The copper bar shall be installed on the inside of the box as shown in the Drawings.

#### **E. Connectors**

1. Secure ground lugs to equipment with grade 5 bolts and washers. Torque to manufacturer's recommendations.
2. Bond antenna support base with a # 2 AWG minimum copper wire to grounding electrode system.
3. The antenna support base shall be bonded to grounding electrode system the same day the antenna support base is erected.

#### **F. Supplemental Ground Rods**

1. Install according to manufacturers recommendations and the Drawings.

#### **G. Identification**

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.

**END OF SECTION**

## SECTION 13410

### BASIC MEASUREMENT AND CONTROL INSTRUMENTATION MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. This Section contains the basic materials and methods required to install the measurement and control instrumentation system.

##### 1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 13410.F30) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.

1. Pursuant to Section 01330 Submittal Procedures.
2. Provide product data on all components specified.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

A. **Insulated Wire Ferrules (13410.F30).**

1. Ferrules shall be plastic sleeved and insulated.
2. Ferrules shall be color coded per the DIN Standard.
3. Provide Weidmuller ferrules, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. CONTRACTOR shall install and connect junction boxes, termination boxes, control panels, field devices, etc. as shown on the Drawings.
- B. Conductor Terminations.
  - 1. Provide ferrules on all conductors terminating on terminal strips.
  - 2. Ferrules shall be installed with a tool supplied by the ferrule manufacturer design specifically for that purpose.
  - 3. No more than one conductor shall be terminated on each side of a terminal block unless specifically shown otherwise on the Drawings.
- C. Terminal Block Jumpers.
  - 1. When connecting adjacent terminal blocks in a terminal strip to provide for common potentials, pre-manufactured bridge type jumpers supplied by the terminal manufacturer shall be used. These jumpers screw into and connect adjacent terminal blocks at the center of the terminal blocks.
  - 2. Comb type jumper shall not be used.
  - 3. Jumpers fabricated from short lengths of wire shall not be used.
- D. Twisted Shielded Pair (TSP) Cable Preparation.
  - 1. Strip cable insulation back only to the extent necessary to separate the individual conductors for termination. The shield shall be removed up to the point where the cable insulation has been removed.
  - 2. Provide green heat shrink tubing on the full length of exposed drain wire from the point of termination back to where the cable insulation has been removed. The tubing shall be properly sized for the conductor and shall be shrunk after installation. Reference Section 16150 Wiring Connections for specification requirements for heat shrink tubing.
  - 3. The drain wire shall be grounded as indicated on the Drawings.
  - 4. Provide black heat shrink tubing at the point where the cable insulation has been removed. The tubing shall be 3 inches long and shall extend 1.5 inches up the insulation and 1.5 inches down the individual conductors. The tubing shall be properly sized for the cable and shrunk after installation. No part of the shield and no un-insulated part of the drain wire shall extend beyond this tubing. Reference Section 16150 Wiring Connections for specification requirements for heat shrink tubing.
- E. Equipment Grounding.
  - 1. Each control panel, terminal box and junction box shall have a single grounding point consisting of a grounding bus bar. All grounding conductors terminating within the enclosure shall terminate on the ground

bus. The ground bus bar shall be 100 percent copper with 10 percent spare opening for future use. Reference Section 16060 Grounding And Bonding for specification requirements for grounding bus bar.

- F. Conductor Splicing.
  - 1. Conductors shall be spliced on terminal blocks installed for this purpose.
  - 2. Conductors shall only be spliced where identified on the Drawings.
  - 3. No other splicing methods shall be approved without prior approval by the ENGINEER.
- G. Instrument and Control Device Mounting Brackets.
  - 1. The instrument/control device mounting bracket available from the manufacturer shall be provided and installed as directed unless a detail Drawing indicates a custom mounting bracket shall be provided.
- H. Terminal Block and Terminal Strip Identification.
  - 1. Terminal blocks shall be identified as shown on the Drawings. Identification shall be provided on both sides of the terminal block. The plastic identification inserts shall be machine printed and provided by the manufacturer of the terminal blocks.
  - 2. Terminal strips shall be identified as shown on the drawings.
- I. Identification
  - 1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.

### 3.02 FIELD QUALITY CONTROL

- A. Site Tests.
  - 1. Control and instrumentation related conductors shall be tested for resistance to ground through the use of an ohm meter and visual damage to the insulation. Grounded conductors (neutrals and negative conductors) shall be isolated from the grounding system before testing.
  - 2. High voltage “meggers” shall not be used.
  - 3. A conductor shall be replaced if the resistance reading is less than one meg-ohm.
  - 4. CONTRACTOR shall record the results of these tests on the Continuity Test Certification forms and submit them to the ENGINEER as specified in Section 16080 Electrical Testing.

**END OF SECTION**

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## SECTION 13420

### INSTRUMENTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes

1. This section includes the requirements pertaining to the measurement and control instruments.

##### 1.02 REFERENCES

A. American National Standards Institute (ANSI).

1. 51.1-1979 - (R1993) - Process Instrumentation Terminology.
2. 5.1-1984 - (R1992) - Instrumentation Symbols and Identification.

B. Instrumentation, Systems, and Automation Society (ISA).

1. 5.3-1983 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.

C. National Fire Protection Association (NFPA) 70 - National Electrical Code.

D. National Electrical Manufacturer's Association (NEMA).

1. 1-2000 - Industrial Control and Systems General Requirements.

E. Underwriters Laboratory (UL).

1. 508 - Industrial Control Equipment.
2. 3121-1 - Standard for Safety for Process Control Equipment.

##### 1.03 DEFINITIONS

A. Manufacturer's Representative - manufacturer's authorized employee of the service division.

##### 1.04 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 13420.F21) typewritten in the upper right hand corner of the

submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.

3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data

1. Pursuant to Section 01330 Submittal Procedures.
2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS

C. Quality Assurance/Control Submittals

1. Manufacturers' instructions for each item specified in PART 2 PRODUCTS.
  - a. Complete user manual including installation, wiring schematic, programming, calibration, communication, diagnostics, troubleshooting, recommended spare parts, and maintenance recommendations or requirements.

## 1.05 SEQUENCING

- A. CONTRACTOR shall not energize instrumentation until the completion of the continuity test certification and certification of installation by manufacturer's representative.

## 1.06 SYSTEM START UP, COMMISSIONING, AND OWNER'S TRAINING

- A. Pursuant to Section 13490 Measurement and Control Commissioning.

## PART 2 - PRODUCTS

### 2.01 EQUIPMENT

A. **Radar Level Sensor and Display (13420.L01).**

1. Radar level sensor shall be provided as shown on the Drawings with a display.
2. The pulsed time of flight radar transmitter shall operate at 26 GHz using 2-wire technology for level measurement and/or open channel flow measurement.
3. Accuracy shall be +/- 0.08" by application.
4. Maximum measurement distance shall be 0- 66 ft.

5. The radar output signal shall be 4-20 mA DC loop powered.
6. The radar unit shall be rated for IP66/68, NEMA4X/6P by application.
7. Transmitter housing shall conform to NEMA 4X classification.
8. Provide an Endress+Hauser RIA452 series remote transmitter for display of level, OWNER standard.
9. Provide an Endress+Hauser Micropilot, FMR20 series, model number FMR20-CBABNVCERPF \_\_, or approved equal.
  - a. CB Approval = CSA C/US NI CI.1 Div.1 Gr. A-D
  - b. A Power Supply; Output; Operation = 2-wire; 4-20 mA HART
  - c. BN Antenna; Max. Measuring Range = 80mm/3"; 20m liquid
  - d. VCE Process Connection Rear Side = Thread ASME MNPT1; FNPT 1/2" conduit connection.
  - e. RPF Process Connection Front Side = UNI slip on flange
  - f. \_\_ Cable Length = CONTRACTOR to determine lengths.

**B. Gauge Pressure Transmitter (13420.P43).**

1. Pressure transmitter shall be provided as shown on the Drawings.
2. Pressure transmitter shall be 24 VDC, loop powered.
3. The transmitter shall be a 2-wire, high-performance piezoresistive pressure transmitter with digital communications capabilities including 4-20 mA HART.
4. Measure capacitance changes in the sensor as pressure varies and produces a linear 4-20mA DC output proportional to the pressure. The unit shall have self-diagnostic capability and a non-volatile memory.
5. Pressure transmitter shall have a display that is integrally mounted, 4-line LCD scaled with engineering units.
6. Sensor shall be a piezoresistive, oil-filled element with metal process diaphragm.
7. The unit shall be rated for process temperature of minus 40°F to 275°F and an ambient environment of minus 40 degrees F to 185 degrees F.
8. Reference accuracy shall be +/- .15% of calibrated span including non-linearity hysteresis and non-reproducibility in accordance with IEC 60770. Total performance accuracy including non-linearity hysteresis and non-reproducibility in addition to thermal change of the zero point shall be +/- .2% URL.
9. Unit shall have ATEX, FM, CSA or IECEx approvals as required.
10. Provide Endress & Hauser Cerabar PMP51 transmitter model PMP51-CB12JD1PGFRLJA1+N2PK, or approved equal.

- a. CB Approval = CSA C/US XP Cl. I, II, Div. 1 Gr. B-G, Ex d
- b. 1 Output; Input = 4-20 mA HART
- c. 2 Display, Operation = LCD, push button on display
- d. J Housing = F31 Alu, glass window
- e. D Electrical Connection = Thread NPT ½ inch, IP66/68
- f. 1P Sensor Range = 150 psi gauge
- g. G Reference Accuracy = Standard.
- h. F Calibration = 0.5%
- i. RLJ Probe Connection = Thread ANSI MNPT1/2, 316L
- j. A Membrane Material = 316L
- k. 1 Fill Fluid = Silicone Oil
- l. N2 Accessory Mounted = 71345524 Block & Bleed manifold
- m. PK Accessory Enclosed = Mounting bracket B&B manifold

**C. Magnetic Flow Meter (13420.F50).**

1. Magnetic flow meter shall be provided as shown on the Drawings with a remote transmitter.
2. Provide a pair of ground rings for each meter installation. The ground rings shall be bonded to ground per the meter manufacturer's instructions.
3. Magnetic flow meters shall be FM approved non-incendive Class I, Division 1.
4. The meter body diameter shall be provided as shown on the Drawings. Meter body shall be flanged style with Class 150, A105, carbon steel flanges in accordance with ANSI B16.5.
5. The meter shall be equipped with a remote transmitter rated NEMA 4X and 120 volt AC input power. The transmitter shall display instantaneous flow rate and totalized flow. The meter shall be configured to permit the transmission of instantaneous flow rate over a 4-20mA DC output, provide a pulsed output for totalizing flow, all transmitted to the graphic data manager as shown on the drawings.
6. Magnetic flow meters shall indicate, totalize, and transmit flow information.
7. Magnetic flow meters shall use pulsed AC measurement technology. Pulsed DC measurement technology is not acceptable.
8. Magnetic flow meters shall include an auto-zero feature.
9. Magnetic flow meters shall compensate for eddy currents.
10. Magnetic flow meters shall be designed for bi-directional measurement of flow in a full pipe with fluid conductivity as low as 5 µS/cm, without preamplifiers.

11. The electromagnetic induction flow meter shall generate a voltage linearly proportional to flow for full-scale velocity settings from one to 33 feet per second. Standard accuracy of the pulse output shall be  $\pm 0.5\%$  of rate  $\pm 0.05\%$  of full scale (33 ft/s) for all meters.
12. The flow meter shall be equipped with “heartbeat technology” which allows the end user the ability to verify calibration with the equipment left in place with their staff.
13. All components of the flow meter, including meter tube, sensors and recorder/totalizer shall be products of a single manufacturer.
14. Magnetic flow meter flow tubes shall be factory assembled units comprised of a carbon steel spool piece and sensors.
  - a. Flow tube flanges shall be carbon steel, conforming to AWWA C110, and shall match the flange style of the piping to which they are connected.
  - b. Flow tubes shall be provided with stainless steel retention bolts.
  - c. Flow liner shall be polyurethane.
15. Magnetic flow meter sensors shall be solid state design, each with a pair of sensing electrodes, exciter coil, sensor reference coils, and internal grounding electrode.
  - a. Magnetic flow meters shall be provided with a minimum of two opposed sensors to distribute the magnetic field over the entire cross-sectional area of the flow tube, and to allow continued operation and flow sensing, with reduced accuracy, in the event of a single sensor failure.
  - b. Sensor grounding and sensing electrodes shall be stainless steel.
  - c. Sensors shall automatically compensate for media noise including: electrochemical effects; entrained magnetic particles; particulate impact on electrodes; frictional effects against electrodes; variable conductivity; and coated electrodes.
  - d. Sensor accuracy shall be unaffected by electrode coatings.
  - e. The meter shall incorporate a high impedance amplifier of 1012 ohms or greater, eliminating the effect of buildup on the electrodes. The meter shall utilize bipolar pulsed DC coil excitation with automatic coil-current fine tuning by the microcontroller to adjust the sensor current within a tolerance of  $\pm 100\text{mA}$ . The amplifier shall incorporate 3-stage signal processing to maintain system accuracy by the use of a 26 bit analog/digital converter. The first stage will adjust the common-mode rejection ratio to filter out noise. The second stage will incorporate an INTEGRATED AUTOZERO function, which compensates for any external interference signals and eliminates zero drift. Manual zero adjustments shall not be

required even at start-up. In stage three, the measuring signal will be amplified by an AUTOGAIN function, depending on the actual amplitude of the flow signal, to automatically increase the measurement resolution at various flow rates, providing a turndown of at least 1000:1. To further ensure the specified accuracy, the electronics shall automatically perform internal temperature drift compensation. Power consumption shall be no more than 15 VA, independent of meter size. Upon any power failure, the unit will retain all setup parameters and accumulated measurements internally in non-volatile memory. All units will be protected against voltage spikes from the power source by utilizing internal transient protection.

16. The magnetic flow meter transmitter shall be microprocessor based with integral electronics. The flow meter shall have a 2-line push-button display used for programming as well as for simultaneous display of flow rate and total flow in user-selectable engineering units, and readout of diagnostic error messages, selectable from 12 standard languages. The microprocessor shall safeguard against entering of invalid data for the particular meter size, and all programming parameters shall be access-code protected. The electronics shall include infinitely adjustable low flow cutoff.
  - a. Transmitter power supply shall be 24 VDC.
  - b. Transmitters shall be shielded or filtered from common RF noise effects including: radio transmissions; variable frequency drives; etc.
  - c. Transmitters shall be housed in a corrosion-resistant epoxy painted, cast aluminum, NEMA 4X (IP67) enclosure, suitable for conduit connections, and shall include a clear polycarbonate window to allow viewing of the display without opening the enclosure.
  - d. Transmitter operation, configuration, and calibration shall be via the keypad with visual prompts and built-in help at the LCD display.
  - e. The flow meter shall have the capability of being programmed remotely using HART/analog protocol.
  - f. Transmitter display shall indicate flow rate and/or total flow in user-selectable units of measure.
  - g. Transmitters shall include:
    - 1) Isolated, independently configurable 4-20 mA analog output. Response time shall be adjustable between 0.05 and 100 seconds.
    - 2) Configurable pulse output for volume units per pulse, or frequency proportional to flow rate. Frequency shall be adjustable up to 10kHz and pulse width shall be adjustable between 0.05 and 2 seconds.

- 3) Totalizers for forward, reverse, net, and gross total flow, with user-specified volume units.
  - 4) Independently configurable contact inputs, programmable for measured value suppression, totalizer reset, or error-message reset.
17. The meter shall be provided with a minimum of 0.5% calibration.
  18. The tests and the associated documentation will be able to be retained in an electronic format and convertible into a hard copy document compatible for customer review or printing. The technology is commonly referred to by the manufacturer as “Heartbeat Technology”. The data format will define all meter settings, ranges, fail-safes, and configuration detail to conform to these requirements. Sensor model, serial number, and test result will be identified for each verification in a date recorded format.
  19. The magnetic flow meter shall be an Endress+Hauser Proline Promag W 500 Series model number, Promag 5W5B4H-CNIBAD5DUA1KGA+AAEB, or approved equal.
    - a. CN Approval = CSA C/US NI CI.1 Div.2 gr. U
    - b. I Power Supply = 100-240VAC / 24 VAC/DC.
    - c. BA Output; Input = 4-20mA HART, Pulse/freq. output switch output.
    - d. D Housing = Polycarbonate.
    - e. 5 Cable, Remote Version = CONTRACTOR to determine lengths.
    - f. D Electrical Connection = Thread NPT ½ inch.
    - g. U Liner = Polyurethane.
    - h. A1K Process Conn. = 150, carbon steel, flange ASME B16.5
    - i. G Electrodes = 1.4435/316L Bullet Nose.
    - j. A Calibration = 0.5%
    - k. AA Operation Language Display = English
    - l. EB Application Package = Heartbeat Verification + Monitoring

**D. Float Switch Connection System (13420.F01)**

1. Float switch connection system shall be provided as shown on the Drawings.
2. Float switch connection system shall include a 4-port manifold to easily connect 1-4 float switches for level control applications.
3. Float switch connection system wiring shall be color coded to match colored caps on the manifold for easy identification.
4. Float switch connection system shall include float switches with quick release connections, rated for temporary submersion. Quick release

connections shall have dual seal design for improved protection against water ingress and corrosive gases.

5. Float switches shall be rated for 1 A, at 125 VAC.
6. Number of float switches shall be provided as shown on the Drawings.
7. Float switch connection system shall include sealing plugs for all unused ports on the 4-port manifold.
8. Float switch connection system shall include a manifold kit with a 6-position stainless steel hook bracket.
9. Provide Primex Kwikswitch 4-port manifold, model number 10539\_\_, or approved equal. CONTRACTOR to determine lengths of cable required.
10. Provide Primex Kwikswitch Float, N.C., 105395\_\_, or approved equal. CONTRACTOR to determine lengths of cable required.
11. Provide Primex Kwikswitch Sealing Plug, OWNER standard.

**E. Vault Intrusion Limit Switch (13420.H05).**

1. Limit switches for hatch lid applications shall be provided as shown on the Drawings.
2. Limit switch operation shall be clockwise or counter-clockwise depending on the application and the orientation of the limit switch.
3. Limit switch output shall be normally open or normally closed as shown on the Drawings, with normally open or normally closed output selected on the basis of providing fail-safe circuits.
4. Limit switch shall be rated for Class 1, Division 1, Group D, hazardous location applications.
5. Provide Microswitch model GSX-A42D5C1, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

**A. General**

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
2. Field wiring shall be installed according to the Drawings and manufacturer's instructions.
3. Wire and cable shall be connected from terminal to terminal without splices.
4. Wire and cable shall be arranged in a neat manner and securely supported in cable groups.
5. Wiring shall be protected from sharp edges and corners.



6. Float switches shall be installed as shown on the Drawings.
7. Transmitter connections shall be made using a terminal junction box, analog receptacles, and analog connectors as shown.
8. All equipment to be located as shown, and rigidly attached to walls or floor as shown or directed by Owner's Representative. Install all equipment in strict accordance with manufacturer's recommendations and in compliance with all rules and regulations of jurisdictions having authority. All work to be set plumb or level, as applicable, to be rigid and neat in appearance. Provide shop drawing of equipment and accessory layout and manufacturer's recommendations for installation and accessories before installing.
9. All piping shall be installed as shown on the plans or as directed by Owner's Representative.
10. All piping shall be supported as required to eliminate stresses on equipment including, but not limited to, the feed pump and chlorine tablet feeder.

### 3.02 ADJUSTING

- A. The Contractor shall furnish a representative of the manufacturer to perform inspection, startup and training services. The manufacturer's representative shall be experienced in the operation and maintenance of the equipment.
- B. The representative shall check the installation and supervise initial startup of the equipment. He shall certify that the installation is correct and that the equipment has operated satisfactorily.
- C. After the installation and operation of the equipment has been certified, the manufacturer's representative shall train the City's personnel in the proper operation and maintenance of the equipment.

**END OF SECTION**

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## SECTION 13430

### BOXES, CONTROL PANELS, AND CONTROL CENTERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes

1. This section contains the requirements pertaining to the construction and installation of the control panels.

##### 1.02 SUBMITTALS

###### A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 1630.H17) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

###### B. Product Data

1. Pursuant to Section 01330 Submittal Procedures.
2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.

###### C. Shop Drawings

1. Dimensional drawings showing the overall length, width, and height of the assembled control panel. Included on these drawings shall be the back panel layout of installed control devices showing part numbers, dimensions, nameplate text, and other details required for a complete assembly. The CONTRACTOR shall obtain the Drawings for the control panel layout and schematic from the ENGINEER. The CONTRACTOR shall modify the

Drawings as required for submittal and for as-built documentation. The CONTRACTOR shall not generate their own drawings.

2. For large control panel, physical properties, handling, mounting, shipping break point locations shall be shown in submittal drawings. This shall include total weight, lifting instructions, height, and floor space required.
3. Provide electrical schematic drawings that include: wiring details such as internal and field connection terminal block numbers; shielded wire termination requirements; grounding requirements; and wire colors. Show all required internal and external interlocking. Each drawing shall be circuit specific for the system submitted. No typical schematic drawings shall be submitted.
4. Drawings shall list the equipment number of the box, control panel, or center submitted.
5. Component designations shall match those shown on the Drawings.
6. Complete bills of materials shall be included with submittal.

### 1.03 QUALITY ASSURANCE

#### A. Qualifications

1. Equipment provided as part of this section shall be manufactured by a single licensed firm, regularly engaged in the design and manufacture of such equipment for a minimum of five years. The control panels shall have a UL508A listing. Components within control panels shall be listed in a manner consistent with UL508A requirements.

### 1.04 MAINTENANCE

- #### A. Manufacturer shall provide and list in the bill of materials the following spare parts.
1. One each of all power and control fuses provided in the assembled control panel/ center.
- #### B. Provide Operation and Maintenance Data and Manuals Pursuant to the Contract Documents.

## PART 2 - PRODUCTS

### 2.01 COMPONENTS

#### A. **Terminal Strip Identification Block (13430.T15).**

1. Provide a terminal strip identification block with a machine generated label to match those shown on the Drawings.
2. Provide a Phoenix Contact marker carrier model number UBE/D, or approved equal.

**B. Low Current Terminal Blocks (13430.T10).**

1. Low current terminal blocks shall be provided as shown on the Drawings and in all panels requiring low current field terminations. Provide accessories as required and as shown including, but not limited to end anchors, end barriers, bridge jumpers, terminal strip pre-printed markers and snap-in pre-printed terminal block markers.
2. Low current terminal blocks shall be used for electrical circuits rated at or less than 30 amps.
3. Low current terminal blocks shall mount on DIN rail.
4. Low current terminal blocks shall be supplied with all required accessories including end covers, fixed bridge bars, partition plates and end brackets.
5. Low current terminal blocks shall be supplied with machine printed terminal block and terminal strip identification numbers that match the approved submittals.
6. Low current terminal blocks shall be grey in color.
7. Low current terminal blocks shall be UL rated for up to 30 amps at 600 VAC.
8. Low current terminal blocks shall accept wires from 24 to 10 AWG for single conductor per termination.
9. Provide Phoenix Contact model UK5N, or approved equal.

**C. Grounding Terminal Blocks (13430.T60).**

1. Grounding terminal blocks shall be provided as shown on the Drawings and in all panels requiring field terminations.
2. Grounding terminal blocks shall be used for electrical circuits rated at or less than 30 amps.
3. Grounding terminal blocks shall mount on DIN rail.
4. Grounding terminal blocks shall be UL rated for a maximum of 30 amps and 600 VAC and to accept wires from 26 to 10 AWG for single conductor per termination.
5. Grounding terminal blocks shall be supplied with all required accessories including end covers, fixed bridge bars, partition plates and end brackets.
6. Low current terminal blocks shall be supplied with machine printed terminal block and terminal strip identification numbers that match the approved submittals.
7. Grounding terminal blocks shall be green / yellow in color.
8. Provide Phoenix Contact model USLKG5, or approved equal.

**D. Spiral Wrap (13430.W31).**

1. Spiral wrap shall be provided for all conductors and cable wire assemblies that cross hinges.
2. Provide Panduit, Thomas & Betts, or approved equal.

**E. Cable Ties (13430.W40).**

1. Cable Ties shall be provided as required for organizing and arranging conductors within boxes, control panels, and control centers.
2. Cable ties shall be UV resistant.
3. Cable ties shall be black in color.
4. Cable ties shall be installed using a tool from the cable tie manufacturer and specifically intended for use with the cable ties provided.
5. Provide Panduit, Thomas & Betts, or approved equal.

**F. DIN Mounting Rail (13430.D10).**

1. DIN Mounting Rail shall be provided as shown on the Drawings and in all panels requiring DIN mounting rail.
2. DIN mounting rails shall be made of steel, galvanized, and yellow chromated.
3. Provide Allen-Bradley model 199-DR1, or approved equal.

**G. Ground Bars (13430.G06).**

1. Ground bars shall be provided as shown on the Drawings.
2. Ground bars shall be low profile, “bus” type with set screw or pressure type connections and all copper construction.
3. Ground bars shall include sufficient termination points to accommodate all equipment grounding conductors as shown on the Drawings.
4. Ground bars shall include spare termination points to accommodate twenty (20) additional conductors sized, #14 through #8 AWG.
5. Provide Cutler-Hammer model GBK21, GE model TKG42, Square D model PK27GTA, or approved equal.

**H. Lighting Contactors (13430.L37).**

1. Lighting contactors shall be provided as shown on the Drawings.
2. Lighting contactors shall be rated for 20 amps at 240V AC.
3. Lighting contactor coils shall be 120V AC/60Hz.
4. Provide Allen-Bradley model 100L-C20ND4, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLERS**

- A. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
- B. CONTRACTOR shall install and connect junction boxes and control panels and to field devices as shown on the Drawings.
- C. For all conductors terminating on terminal strips, install crimp-on, insulated plastic sleeve ferrules on each wire. Install ferrules with a crimping tool provided by the ferrule manufacturer for that purpose.
- D. Individual conductors and cables shall be grouped together and routed through plastic wire ducts mounted on the backpanel surface.
- E. Bond each enclosure back-panel to the grounding electrode system with a # 8 AWG copper conductor.
- F. Where conductors and cables are routed in boxes or enclosures, they shall be neatly bundled with cable ties at intervals not to exceed 12 inches on center. The tension for the cable ties shall be set with a tool specifically made for this purpose and of the same manufacturer as the cable tie. Side cutters or other type tools shall not be used to cut the tail end of the cable tie. The CONTRACTOR shall only use the tool specifically made for this purpose and designed for use with the cable ties provided.

**END OF SECTION**

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## SECTION 13490

### MEASUREMENT AND CONTROL COMMISSIONING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes

1. The section includes the requirements pertaining to the checkout, calibration, and testing of the instrumentation provided as part of this project.
2. Supplement 13490 – A; Process Control Narrative.

##### 1.02 SYSTEM START UP, COMMISSIONING, AND OWNER'S TRAINING

###### A. General

1. CONTRACTOR shall conduct System Start Up, Commissioning and OWNER's Training pursuant to the general instructions in Sections 16001 - Commissioning, 16005 - Starting and Adjusting, and 16015 - Demonstration and Testing. CONTRACTOR shall follow the instructions given in each section which are specific to instrumentation and control of the station.

###### B. Checkout

1. After installation and connection work has been completed, CONTRACTOR shall verify the equipment is properly installed.
2. CONTRACTOR to verify the following
  - a. Polarity of electric power and signal connections.
  - b. Correct applied voltages to all equipment.
  - c. Required grounds are properly connected.
  - d. The integrity of all connections.
3. CONTRACTOR shall certify in writing each loop or system has been verified for proper installation.

###### C. Calibration

1. CONTRACTOR shall provide labor, tools, and equipment to calibrate each instrument in accordance with the manufacturer's specifications and instructions.
2. Analog instruments shall be calibrated and tested in place without removal.
3. Test equipment and instruments used to simulate inputs and read outputs shall be suitable for the purpose intended and shall be calibrated to accuracy greater than the required accuracy of the instrument being calibrated. Test

equipment shall have accuracy traceable to the National Bureau of Standards.

D. Analog Loop Tests

1. CONTRACTOR shall provide labor, tools, and equipment to field test, inspect and adjust each instrument installed under this contract to its specified performance requirement in accordance with manufacturer's specifications and instructions.
2. Instruments provided by CONTRACTOR which fails to meet any contract requirement or any published manufacturer performance specification for functional and operational parameters not specified in the contract, shall be repaired or replaced, at no cost to OWNER.
3. Each element of the analog loop shall be tested and exercised by the CONTRACTOR to demonstrate proper operation, first individually and then as a complete loop.
4. Each analog loop shall be tested to verify proper performance within specified accuracy tolerances.

E. System Testing

1. The CONTRACTOR shall notify the ENGINEER a minimum of 14 days in advance of the scheduled system testing.
2. System testing shall not commence until after approved acceptance of all wire, calibration, and loop tests.
3. All systems shall be tested prior to the beginning of plant operational testing.
4. Completion of system testing activities shall be documented by a certified report, including all test forms, with test data entered, furnished to ENGINEER.
5. System testing shall at a minimum demonstrate the following:
  - a. Each component of the system operates properly with all other components of the system.
  - b. Analog control loops operate in a stable manner.
  - c. Interlocks perform properly.
  - d. Control sequences perform properly.
6. System testing activities shall include the use of water to establish service conditions simulating normal final control element operating conditions in terms of applied process loads, operating ranges and environmental conditions.
7. Final control elements, control panels and supplementary equipment shall be tested under start up and steady state operating conditions to verify

proper and stable control is achieved using all control center and field mounted control circuits associated with each system.

8. Hardwired and software control circuit interlocks and alarms shall be operational.
9. Control of final control elements and supplementary equipment shall be tested using both manual and automatic control circuits.
10. Stable steady state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers, to eliminate oscillatory final control element operation.
11. CONTRACTOR shall submit to ENGINEER a copy of completed test reports specified in this Section and Section 16080 - Electrical Testing.

F. System Start Up

1. After system Calibration and Testing verification is complete, CONTRACTOR shall inform the ENGINEER in writing that the station controls are installed according to the Drawings and that the station is ready for Start Up.
2. When Start Up begins, the CONTRACTOR shall have his technicians available on site at all times during testing to aid the ENGINEER.
3. After ENGINEER has verified all installed control systems are operating properly, commissioning may commence.

G. Commissioning

1. CONTRACTOR shall then perform Commissioning as follows:
  - a. Operating the station for 14 consecutive days without a significant interruption with the exception of any interruption caused by training conducted during this time period.
  - b. The station shall be operated in every designed control mode including the operation of all equipment.
2. Should a significant interruption occur the fault causing the interruption shall be corrected by the CONTRACTOR and the Commissioning period of 14 consecutive days shall be restarted.

H. OWNER's Training

1. Coordinate with OWNER.

**PART 2 - PRODUCTS – NOT USED.**

**PART 3 - EXECUTION**

3.01 SUPPLEMENT 13490 – A; PROCESS CONTROL NARRATIVE.

**END OF SECTION**

## SUPPLEMENT 13490 – PROCESS CONTROL NARRATIVE

### PART 1 - DESCRIPTION

The Albany Wet Weather Lift Station pumps raw wastewater and infiltrated stormwater collected from the City's Riverfront Interceptor (RFI) from a diversion structure adjacent to the lift station. The station includes three submersible pumps, operating in a duty/standby configuration, with two pumps providing the design capacity and the third pump as a standby pump. The system pumps wastewater out into a new 30-in force main. Under normal conditions the pump station operates automatically, using operator-adjustable wetwell operating levels.

The diversion structure will consist of the following:

- High water alarm float
- Radar level sensor to monitor and transmit water level
- Actuated slide gates. One actuated slide gate will close to divert flow from the RFI into the wet well during high flows. The other actuated slide gate will be closed during low flows, preventing flow into the wet well, and maintaining flow in the RFI.

The lift station and associated valve vault will consist of the following:

- Three variable-speed pumps with two pumps on to supply the design flow, and the third pump will operate as a backup. The duty pumps will be alternated on each startup to maintain similar usage of the pumps.
- Three electromagnetic flow meters will be installed – one for each of the three discharge pipes. The flow meters will be installed vertically on the 16-inch pump discharge lines and will be used to measure the flow rate through the effluent force main.
- High water alarm float switch
- Low level alarm/pump off float
- Radar level sensor to monitor and transmit water level
- Check valves on each discharge line to prevent any backflow in the system
- Combination air release valves with associated isolation valves on each line to exhaust large quantities of air on start-up, to admit air on shut-down, and to release air continuously during operation.
- Pressure indicating transmitters on each of the pump discharge lines to monitor and transmit pump discharge pressure
- Isolation plug valves installed on each discharge line to provide isolation between the combined discharge header and upstream valves and equipment
- A sump and sump pump to drain residual amounts of wastewater and infiltrated water from the wet well when the lift station pumps are not running
- Provisions to install a temporary pipeline pigging station.

## **PART 2 - REQUIREMENTS**

Typical lift station operation will be in Auto mode. The pumps will operate based on the wet well water levels shown in the table below:

Level Setting	Elevation (feet)	Notes
Wetwell Rim Elevation	205.8	
High water alarm float	184	6-in above top of Interceptor
Divert to Lift Station	183.5	Top of Interceptor. Operator adjustable; measured in the diversion structure
Start Lag pump	183.0	Operator adjustable
Start Lead pump	182.5	Operator adjustable
Target Water Level	182.0	Operator adjustable
RFI invert at diversion structure (approximate)	181.0	
Stop Lag pump	181.0	Operator adjustable
Resume flow to RFI	181.0	Operator adjustable
Stop Lead pump	178.8	Operator adjustable
Low water level float	177.0	interlock with pumps to shut off at low level
Bottom of wet well	175.5	

1. In Auto the lead pump will start at low speed and ramp up to full speed as needed to maintain the Target Water Level.
2. The lag pump will start at low speed if the lead pump as full speed cannot maintain the target water level.
3. The Pump Operating Levels are as shown in the table above with preliminary level set points. Start Lead Pump, Start Lag Pump, Target Water Level, Stop Lead Pump and Stop Lag Pump are operator adjustable level set points
4. The local pump controls will include a Manual/Auto/Off (MAO) switch for each pump. In Manual mode pump speed can be set at the VFD.

## **PART 3 – RELATED DOCUMENTS**

- Albany Wet Weather Lift Station P&ID

#### **PART 4 – DEVICES, ALARMS, AND INTERLOCKS**

1. Level Sensor in the Wet Well

The signal from the level sensor will be transmitted to the existing programmable logic controller (PLC). When the pumps are in Auto the SCADA system will use water level to start and stop the pumps.

2. High Level Float

The High Level Float will send a high level alarm to the PLC and interlock with two of the pumps to operate at full speed at high level.

3. Low Level Float

The Low Level Float will be interlocked to the pumps and shut down all pumps at low level.

4. Pressure Indicating Transmitter

The pressure indicating transmitters will continually monitor and transmit the gauge pressure in each of the pump discharge lines to the existing PLC. A High pressure alarm will signal at an operator adjustable set point. Initial set point is 25 psi.

5. Flow Meter

The flow meters will monitor and transmit combined flow through the pump discharge pipes to the existing PLC. A low flow alarm will signal when one or both pumps are in operation and sustained flow is below an operator adjustable set point. Initial set point is 200 gpm.

#### **PART 5 – RECORDING**

The following data will be recorded for use by operations

- Pump on and off times
- Pump operating speed
- Pump discharge flow rate
- Total flow
- Pump discharge pressure
- Wet well level

**END OF SUPPLEMENT**

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## SECTION 15110.3

### POWERED VALVE OPERATORS AND OPERATOR APPURTENANCES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Powered operators for valves and operator appurtenances.
- B. Electric Actuator Schedule

Valve or Gate					Actuator			
Location	Type	Size, Inches	Service	Operating Press., PSI	Type <sup>(1)</sup>	Tag No.	Hazardous Area	Dwg Ref
Diversion Structure	Slide Gate	36	O/C	2.5	EMTI	MOV11	Yes NEMA 7	M102
Diversion Structure	Slide Gate	30	O/C	2.5	EMTI	MOV12	Yes NEMA 7	M102

<sup>(1)</sup> See Paragraph 3.04

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 – Submittals
  - 2. Section 01600 – Materials and Equipment
  - 3. Section 01782 – Operation Maintenance and Information
  - 4. Section 01785 – Warranties and Bonds
  - 5. Section 01820 – Training
  - 6. Section 01825 – Equipment and System Testing, Start-up and Demonstration
  - 7. Section 01999 – Reference Forms
  - 8. Section 11000 – General Requirements for Equipment

##### 1.03 DEFINITIONS

- A. For use in control valve schedules in other sections and in this section, powered operators are defined as follows:

Operator (OPSPEC) Type	Service	Definition
EMTI	Isolating	Electric motor multi-turn

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.

- B. Include the following items:
  - 1. Electrical power and control wiring diagrams for electric motor operators marked to show specific changes necessary for the supplied equipment. If no changes are required, the drawing shall be marked “No Changes Required.”
  - 2. Manufacturer’s catalog information and other data confirming conformance to design and material requirements.
  - 3. Operating and maintenance information specified in Section 01782.

#### 1.05 QUALITY ASSURANCE

##### A. Unit Responsibility

- 1. Assign unit responsibility, as specified in Section 11000, for equipment, accessories and appurtenances specified in this Section to the powered operator manufacturer. Extend this responsibility to include the gate or valve associated with the operator.

##### B. ISO 9001 Quality System

- 1. Compliance by pump manufacturer is required.
- 2. Submit documentation of compliance prepared by independent certification agency approved by International Organization for Standardization.
- 3. Do not ship equipment before compliance documentation review has been completed.

#### 1.06 PRODUCT SHIPMENT, PROTECTION, AND STORAGE

- A. Comply with Section 01600.

#### 1.07 WARRANTY

- A. Comply with Section 01785.

### **PART 2 - PRODUCTS**

#### 2.01 MANUFACTURERS

- A. One of the following:
  - 1. Rotork IQ series
  - 2. Or pre-approved equal, as defined by Section 01330.
- B. Modify equipment if necessary to comply with this Section.

#### 2.02 COMPONENTS

##### A. General

- 1. Size operators to produce an operating torque equal to 1.5 the maximum required valve operating torque under the specified flow conditions.

2. Actuator shall be non-intrusive (digital) and be able to interface with setting tool that Infrared (IR) and Bluetooth callable to aid with commissioning actuator.
3. On each valve body or operator cast the word “OPEN”, an arrow indicating the direction to open, and flow direction arrows.
4. Specific requirements for each type of powered operator are specified in OPSPEC sheets at the end of this Section.

B. Motor

1. Design specifically for valve or gate actuator service and be of totally enclosed, non-ventilated construction.
2. Suitable for use with 120V, single phase, 60 Hz power.
3. Provide low inertia, high torque design with NEMA Class F insulation resulting in class B temperature rise with a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque.
4. Embed thermostat for thermal protection in the motor end windings.
5. Minimum Size: As sized by the manufacturer for valve type and service conditions specified, but not more than the size listed in the Electric Actuator Schedule.
6. Motors for throttling (modulating) service shall be designed for 1200 start-per-hour (S4, Class C).
7. Electrical and mechanical disconnection of the motor shall be possible without draining the lubricant from the actuator gearcase.
8. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of the valve travel irrespective of the connection sequence of the power supply.

C. Motor Protection

1. Stall – the motor must be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed valve.
2. Over temperature – thermostat will cause tripping of the moto. Auto-reset on cooling
3. Single phasing – lost phase protection.
4. Direction – phase rotation correction.

D. Enclosures

1. Rate motor and all electrical enclosures for NEMA 6/IP68.
2. In hazardous areas such as the diversion structure, rate enclosures for both NEMA 6/IP68 and NEMA 7 Class 1 Div 1 Groups C and D.
3. Enclosure standard: double o-ring sealed to prevent moisture ingress through conduit entry.

4. Local control knobs shall not penetrate actuator housing.
- E. Gearing
1. Totally enclose the actuator gearing in an oil-filled gearcase suitable for operation at any angle.
  2. Manufacture all drive gearing and components of metal with an aluminum-bronze worm gear.
  3. For rising spindle valves provide a hollow output shaft to accept a rising stem, and incorporate fully enclosed ball bearings at the base of the actuator.
  4. Design to permit the opening of the gearcase for inspection or disassembly without releasing the stem thrust or taking the valve out of service.
- F. Torque Switch
1. Use solid-state non-contacting electronic means capable of displaying torque percentage on local LCD display.
    - a. For EMTI & EMTT actuators, shall use piezo type for torque sensing.
  2. Set point to be determined by valve manufacturer.
  3. Permit settings, adjustments, calibration, diagnostics, and datalog file extraction to be accomplished without opening any electrical compartment.
  4. Provide PC/PDA compatible software to allow the Owner to perform diagnostics, save operational history and save torque profiles.
- G. Manual Operator
1. Provide with a handwheel for manual operation.
  2. Design so handwheel does not rotate during motor operation and so a locked motor or locked gearing does not prevent manual operation.
  3. For rising stem valves and gates, do not share any gearing with the motor.
  4. Provide motor or manual selection using a positive lockable declutching lever which will disengage the motor and motor gearing mechanically but not electrically. Plastic declutch levers are not acceptable.
  5. Design to prevent simultaneous operation in manual and motor modes.
  6. Design to limit rim effort to 80 lbs of rim effort at maximum torque.
- H. Position Sensing and Remote Indication
1. Sense position without the use of switches via an absolute encoder with no more than four moving parts which has built in redundancy should one of the four parts fail in any way or a similar device. Display position on the LCD as open limit, closed limit, or 1-99% open in 1/10% increments.
  2. Provide a minimum of four software configurable indication contacts as shown in the OPSPEC sheets.

3. Local position display and indication contacts shall update even during loss of main power by the use of lithium-ion 9v battery. External control power shall not be necessary to achieve this.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General**

1. Locate operators so that they are readily accessible for operation and maintenance.
2. Mount for unobstructed access, but do not obstruct walkways.
3. Do not mount where shock or vibration will impair operation.
4. Do not attach support systems to handrails, process piping, or mechanical equipment.
5. Locate manual operating accessory, where possible, between 36" and 48" above the floor or a permanent work platform.

#### **B. Identification Tags**

1. Provide each powered operator with a 16-gage stainless steel identification tag.
2. Inscribe complete equipment number of the operator.
3. Characters: 1/4", die-stamped.
4. Securely attach to the operator in a readily visible location using stainless steel screws or wire.

#### **C. Electrical Power and Signal Wiring and Equipment**

1. Comply with Division 16.

### **3.02 MANUFACTURER'S FIELD SERVICES**

#### **A. Provide field inspection and instruction services by factory-trained service technician of the manufacturer as specified in Sections 01820. Services by a sales representative are not acceptable.**

1. Provide minimum one (1) visit of 8 hours, excluding travel time, to inspect and test initial operation, and make necessary adjustments.
2. Provide minimum one (1) visit of 4 hours, excluding travel time, to train plant operators.
3. Include one follow up training and troubleshooting session as specified in Section 01820.

#### **B. Complete and submit the following forms in Section 01999:**

1. Manufacturers Installation Certificate Form
2. Manufacturers Instruction Certificate Form

3.03 DEMONSTRATION

A. Comply with Section 01825.

3.04 OPERATOR SPECIFICATION (OPSPEC) SHEETS

A. The following OPSPEC sheets are included in this section: EMTI.

Operator Type	EMTI
Description:	Electric Multi-turn Isolation valve operator
Construction:	Rotork IQ, modified as necessary to provide the specified features and to meet the specified operating requirements. Where specified in the Electric Actuator Schedule, provide Rotork IQ with IB or IW gearbox
Controller:	Phase detecting combination starter in compliance with NEMA ICS, correcting backwards phase landing for motor protection.
Controls:	<ol style="list-style-type: none"> <li>1. Control power: Provide by an integral 120 volts AC, single-phase control transformer unless a separate power source is shown on the electrical drawings.</li> <li>2. Size transformer to operate at not more than 80% of rating with the connected load shown: Include protective secondary fusing.</li> <li>3. Provide with an integral control station.               <ol style="list-style-type: none"> <li>a. Include “Local/Stop/Remote” toggle switch and “Open/Close” toggle switch. “Local/Stop/Remote” shall accept standard 1/4” padlock to lock in either position.</li> <li>b. Momentary operation of the “OPEN” or “CLOSE” toggle: Causes the operator to drive the valve or gate to the appropriate limit. Software configuration shall allow push-to-run operation where desirable.</li> <li>c. Momentary operation of the “STOP” pushbutton: Causes the operator to stop.</li> <li>d. Provide terminals for remote “OPEN” and “CLOSE” pushbuttons.</li> </ol> </li> </ol>
Remote Valve Position/ Actuator Status indication:	<ol style="list-style-type: none"> <li>1. Provide at a minimum four contacts which can be selected to indicate any position of the valve or gate.               <ol style="list-style-type: none"> <li>a. Provide for the selection of a normally closed or open contact form.</li> <li>b. Maintain and update position indication during handwheel operation when all external power to the actuator is isolated.</li> <li>c. Rate at 5A, 120V AC, 30V DC.</li> </ol> </li> <li>2. As an alternative to providing valve position, configure so any of the contacts may be selected to signal one of the following:               <ol style="list-style-type: none"> <li>a. Valve opening, closing or moving</li> <li>b. Thermostat tripped, lost phase</li> <li>c. Motor tripped on torque in mid travel, motor stalled</li> <li>d. Remote selected</li> <li>e. Actuator being operated by handwheel</li> </ol> </li> </ol>

**END OF SECTION**

## SECTION 15111

### GATE VALVES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Resilient seated gate valves.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section:
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: Provide manufacturer's catalog data, weights, dimensions, and assembly drawings with materials of construction.
- C. Submit product data sheets including color for the coating material.
- D. Demonstration of Compliance with Referenced Standard:
  - 1. Testing records per Section 5 of AWWA C509.
  - 2. Affidavit of compliance with AWWA C509.

#### PART 2 - PRODUCTS

##### 2.01 RESILIENT SEATED GATE VALVES

- A. General Requirements:
  - 1. Use resilient seated type gate valves for valves 3-inches in nominal size and larger.
  - 2. Pressure Ratings:
    - a. Valves less than 16 inches in nominal size: 200 psi.
    - b. Valves 16-inch and larger: 150 psi.
  - 3. Type:
    - a. Exposed Gate Valves: Rising stem type with stem yoke.
    - b. Buried Gate Valves: Non-rising stem type.
    - c. Air/Vacuum Valve Assembly Gate Valve: Bevel Gear
- B. Manufacturers: One of the following, or equal:
  - 1. American Darling
  - 2. M&H / Kennedy Valve Company

3. Clow Corporation
  4. Mueller Company, 2362 Series.
  5. AVK
- C. Valve Design:
1. Body, Bonnet, and Wedge: Cast iron conforming to ASTM A126, Class B or ASTM A536 Ductile Iron.
  2. Wedge: Fully encapsulated with SBR rubber conforming to ASTM D5000 and meeting rubber-to-metal bond tests specified in ASTM D249.
  3. End Connections: Unless otherwise indicated on the Drawings, provide valves with the following end connections:
    - a. Exposed Gate Valves: Flanged ends conforming to ANSI B16.5.
    - b. Buried Gate Valves: Mechanical joint or push-on ends.
    - c. Air/Vacuum Valve Assembly Gate Valve: Flanged ends conforming to ANSI B16.5.
  4. Stem: Cast bronze with integral collars.
  5. Stem Packing:
    - a. Rising stem valves: Teflon braid packing in a stuffing box.
    - b. Non-rising stem valves: Provide with double or triple o-ring stem seals or with braided packing material.
  6. Operator Extension: As indicated on the Drawings.
- D. Valve Actuator:
1. Exposed Gate Valves: Provide valve with manual handwheel actuator unless a powered actuator is indicated on the Drawings. See D.3 for requirements for exposed valves for air/vacuum valve assemblies.
    - a. Valves 8-inch in Nominal Size and Larger: Provide geared type actuator.
  2. Buried Gate Valves: AWWA operating nut on a shaft that extends to within 6 inches below finished grade. Support shaft at 5-foot intervals with the last support just below the operating nut. Provide 42-inch long operating wrench.
  3. Air/Vacuum Valve Assembly Gate Valve: Provide valve with bevel gear open left and AWWA operating nut facing up. Provide operating wrench with extension shaft that allows wrench length to extend to 108-inches
  4. Operation: Counter clock-wise to open.
- E. Coating:
1. Coat interior and exterior of valve body and bonnet with fusion bonded epoxy.



- a. Fusion bonded epoxy: Complying with AWWA C550. Color as approved by the Owner.

## 2.02 METAL SEATED GATE VALVES

- A. Use metal seated type gate valves for valves less than 3-inches in nominal size.
- B. Gate Valves Smaller than 3 inches in Nominal Size:
  - 1. Non-rising stem type valve with bronze body, solids wedge disc, screw-in bonnet with PTFE packing.
  - 2. Pressure Rating: 125 psi.
  - 3. Valve Ends: Threaded in accordance with ASME B1.20.1.
  - 4. Coating: Standard factory finish.
- C. Manufacturers: One of the following or equal:
  - 1. Crane Company 1700 Series.
  - 2. Jenkins, Figure 47.
  - 3. Mueller H10914.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install valves in accordance with the manufacturer's recommendations.
- B. Provide a pipe union within 2 feet of each valve with threaded connections to facilitate removal.
- C. Repair damaged areas of epoxy coating in accordance with AWWA C550 such that coating is free of holidays and other defects.

**END OF SECTION**

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WEST YOST GUIDE SPECIFICATION

**SECTION 15115.1**  
**ECCENTRIC PLUG VALVES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Non-lubricated eccentric plug valves.

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section:
  - 1. Section 01330 – Submittals
  - 2. Section 01782 – Operation and Maintenance Information

1.03 UNIT RESPONSIBILITY

- A. Plug valve manufacturer has unit responsibility for valve and actuator compatibility.
- B. Responsibility of the manufacturer extends to the proper selection, assembly, factory testing, and furnishing of the specified products.

1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data: Submit Manufacturer’s standard product data.
- C. Applicable operating and maintenance information specified in Section 01782.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

- A. Manufacturers: One of the following or equal:
  - 1. DeZurik, Model PEC (reduced port) and PEF (full port).
  - 2. Clow Valve Company, Model F-5412 (flanged) or F-5413 (mechanical joint).

2.02 ECCENTRIC PLUG VALVES

- A. General
  - 1. Description: Non-lubricated, eccentric plug-type valve.
  - 2. Suitable for drip-tight, bi-directional shutoff at the specified valve design pressure.

3. Comply with ANSI/AWWA C517, Resilient-Seated Cast Iron Eccentric Plug Valves.
- B. Valve Design
1. Port Design
    - a. Rectangular shaped.
    - b. Port Area:
      - 1) Valves less than or equal to 16-inches in nominal size: At least 80 percent of the full pipe cross-sectional area (reduced port)
      - 2) Valves greater than 16-inches in nominal size: At least 100 percent of the full pipe cross-sectional area (full port)
  2. Plug Design:
    - a. Geometry: Eccentrically shaped with a cylindrical seating surface that is offset from the center of the plug shaft.
    - b. Facing:
      - 1) Encapsulate entire plug with resilient material.
      - 2) Bond between Resilient Facing and Metal Plug: Capable of withstanding 75-pound pull in accordance with ASTM D429, Method B.
  3. Valve Seats: Welded-in overlay of not less than 90 percent pure nickel to form a raised area at least 1/8-inch thick for contact with the plug facing. Machine seat after welding to provide a smooth surface.
  4. Shaft Bearing and Bottom Bearing:
    - a. Provide replaceable bearings in the upper and lower shaft trunnions.
    - b. Design: Sleeve-type, permanently lubricated.
  5. Shaft Seal: Chevron type packing seal, held in place with an adjustable gland follower. Valves using O-ring type shaft seals are not acceptable.
- C. Valve Body Pressure Ratings
1. Valves 12 inches in nominal size and smaller: 175 psi.
  2. Valves 14-inches through 36-inches in nominal size: 150 psi.
  3. Valves 42-inches through 54-inches in nominal size: 125 psi.
- D. End Connections
1. Valves 3 inches and Smaller: Threaded ends.
  2. Valves Larger than 3 inches:
    - a. Exposed Piping Systems: Flanged end connections with flange dimensions, facing and drilling conforming to ANSI B16.1, Class 125.

- b. Buried Piping Systems: Mechanical joint end connections conforming to ANSI A21.11/AWWA C606.

## 2.03 MATERIALS

### A. Materials of Construction

1. Body: Cast iron, ASTM A126, Class B.
2. Plug: Cast iron, ASTM A126, Class B, or cast iron ASTM A436 (Ni-resist), or ductile iron, ASTM A536.
3. Plug Facing: Neoprene or Buna-N.
4. Body Seats:
  - a. Valves less than 3 inches in nominal size: Cast iron, ASTM A126, Class B.
  - b. Valves 3 inches in nominal size and larger: Stainless steel, ASTM A276, Type 304 or nickel.
5. Stem Packing: Buna-N or PTFE.
6. Plug Bearings: Type 316 stainless steel.
7. Bolts, Studs, Nuts and Washers: Zinc plated in exposed installations, Type 316 stainless steel in buried installations.

### B. Shop Applied Interior and Exterior Coatings

1. Interior Surfaces: Apply two coats Ameron Amerlock 400, Kop Coat Carboline 890LT, or equal. Apply each coat to 4 to 5 mils thick.
2. Exterior Surfaces: Apply polyurethane coating system consisting of one coat primer, one intermediate coat of polyamide epoxy, and one final coat of polyurethane.
  - a. Primer and Intermediate Coats: Ameron Amerlock 400, Kop Coat Carboline 890LT, or equal. Apply each coat to 4 to 5 mils thick.
  - b. Finish Coat: Ameron Amercoat 450HS, Kop Coat Carboline 134HS, Tnemec Series 74 Semi-Gloss Endura-Shield, or equal. Apply 1.5 to 2 mills thick.

## 2.04 VALVE ACTUATORS

- A. Buried Service Valves: Provide valve with standard 2-inch AWWA wrench nut and valve box with lid to accommodate operating stem extension.
- B. Exposed Service Valves
  1. Valves 4 inches and Smaller: Provide with lever type manual operator.
  2. Valves Larger than 4 inches: Provide with totally enclosed worm gear actuator with handwheel operator.
- C. Provide adjustable stop on manual actuators.

- D. Size valve actuator components for the valve design pressure in accordance with AWWA C504. Size manual operators such that the torque that must be applied to the actuator to open the valve does not exceed 80 ft-lbs.
- E. Direction of Rotation: Counterclockwise for opening.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Clean interior of valve and valve end joints before installation.
- B. Use slings or chains placed around the valve body to lift valve or to lower valve into position. Do not place slings or chains through the port opening or use the mounted actuator for lifting.
- C. Valve Seat Positions
  - 1. Clean Water Installations: Install valve with the seat on the downstream side of the plug so that in the closed position the higher upstream pressure in the pipeline applies a seating head on the valve plug against the seat. Install valve with the plug stem in the horizontal position with the plug rotating upwards upon opening.
  - 2. Wastewater Installations and Installations with Entrained Suspended Solids:
    - a. Vertical Pipe Runs: Install valve with the seat on the top of the valve to prevent solids from packing into body cavity when shut.
    - b. Horizontal Pipe Runs: Install valve with the seat on the upstream side of the valve to prevent solids from packing in body cavity when shut. Install valve with the plug stem in the horizontal position with the plug rotating upwards upon opening.

### **END OF SECTION**

## SECTION 15117.1

### WASTEWATER COMBINATION AIR VALVES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Contractor furnished, installed, and tested wastewater combination air valves.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  - 1. Section 01330 - Submittals
  - 2. Section 15996 – Testing Pressure Pipe

##### 1.03 SUBMITTALS

- A. Comply with Section 01330 and submit a summary sheet for all combination air valves to be furnished for the project; indicate the size and orifice diameters for each.
- B. Provide product data sheets for each type of valve to be furnished.
- C. Submit product data sheets including color for the coating material.

##### 1.04 QUALITY ASSURANCE

- A. Valves shall conform to AWWA C512.
- B. Following installation, valves shall be tested per Paragraph 3.02.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. Combination air valves, including both single and dual body construction, shall have a small venting orifice to vent the accumulation of air and other gases with the line or system under pressure and shall have a large venting orifice to permit the release of air as the line is being filled or to relieve vacuum as the line is draining or if it is under negative pressure.
- B. The inlet and orifice sizes of air valves shall be as indicated.
  - 1. If the orifice sizes are not indicated, supplier shall propose an orifice size for each valve as part of the Shop Drawings.
- C. Valves shall be suitable for operating pressures up to 150 psi.
  - 1. If higher operating pressures are indicated, valves with higher pressure ratings shall be furnished as required by the operating pressures.

## 2.02 PROTECTIVE COATINGS

- A. Ferrous surfaces on the interior and exterior of all valves for wastewater service shall be abrasive blasted and coated with a minimum of 8 mils of Polyamine Epoxy per valve manufacturer.
1. Surface preparation for interior shall be a White Metal Blast Cleaning per SSPC-SP5.
  2. Surface preparation for exterior shall be a White Metal Blast Cleaning per SSPC-SP10.
- B. Coatings shall be applied by manufacturer prior to assembly of component parts.

## 2.03 MATERIALS

- A. Materials shall be as follows and selected to avoid galvanic corrosion between dissimilar metals.

1. 6-Inch Valves:

Body, cover	Cast iron, ASTM A 126, Grade B, or ASTM A 48, Class 35
Float	Stainless steel, ASTM A 240, Type 304
Seat	Buna-N or Type 316 stainless steel
Lever mechanism	Stainless steel, ASTM A 240, Type 304
Trim	Stainless steel, ASTM A 240, Type 304

2. 4-Inch Valves:

Body, cover	Ductile iron, ASTM A 536, Grade 65-45-12
Float	Stainless steel, ASTM A 240, Type 304
Seat	Buna-N or Type 316 stainless steel
Lever mechanism	Stainless steel, ASTM A 240, Type 304
Trim	Stainless steel, ASTM A 240, Type 304

- B. Seat washers and gaskets shall be designed to provide drop tight shutoff when valves are closed.

## 2.04 COMBINATION AIR VALVES

A. Wastewater Service

1. Elongated body that prevents contact of wastewater with the orifice and lever mechanisms.
2. APCO Series 440 in a single valve body with double orifice, or equal. For valves indicated in the Drawings, provide double-acting throttling device in the threaded outlet port of the valve.
3. Backwash accessories shall be furnished with each valve for wastewater service.



4. The accessories shall be furnished assembled to the valves, and consist of two inlet shutoff valves, two blowoff valves, two flushing valves, rubber hose and quick disconnect couplings.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install valves in strict accordance with manufacturer's recommendations.
- B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- C. Assemblies will be installed with a sanitary vent screen to the exhaust port of the valve, unless otherwise directed by the Engineer.
- D. Assemblies installed will have an isolation valve to permit future maintenance. Isolation valves installed above ground will have the capability to be locked out. Isolation valves installed below ground will be required to have a debris cap with a locking device.

#### **3.02 TESTING**

- A. Following installation, test each valve to demonstrate the intended operation, and zero leakage when closed.
- B. Test valves at the same time that the connecting pipelines are pressure tested. See Section 15996, for pressure testing requirements.
- C. Protect or isolate any parts whose pressure rating is less than the test pressure.

**END OF SECTION**

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**SECTION 15143**  
**DUCTILE IRON PIPE**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Ductile iron pipe, joints, fittings, gaskets, polyethylene encasement, and pipe lining and coating.

1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section.
  - 1. Section 01330 – Submittals
  - 2. Section 02320 – Trenching
  - 3. Section 15145 – Polyvinyl Chloride (PVC) Pipe
  - 4. Section 15996 – Testing Pressure Piping

1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Certifications
  - 1. Manufacturer’s certificates of compliance with the specified standards.
- C. Shop Drawings
  - 1. Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, connections to structures and joint thrust restraint details.
- D. Product Data
  - 1. Photographs, drawings, and descriptions of fittings, gaskets, couplings, grooving of pipe and fittings, pipe linings, and coatings.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 106.06.00 of the City of Albany Standard Construction Specifications.
- B. Block piping material for shipment, prevent damage to castings and linings.

- C. Carefully handle piping material during loading, unloading, and installation. Do not drop piping material from cars or trucks. Lower piping material by mechanical means. Do not drop or pound pipe to fit grade.
- D. Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C104. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.
- E. Protect gaskets and polyethylene encasement from long term exposure to sunlight.
- F. Store fittings and other accessories such that they do not accumulate and hold rainwater, dirt, and debris.

## **PART 2 - PRODUCTS**

### **2.01 DUCTILE IRON PIPE**

- A. Conforming to the City of Albany Standard Construction Specifications.
- B. Type: Conforming to AWWA C150 and AWWA C151. The minimum thickness class for all sizes of ductile iron pipe shall be Class 52. Ductile iron pipe that is to be threaded for flanges shall be Class 53.
- C. Manufacturer:
  - 1. US Pipe;
  - 2. Pacific States Cast Iron Pipe Co.;
  - 3. American
  - 4. McWane
  - 5. Griffin Ductile Iron Pipe
- D. Pipe Joints
  - 1. General Intent:
    - a. Use push-on type joints on buried pipe unless mechanical joints are specifically indicated on the Drawings. All ductile iron pipe joints shall be restrained.
    - b. Use restrained joints on buried piping on fittings that create a change in pipe size and on fittings that result in a change of direction, whether the change is in horizontal plane or a vertical plane.
    - c. Use flanged joints on all exposed pipes. Use flanged joints in buried situations only where flanged joints are specifically indicated on the Drawings and not without approval of the City Engineer.
    - d. Exposed Piping: Use factory-assembled pipe spools with flanges for exposed piping.
  - 2. Push-On Joints:
    - a. Conforming to 501.01.01A of the City of Albany Standard Construction Specifications.

3. Flanged Joints:
  - 1) Conforming to 501.01.01A of the City of Albany Standard Construction Specifications.
4. Restrained Mechanical Joints; all types:
  - a. Conforming to 501.01.01A of the City of Albany Standard Construction Specifications.
5. Restrained Mechanical Joints: Ductile Iron Fittings for joining Ductile Iron Pipe to ductile iron mechanical joint fittings:
  - a. Conforming to 501.01.01A of the City of Albany Standard Construction Specifications.
6. Restrained Mechanical Joints for joining C900 CIOD PVC pipe to ductile iron mechanical joint type ductile iron fittings:
  - a. Refer to Section 15145.

## 2.02 FITTINGS

- A. Conforming to 501.01.04 of the City of Albany Standard Construction Specifications.

## 2.03 GASKETS

- A. Conforming to 501.01.00 of the City of Albany Standard Construction Specifications.

## 2.04 PIPE LININGS AND COATINGS

- A. Asphaltic Base Coating
  1. Apply to outside surface of pipes which will not receive another coating. Apply in accordance with AWWA C151/ANSI A21.51.
- B. Cement-mortar Lining
  1. Apply mortar lining in accordance with AWWA C104 to interior surface of pipe unless un-lined pipe is specifically indicated on the Drawings or specified.
  2. Apply mortar to clean, bare metal surfaces, extended to faces of flanges, ends of spigots, and shoulders of hubs.

## 2.05 DUCTILE IRON PIPE APPURTENANCES

- A. Dismantling Joints
  1. Flange Spool: AWWA Class D Steel ring flange. Pipe is ASTM A36 plate.
  2. End Ring and Body: ASTM A36 steel.
  3. Gaskets: NBR made from rubber compounded for water and sewer service.
  4. Bolts and Nuts: Type 304 stainless steel conforming to ASTM A588.
  5. Pressure: Rated to 150 psi.
  6. Manufacturers: Romac Industries Inc., DJ400 or equal.

B. Lug-type Restrained Flange Adapters

1. Comply with 501.01.05 of the City of Albany Standard Construction Specifications.
2. Use lug type restrained flanged adapters when connecting flanged joints on pipe, fittings, or valves to straight pipe that has been cut to length in the field.
3. Material: Ductile iron conforming to ASTM A536.
4. Restraint Mechanism: Consists of multiple gripping wedges designed to maximize restraint capability. Use torque limiting actuating screws to insure proper initial set of gripping wedges. Restrained flange adapters using set screws are not acceptable.
5. The flange adapter shall be capable of deflection during assembly, or permit lengths of pipe to be field cut, to allow a minimum of 0.6” gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
6. Manufacturers: EBAA Iron Inc. Series 2100 Megaflange, or equal.

2.06 POLYETHYLENE ENCASEMENT

- A. Conforming to 501.01.07 of the City of Albany Standard Construction Specifications.

2.07 CATHODIC PROTECTION

- A. As shown on the Drawings.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. General

1. Install ductile iron piping in accordance with the City of Albany Standard Construction Specifications, AWWA C600, Section 02320, the manufacturer’s recommendations, and the Drawings.
2. Lay mechanical joint or bell and spigot pipe with 1/8-inch space between the spigot and shoulder of the pockets.

B. Polyethylene Encasement

1. Wrap ductile iron pipe, fittings, and valves to be buried with polyethylene encasement in accordance with ASTM A674 and AWWA C105.
2. Repair tears and make joints with two layers of plastic tape.
3. Wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe, and any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

4. Wrap at 2-foot intervals along the barrel of the pipe in accordance with manufacturer's requirements.
5. All bolts and restraining hardware shall be coated with bitumastic prior to encasement in the polyethylene bag.
6. Wrap fittings and valves with a flat sheet of polyethylene film by passing the sheet under the appurtenance and bringing the sheet around the body. Make seams by bringing the edges of the polyethylene sheet together, folding them over twice, and taping them. Tape the polyethylene securely in place at the valve stem, connections to pipe, and other penetrations.

### 3.02 FIELD QUALITY CONTROL

- A. Test ductile iron piping as specified in Section 15996.

**END OF SECTION**

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## SECTION 15145

### POLYVINYL CHLORIDE PIPE (AWWA C900-16)

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Polyvinyl chloride pipe manufactured in compliance with AWWA C900-16 sizes 4-inch through 60-inch.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this section:
  - 1. Section 01330 – Submittals
  - 2. Section 02511 – Utility Pipelines and Site Piping
  - 3. Section 15143 – Ductile Iron Pipe
  - 4. Section 15951 – Testing Gravity Flow Pipelines
  - 5. Section 15996 – Testing Pressure Pipe

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Product Data
  - 1. Manufacturer's product data for all materials proposed for use in the Work.
  - 2. Shop drawings showing detailed layout of pipe spools, spacers, adapters, connectors, fittings and pipe supports not indicated in the Contract Documents.
  - 3. Manufacturer's technical data and installation instructions.
  - 4. Manufacturer's certificate of compliance indicating that all materials provided under this Section meet the requirements of the Contract Documents.
- C. Test reports from:
  - 1. Hydrostatic proof testing
  - 2. Sustaining pressure testing
  - 3. Burst strength testing

## 1.05 DEFINITIONS

- A. Field joints: Joints between subsequent pipe pieces (does not include fitting joints).

## 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 106.06.00 of the City of Albany Standard Construction Specifications.
- B. Handling
  1. Use wide fabric choker slings.
  2. Do not drop pipe or fittings.
  3. Do not use hooks.
  4. Use extra care when handling and installing PVC pipe during cold weather due to reduced impact resistance.
- C. Storage
  1. Store in accordance with the manufacturer's requirements.
  2. Store pipe at the job site in unit packages provided by the manufacturer.
  3. Avoid compression, damage, or deformation to the pipe bells and barrels.
  4. Keep manufactures pipe supports and straps in place until just before installation.
  5. When unit packages of flexible pipe are stacked, insure that weight or upper units do not cause deformation to pipe in lower units.
  6. When long-term storage with exposure to direct sunlight is unavoidable, cover flexible pipe with an opaque material while permitting adequate air circulation above and around the pipe as necessary to prevent excessive heat accumulation.
  7. Do not store flexible pipe near heat sources or hot objects such as heaters, boilers, steam lines, engine exhaust, etc.
  8. Project gaskets from excessive exposure to heat and sunlight.
  9. Store and use lubricants in a manner that will avoid contamination.

## **PART 2 - MATERIALS**

### 2.01 PIPE

1. 4-inch diameter to 60-inch diameter in nominal size: Conform to AWWA C900-16, Pressure Class 165 with a dimension ratio (DR) of 25 unless otherwise indicated.
2. Pipe Materials: Manufactured from Class 12454A or 12454B virgin compounds as defined in ASTM D1784.

3. Outside Diameter of Pipe: Conform to outside diameter of cast iron pipe to allow connection directly into cast or ductile iron fittings without adapters.
4. Joint Design: Bell and spigot push-on, O-ring gasket, compression type conforming to ASTM D3139-98.
5. Gaskets: Elastomeric with solid cross section, conforming to the requirements of ASTM F477.
6. Pipe Lengths: Standard laying length of 20 feet. Shorter pipe lengths may be used in curved alignments to meet manufacturer's joint deflection limitations.
7. Color: Green.

## 2.02 FITTINGS

- A. Ductile iron conforming to Section 15143.

## 2.03 RESTRAINED JOINTS

- A. Restrain pipe by use of joint restraint devices installed as indicated or as necessary to restrain the pipe joint from coming apart due to internal pressure.
- B. Comply with Section 02511 and 15143.
- C. Field joints, 4-inch to 12-inch diameter pipe:
  1. Harness type joint restraint specifically designed for use with the specified pipe.
  2. Description: Two rings that clamp to the pipe which utilize machined teeth to grip the outside surface of the pipe and rods to connect the two rings to restrain the joint.
  3. Design and Materials
    - a. Restrainer Rings: Ductile iron conforming to ASTM A536, split ring with clamping lugs and bolts, serrated on inside face
    - b. Restraint rods: High strength, low alloy steel per AWWA C111.
    - c. Pressure Rating: 200 psi with a minimum safety factor of 2.
    - d. Coatings: manufacturer's standard.
  4. Manufacturers:
    - a. EBAA Iron, Series 1500.
    - b. Romac Industries, Style 611 Pipe Restraining System.
    - c. Or equal.
- D. Field joints, pipe larger diameter than 12 inches:
  1. Harness type joint restraint specifically designed for use with the specified pipe.

2. Design and Materials
    - a. Restrainer rings: Ductile iron or mild steel, split ring with clamping lugs and bolts, serrated on inside face.
    - b. Restraint rods: High strength, low alloy steel per AWWA C111. Pressure Rating: 200 psi with a minimum safety factor of 2.
    - c. Coatings: manufacturer's standard.
  3. Manufacturers:
    - a. Romac Industries, Style 470SJ,
    - b. EBAA Iron, Series 2800,
    - c. Or equal.
- E. Flexible Couplings
1. Design
    - a. Split restraint rings manufactured from ductile iron with gripping wedges that are tightened against the exterior surface of the pipe.
    - b. Incorporate tie bars into the harness that span the distance between the restraint rings and provide adequate clearance from the flexible coupling.
  2. Coatings: manufacturer's standard.
  3. Manufacturers: One of the following, or equal:
    - a. EBAA Iron, Series 1100HV (14-inch to 30-inch) or Series 1900 (12 -inch and less).
    - b. Romac Industries, Series 470 (14-inch to 24-inch) or Series 611 (12-inch and less).
- F. Pipe Fittings and Valves
1. Specifically designed for use with the specified PVC pipe.
  2. Designed as a mechanical joint follower gland for ductile iron fittings and valves with mechanical joint ends. Designed with multiple gripping wedges to grip the outside surface of the PVC pipe.
  3. Materials
    - a. Gland Body, Wedges and Wedge Actuating Devices: Ductile iron conforming to ASTM A536 steel.
    - b. Coatings: manufacturer's standard.
  4. Pressure Rating: 150 psi with a minimum safety factor of 2.
  5. Manufacturer:
    - a. EBAA Iron, Series 2000PV (3-inch through 36-inch)
    - b. Romac Industries, RomaGrip (3-inch through 24-inch)
    - c. Or equal.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Promptly remove PVC pipe with any of the following visual defects from the project site:
  - 1. Pipe that is sufficiently out-of-round to prohibit proper joining.
  - 2. Improperly formed ends.
  - 3. Fractured, cracked, chipped, dented or otherwise damaged pipe.
  - 4. Pipe that has been damaged during shipment or handling.

### **3.02 PREPARATION**

- A. Straight Pipe Runs: Cut pipe smooth, straight, and at right angles to the pipe axis with saws or pipe cutters designed specifically for the material.
- B. Remove any burrs and dust from the jointing surfaces.
- C. Bevel cut ends in accordance with manufacturer's recommendations.

### **3.03 INSTALLATION**

- A. Conform to AWWA C605 and the manufacturer's requirements for the installation of PVC pipe.
- B. Petroleum Tape Wrap all non-coated, buried hardware per Section 09960.

### **3.04 FIELD QUALITY CONTROL**

- A. Pressure test per Section 15951 and 15996.
- B. When testing is unsuccessful, remove defective pipe or make necessary corrections and re-test.
- C. Following successful testing, drain water from the pipe; secure both ends with caps and leave in place for future connection.

**END OF SECTION**

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## SECTION 15146

### HIGH DENSITY POLYETHYLENE (HDPE) PIPE (AWWA C906-15)

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. High density polyethylene (HDPE) pipe manufactured in compliance with AWWA C906-15.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section
  1. Section 01330 – Submittals
  2. Section 02320 – Trenching
  3. Section 15996 – Testing Pressure Piping

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Dimensional data for pipe and fittings.
- C. Pipe manufacturer's installation instructions.
- D. Joint design and connection details.
- E. Experience qualifications of individuals who will be butt fusing the pipe joints.
- F. Certified copies of physical and chemical test results for the materials to be provided.
- G. Provide a manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these specifications. The certificate shall state the specific resin used, its source, and list its compliance to these specifications.
- H. Provide a certification that the material is listed by the Plastics Pipe Institute in PPI TR-4 with a 73°F hydrostatic design stress rating of 1600 psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.
- I. Certification that stress regression testing has been performed on the specific product. Provide stress life curve in accordance with ASTM D2837.

- J. Certifications of tests: Submit a certified affidavit of compliance for pipe and other products or materials furnished under this Section. Expenses incurred in making samples for certification of tests shall be borne by the Contractor as part of the Work.
  - 1. Hydrostatic proof test reports.
  - 2. Sustained pressure test reports.
  - 3. Burst strength test reports.
  - 4. All data and recorded information from the data logger device.

#### 1.05 DESIGN CRITERIA

- A. HDPE Force Main: 32-inch nominal diameter, Iron Pipe Size, Dimension ratio (DR) 21 with a pressure rating of 100 psi minimum.

#### 1.06 QUALITY ASSURANCE PROGRAM

- A. Manufacturer shall have an approved in-house QA/QC program for compliance to the testing specifications and requirements of AWWA C906 for both pipe and fittings.
- B. Inspection: Pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein.
- C. Tests: Unless otherwise indicated or specified, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Section and in the referenced standards, as applicable.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 106.06.00 of the City of Albany Standard Construction Specifications and the manufacturer's recommendation.
- B. Delivery:
  - 1. Transport pipe larger than 3 inches to the jobsite on padded bunks with nylon tie-down straps or padded bonding to protect the pipe.
  - 2. Anchor pipe securely to prevent slippage.
  - 3. Protect the pipe from sharp objects. Cover pipe 100% with protective coverings or tarpaulins to prevent deposition of road salts, diesel smoke, fuel residue, and other contaminants in transit.
- C. Storage:
  - 1. Pipe shall be stored, if possible, at the Site in unit packages provided by the manufacturer. Store pipe on the job site in accordance with the pipe manufacturer's recommendations and on clean, level ground to prevent undue scratching or gouging.



2. Caution should be exercised to avoid compression damage or deformation to the pipe.
3. Pipe shall be stored in such a way as to prevent sagging or bending, and it shall be protected from exposure to direct sunlight by covering with an opaque material that allows adequate air circulation above and around the pipe.
4. Do not stack pipe in excess of that recommended by the manufacturer or 3 rows high, whichever is most stringent.
5. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

D. Handling:

1. Use care in handling storage and installation of the pipe so it is not damaged.
2. Before placing in position, clean pipe, fittings, and accessories, and maintain them in a clean condition. Precautions shall be taken to prevent foreign material from entering the pipe during installation.
3. Proper methods shall be used for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.
4. Hook lifting equipment, such as cranes, extension boom cranes, and side boom tractors, to wide web choker slings that are secured around the load or to lifting lugs on the component. Use only wide web slings. Do not use wire rope slings and chains which can damage components. Use spreader bars when lifting pipe or components longer than 20 feet.
5. Unload large fabrications using a wide web choker sling and lifting equipment such as an extension boom crane, crane, or lifting boom. Do not use stub outs, outlets, or fittings as lifting points, and avoid placing slings where they will bear against outlets or fittings.
6. Remove sections of pipe with cuts, gouges, or scratches that exceed allowable limits. Acceptable limits for cuts, gouges, or scratches are as follows:
  - a. Outer surface: maximum allowable depth of cut, scratch, or gouge shall be 5 percent of wall thickness.
  - b. Inner surface: shall be free of cuts, gouges, and/or scratches.
7. Inspect pipe, fittings and accessories carefully before and after installation and reject those found with defects.

## PART 2 - MATERIALS

### 2.01 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

#### A. HDPE Pipe

1. Type: High molecular weight, high density polyethylene pipe

2. 4-inch diameter to 65-inch diameter in nominal size: Conform to AWWA C906-15 pressure class 100 with a dimension ratio (DR) of 21 unless otherwise indicated.
3. Material
  - a. Commercial virgin PE compounds meeting ASTM D3350 physical property requirements and cell classification 345434C per ASTM D3350.
  - b. Material designation code PE4710 (PE3408).
    - 1) Listed by the Plastics Pipe Institute in PPI TR-4 with a 73°F hydrostatic design stress rating of 1600 psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.
  - c. Recycled compounds are not allowed except that generated in the manufacturer's own plant from resin of the same specification from the raw material pipe.
  - d. Hydrostatic Design basis (HDB) rating at 73-degrees F of 1600 psi determined in accordance with ASTM D2837 and PPI TR-3.
  - e. Homogenous throughout and free of visible cracks, bubbles, holes, foreign inclusions or other injurious defects.
  - f. Uniform in color, opacity, density, and other physical properties.
  - g. Produced to the dimensions and tolerances specified in ASTM F714.
  - h. Inside and outside surfaces: semi-matte or glossy in appearance.
  - i. Provide pipe with inside diameters equal to that determined for the nominal pipe size and DR specified. Wall thickness variability as measured and calculated according to ASTM D2122 in any diametrical cross section of the pipe shall not exceed 12 percent.

**B. Pipe Markings**

1. The following shall be printed on the pipe, spaced at intervals not exceeding five feet:
  - a. Manufacturer's name and/or trademark.
  - b. "AWWA C906" to affirm the product has been manufactured, inspected, sampled, and tested to meet AWWA requirements.
  - c. Nominal pipe size and OD base or custom size.
  - d. Dimension ratio or custom wall thickness
  - e. Standard materials designation code (such as PE4710) and 9-character cell class designation (such as PE 345464C).
  - f. Pressure Class (such as PC 100)
  - g. A production code from which the date and place of manufacture can be determined.

C. Fitting Markings

1. Each fitting shall be marked or labeled to include the following:
  - a. Manufacturer's name and/or trademark.
  - b. "AWWA C906" to affirm the product has been manufactured, inspected, sampled, and tested to meet AWWA requirements.
  - c. Nominal pipe size and OD base or custom size.
  - d. Dimension ratio or custom wall thickness.
  - e. Standard materials designation code (such as PE4710) and 9-character cell class designation (such as PE 345464C).
  - f. Pressure Class (such as PC 100)
  - g. A production code from which the date and place of manufacture can be determined.

2.02 JOINTS

- A. Thermal butt fusion performed in accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer.
- B. Transition mechanical joint adapters, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to connect HDPE pipe mechanically without butt fusion at elbows and tees. Flange adapters should be avoided, if possible. Use of HDPE flanges and flange adapters must be approved by the Engineer.

2.03 FLANGES

- A. HDPE Flange connections must be approved by the engineer. When approved, provide the following pipe flanges:
  1. HDPE with ductile iron backing rings in buried locations.
  2. Type 316 stainless steel backing rings in submerged locations.
- B. Nuts, washers, and bolts: Type 316 stainless steel.

2.04 FITTINGS

- A. Molded butt-type fittings shall meet the requirements of AWWA C906-15 and ASTM D3261. Thermoformed and fabricated fittings shall meet the requirements of AWWA C906-15 and ASTM F2206.
- B. Fittings shall be fully pressure rated by the manufacturer to provide a working pressure equal to the pipe for 50 years of service at 73°F with an included 2:1 safety factor.
- C. Manufacture the fittings from the same resin type, grade, and cell classification as the pipe. Fittings shall be homogeneous throughout and free from cracks, holes, foreign inclusions, voids, or other injurious defects.

- D. Dimensions and pressure class for fittings shall be consistent with the adjacent pipe.
- E. The fittings shall be as uniform as practicable in color, opacity, density and other physical properties. The minimum "quick-burst" strength of the fittings shall not be less than that of the pipe with which the fitting is to be used.

#### 2.05 TRANSITION MECHANICAL JOINT ADAPTER

- A. To join pipe of dissimilar materials, use a high-density polyethylene mechanical joint adapter.
- B. Gasket material shall be selected for the appropriate pressure rating. Gasket material and installation shall be per recommendations by the polyethylene pipe manufacturer.

### **PART 3 - EXECUTION**

#### 3.01 INSTALLATION

- A. Install HDPE pipe in accordance with AWWA M55, the manufacturer's recommendations, the requirements of the City of Albany Standard Construction Specifications and the requirements of this Section. Wherever the provisions of this Section and the requirements are in conflict, the more stringent provision shall apply.

#### 3.02 TRENCHING AND BACKFILL

- A. Excavate and backfill trench as shown on the Drawings and in accordance with Section 02320.

#### 3.03 BURIED PIPE INSTALLATION

- A. Grade pipe bed, taking care to avoid the formation of dips or low points. Pipe shall be supported uniformly and firmly at its proper elevation. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the soil, with recesses to accommodate joints and couplings.
- B. Laying of pipe when the conditions of the trench or weather are unsuitable is not allowed.
- C. Joints shall be installed according to manufacturer's recommendations. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.
- D. Temporarily close the open ends of the pipe with wood blocks or bulkheads at the end of the day.
- E. Carefully place and support pipe at the proper lines and grades.
- F. Slope to permit complete drainage to designated low points.
- G. Follow piping runs shown on the drawings as closely as possible, except for minor adjustments to avoid architectural and structural features.

- H. Major relocations require the approval of the Engineer.
- I. Set pipe flanges level, plumb, and aligned.
  - 1. Set flanged fittings true and perpendicular to the axis of the pipe.
  - 2. Bolt holes in flanges: straddle vertical centerline of pipe.
- J. Install piping without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.
- K. Provide locate balls per Section 02320.

#### 3.04 JOINT WELDING:

- A. Join sections of continuous length polyethylene pipe on the job site above ground.
- B. Join pipe using the thermal butt fusion method in strict accordance with the pipe manufacturer's recommendations.
- C. Use fusion equipment in the joining procedure capable of meeting conditions recommended by the pipe manufacturer, including, but not limited to:
  - 1. Fusion temperature.
  - 2. Alignment.
  - 3. Fusion pressure.
- D. Butt fusion joining:
  - 1. Conform to ASTM D2657 and pipe manufacturer's criteria for the type of joining.
  - 2. 100% efficient and provide a joint strength equal to or greater than that of the adjacent pipe.
- E. Fusion equipment operators:
  - 1. Technicians who have been certified by the pipe manufacturer,
  - 2. Have a minimum of two years of experience fusion welding pipelines of the diameters used in this project.

#### 3.05 FABRICATED FITTING INSTALLATION

- A. To avoid field damage, do not join large diameter (16-inch IPS and above) fabricated directional fittings, such as elbows, tees, wyes, and crosses, to more than one pipe before placement in the trench. Make the remaining outlet connections after placement in the trench with flanges, mechanical couplings, or electrofusion couplings. Perform butt fusion in the trench but place and remove the butt fusion machine in the trench such that the piping is not disturbed.

#### 3.06 FIELD QUALITY CONTROL

- A. Joint Butt Fusion Welding:

1. On every day that butt fusion joints are to be made, the first fusion of the day shall be a test. The test fusion shall be allowed to cool completely, then fusion test straps shall be cut out. Test strap length shall be 12-inches (min) or 30 times the wall thickness with the fused area in the center and width shall be 1-inch (min) or 1.5 times the wall thickness. The Contractor shall bend the test strap until the ends of the strap touch. If the test strap fails at the joint, the Contractor shall perform a new test to be cooled completely and bent as before. The Contractor shall not commence installation of pipe until a test fusion has passed the bent strap test.
  2. The fusion machine used in the joining of the pipe shall incorporate a data logging device that records information related to each individual joint for the construction of the entire pipeline. The recorded information shall include at least the date and time of the fusion, the employee ID of the machine operator, the machine ID, the machine model, the piston area, pipe material, pipe size, the interfacial pressures (including heat, soak, fuse, cool), recommended gauge pressures (including heat, soak, fuse, cool), drag pressure, data logger probe temperature, and the external probe temperature. All data and recorded information from the data logger device shall be submitted to the Engineer.
  3. Butt-fusion joining shall be 100-percent efficient, offering a joint weld strength equal to or greater than the tensile strength of the pipe. No other fusion method shall be used.
- B. Test HDPE piping as specified in Section 15996.

**END OF SECTION**

## SECTION 15805

### VENTILATION EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Work necessary to furnish and install ventilation fans, ductwork, and accessories as shown on the Plans and as specified herein.

##### 1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section
  - 1. Section 01330 – Submittals

##### 1.03 SUBMITTALS

- A. Submit manufacturer's catalog cut sheets, technical data, dimensional drawings, and application instructions in accordance with Section 01330.
- B. Submit operation and maintenance information.

##### 1.04 CODES, ORDINANCES, AND PERMITS

- A. Install work in accordance with the laws, ordinances, rules, and regulations of all local and State authorities having jurisdiction, and the rules and regulations of the National Board of Fire Underwriters, whether shown on the Plans or not. Electrical components shall be UL listed and labeled.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL REQUIREMENTS

- A. Propellers shall be constructed of fabricated aluminum and be statically and dynamically balanced.
- B. Motors shall be permanently lubricated, heavy duty type, carefully matched to the fan load.
- C. Motor drive frame assemblies and fan panels shall be galvanized or painted steel.
- D. Drive frame assemblies shall be welded wire or formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep formed inlet venturi.
- E. The axial exhaust shall bear the AMCA Certified Ratings Seals for both sound and air performance.

F. Fans shall comply with the following:

Equipment No.	Capacity, scfm	Static pressure, inch W.C.	Maximum fan speed, rpm	Motor HP, min	Drive Type	Sound, Sones Max	Operating Voltage/Phase
GC-168	166	0.2	1160	0.075	Direct	3.5	115/1

2.02 EXHAUST FAN (EF-1)

- A. Exhaust fans shall be Cook GC-168, or equal.
- B. Exhaust fan shall be complete with all necessary hardware for installation from rafters.
- C. Motor shall be EC type, Vari-Green or equal, with mounted potentiometer dial
- D. Provide UL/cUL 705 listing.
- E. Switch shall be NEMA-1, toggle, junction box mounted and wired
- F. Roof curb shall be Greenheck model GPIP, or equal, aluminum, capable of mounting on a pitched roof. Provide opening dimensions per manufacturer recommendations. Height of curb shall be 12-inches or as required. (no roof curb needed for this model since ceiling mounted. Update with roof exhaust venting when known).
- G. Fan and motor shall have one year warranty.

2.03 DUCTWORK AND MISCELLANEOUS ACCESSORIES

- A. Construction: Sheet metal ducts and plenums shall be constructed with airtight joints and seams in accordance with ASHRAE standards and SMACNA Duct Construction Manual.
- B. Joints on concealed ducts shall be taped with pressureless tape and adhesive, except welded or soldered joints.
- C. Ductwork materials shall be aluminum, unless otherwise indicated. Minimum duct gauges are as follows (unsure of how duct gauges change with GC-168):

Maximum Dimension of Duct, inches	Galvanized Steel U.S. Standard Gauge	Aluminum B and S Gauge
12 and less	24	22
13 through 30	20	18

- D. Supports for horizontal ducts and plenums shall be galvanized steel angles with hanger rods. Band iron straps shall be allowed for duct sizes recommended by SMACNA. Supports for vertical ducts shall be band iron strap or angle bracket type.
- E. Seismic Restraints: Duct supports and restraints shall be designed for static, dynamic, and seismic loads per the Oregon Building Code. Seismic restraints shall not induce stresses in the ductwork caused by thermal expansion and contraction.



- F. Diffusers, Grilles, and Registers: Supply air registers and diffusers, return air, and exhaust grilles of aluminum construction with smooth corners, flanges, and sponge rubber gaskets.

#### 2.04 ELECTRICAL/CONTROLS

- A. Exhaust Fans

- 1. With switch in “On” position, the fan shall operate continuously.

### **PART 3 - EXECUTION**

#### 3.01 GENERAL

- A. Install the ventilation equipment in accordance with the manufacturer’s installation instructions, and with recognized industry practices, to ensure the equipment complies with requirements and serves the intended purpose. See GEMINI IOM manual.

**END OF SECTION**

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## SECTION 15856

### LOUVERS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Stationary louvers and acoustic louvers
- B. Louver frames, flashing, bird and insect screens, and accessories.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section.
  - 1. Section 01330 – Submittals
  - 2. Section 01999 – Reference Forms
  - 3. Section 07600 – Flashing and Sheet Metal
  - 4. Section 07900 – Caulking and Sealants

##### 1.03 REFERENCES

- A. Air Movement and Control Association International, Inc.:
  - 1. AMCA 500- L - Test Methods for Louvers, Dampers, and Shutters.
- B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International:
  - 1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
  - 3. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
  - 4. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.
  - 5. ASTM E90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Complete Manufacturers Installation Certification (Section 01999).
- C. Shop Drawings:

1. Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, and frames.
- D. Product Data:
1. Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- E. Samples:
1. Submit two hard copy of the manufacturer's standard color charts in size illustrating finish and color of exterior and interior surfaces for preliminary color selection by the Owner.
  2. Submit a minimum of two physical samples of the finish colors on metal for final color selection.

#### 1.05 QUALIFICATIONS

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

#### 1.06 PERFORMANCE REQUIREMENTS

- A. Structural Design Criteria
1. Manufacturer shall design and furnish all supports required to withstand a wind force of not less than 25 pounds per square foot (100 mph). Louvers larger than 72-inches wide by 144-inches high or 144-inches wide by 72-inches high will be fabricated and installed in multiple sections.
  2. Louver blades, frames, mullions and anchorages shall be demonstrated to withstand the specified wind design load.
  3. Louvers shall be factory engineered to withstand the seismic loads indicated on the structural drawings. Minimum design loads shall be calculated to comply with ASCE – 7, and 2014 Oregon Structural Specialty Code.
- B. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.

#### 1.07 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.08 COORDINATION

- A. Coordinate Work with installation of aluminum window frame when installed in the window frame.

#### 1.09 WARRANTY

- A. Include coverage for degradation of fluoropolymer finish.

- B. Furnish minimum twenty-year manufacturer's finish warranty that covers premature failure of the coating including pitting, peeling, discoloration unrelated to environmental staining, cracking, color fading, chalking and failure to adhere to substrate.
  - 1. Chalking, fading or erosion of finish when measured by the following tests:
    - a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
    - b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.
    - c. Finish coating shall not erode at a rate in excess of 10%/ 5 year as determined by Florida test sample.

## **PART 2 - PRODUCTS**

### **2.01 WALL LOUVERS – FIXED STATIONARY STYLE**

- A. Manufacturers:
  - 1. Airolite Company, Model K609.
  - 2. Ruskin Company, Model ELF81S30.
  - 3. Or equal
- B. Louver Construction: Aluminum with fully welded assembly. Welds to be concealed from view.
- C. Louver Panel Thickness: 4 inches deep, face measurements.
- D. Louver Blade Design: Sloped between 30 and 45 degrees; baffle style.
- E. Blades and Frame: 0.081-inch thick aluminum minimum.
- F. Louver Free Area: 50 percent minimum.
- G. Water Penetration: Measured in accordance with AMCA Standard 500-L
  - 1. Beginning Point: 630 fpm.
  - 2. Air Volume Flow Rate at Beginning Point of Water Penetration: 5,000 cfm minimum.
  - 3. Pressure drop at Beginning Point of Water Penetration: 0.07 in H<sub>2</sub>O.

### **2.02 WALL LOUVERS – ACOUSTIC STATIONARY STYLE**

- A. Manufacturers:
  - 1. Airolite Company, Model T9106.
  - 2. Ruskin Company, Model ACL445.
  - 3. Or equal
- B. Louver Construction: Aluminum with fully welded assembly. Welds to be concealed from view.

- C. Louver Blade Design: Sloped between 30 and 45 degrees; baffle style.
- D. Aluminum Components:
  - 1. Frame:
    - a. Frame Depth: 4 inches minimum 6 inches maximum.
    - b. Wall Thickness: 0.100 inch nominal.
    - c. Material: Formed aluminum.
  - 2. Blades:
    - a. Interior Wall Thickness: 0.040 inch, nominal.
    - b. Interior Material: Perforated aluminum, covers insulation.
    - c. Exterior Wall Thickness: 0.081 inch, nominal.
    - d. Exterior Material: Formed aluminum.
  - 3. Acoustic Material: Fiberglass
- E. Louver Free Area: 30 percent minimum.
- F. Sound Data: Tested in accordance with ASTM E90.

Octave Band Frequency (Hz)	2/125	3/250	4/500	5/1000	6/2000	7/4000	8/8000
Free Field Noise Reduction (db)	11	9	11	15	17	16	16

- G. Water Penetration: Measured in accordance with AMCA Standard 500-L
  - 1. Beginning Point: 630 fpm
  - 2. Air Volume Flow Rate at Beginning Point of Water Penetration: 3,900 cfm minimum.
  - 3. Pressure drop at Beginning Point of Water Penetration: 0.06 in H<sub>2</sub>O.

2.03 COMPONENTS

- A. Aluminum: ASTM B209, 6063-T5 alloy, prefinished with shop applied fluoropolymer finish.
- B. Bird Screen: Interwoven wire mesh of aluminum, 1.6 mm diameter wire, 1/2-inch open weave, diagonal or square design.
- C. Insect Screen: 18x by16 aluminum mesh, set in aluminum frame.

2.04 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Flashings: Of same material as louver frame.
- C. Sealants: Type B-Polyurethane specified in Section 07900.

## 2.05 FABRICATION

- A. Fabrication: All components shall be fillet welded.
- B. Intermediate Mullions:
  - 1. Head and Sill Flashings: Roll formed or Extruded to required shape, single length in one piece for each location.
- C. Screens: Install screen mesh in shaped frame, reinforce corner construction.
- D. Finish: 70 percent PVDF.
- E. Finish shall be applied at 1.2 mil total dry film thickness.
- F. Coating shall conform to AAMA 2605. Apply coating following cleaning and pretreatment.
  - 1. Cleaning: AA-C12C42R1X.
- G. Standard 2-coat.
- H. Color: As selected from the manufacturer's standard color range.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify prepared openings and flashings are ready to receive.
- B. Work and opening dimensions are as indicated on shop drawings.

### 3.02 INSTALLATION

- A. Install louvers level and plumb.
- B. Install flashings in accordance with Section 07600.
- C. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louvers in opening framing with concealed fasteners.
- E. Install sealant at perimeter of louver on the exterior and interior sides.
- F. Install stainless steel bird and insect screen and frame to interior of louver. Screen shall be removable for cleaning.

### 3.03 CLEANING

- A. Clean surfaces and components.

### 3.04 SCHEDULES

- A. See Heating and Mixing Building 1 and Heating-Mixing Building 2 Elevations for location and size of louvers.

## END OF SECTION

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## SECTION 15951

### TESTING GRAVITY FLOW PIPELINES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Acceptance testing of gravity flow pipelines, including:
  - 1. Testing sanitary sewers and storm drains
  - 2. Leakage testing of manholes.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section:
  - 1. Section 01330 – Submittals

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Before testing begins and in adequate time to obtain approval through the submittal process, prepare and submit a test plan for review by the Engineer. Include testing procedures, methods, equipment, and tentative schedule.
- C. Submit test reports for each test on each segment of pipeline.

##### 1.05 SEQUENCE AND SCHEDULING

- A. Coordinate testing schedules with Engineer. Perform testing under observation of Engineer.

#### PART 2 - NOT USED

#### PART 3 - EXECUTION

##### 3.01 TESTING SANITARY SEWERS AND STORM DRAINS

- A. Test according to Section 401.02.13 of the City of Albany Standard Construction Specifications.

##### 3.02 LEAKAGE TESTING FOR MANHOLES

- A. After completion of manhole construction, wall sealing, or rehabilitation, test manholes for water tightness using hydrostatic or vacuum testing procedures.

1. New Manhole Construction: Conduct test prior to backfilling.
- B. Plug influent and effluent lines connected to manhole with suitably-sized pneumatic or mechanical plugs.
1. Utilize plugs that are properly rated for pressures required for test.
  2. Place plugs a minimum of 6 inches outside of manhole walls.
  3. When pipes connected to the manhole have not been backfilled, brace pipes to prevent dislodging from the manhole.

C. Vacuum Testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer’s instructions and safety precautions, inflate sealing element to the recommended maximum inflation pressure; do not over-inflate.
2. Evacuate manhole with vacuum pump to 10” mercury (Hg), disconnect pump, and monitor vacuum for the time period specified in table below.

Depth in Feet	Time in Seconds by Manhole Diameter		
	48”	60”	72”
4	10	13	16
8	20	36	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
(a)	5	6.5	8.0

(a) Add times for each additional 2-feet of manhole depth. (The values listed above have been extrapolated from ASTM C924-85).

3. If the drop in vacuum exceeds 1” Hg over the specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Hydrostatic testing:

1. Fill manhole with water to top of frame. Add water over a 24-hour period to compensate for absorption and evaporation losses. After 24 hours, refill to top of frame and observe for loss of water. If, after a 4-hour period the water level is reduced by more than 1/4”, the leakage shall be considered excessive. Contractor shall make necessary repairs and retest the manhole.
2. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test produce until satisfactory results are obtained.

**END OF SECTION**

## SECTION 15996

### TESTING PRESSURE PIPING

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Hydrostatic pressure pipeline testing.

##### 1.02 REFERENCED SECTIONS

- A. The following Sections are referenced in this Section:
  - 1. Section 01330 – Submittals
  - 2. Section 01999 – Reference Forms

##### 1.03 REFERENCES

- A. References in this Section to the City of Albany Standard Construction Specifications means the January 2018 edition as published by the City of Albany.

##### 1.04 SUBMITTALS

- A. Comply with Section 01330.
- B. Testing Schedule and Notification of Testing: Submit advance written notice of testing activities a minimum of 48 hours prior to conducting piping tests.
- C. Testing Plan: Submit a written plan that identifies the methods for water procurement, conveyance and disposal.
- D. Completed Pipe Test Record Form, found in Section 01999.

##### 1.05 TESTING REQUIREMENTS

- A. Furnish personnel, materials, bulkheads, test plugs, restraints, anchors, temporary connections, pumps, pressure gauges and other equipment needed to perform testing.
- B. Water for Testing
  - 1. Use potable water for pressure testing pipelines. Coordinate with the City Engineer to obtain potable water from the City system for pressure testing.
  - 2. Disposal:
    - a. Obtain approvals from the Oregon Department of Environmental Quality and other regulatory agencies to dispose of water in existing drainage ditches and other surface water features. Pay all costs to convey or transport water to the point of disposal.
    - b. Dispose of water used for testing pipelines in the sewer collection system or per Paragraph 1.05.B.2.a above.

- C. Test only those portions of the pipe that have been installed as part of this Contract.
  - 1. Test new pipe sections prior to making final connection to existing piping.
  - 2. Install test plugs or bulkheads to isolate new piping systems.
  - 3. Unless otherwise indicated, valves may not be used to isolate portions of the piping system for purposes of testing. When testing against a valve is indicated or approved by the Owner, provide a test plate “pancake” to further isolate the new and existing piping.
- D. Sequence
  - 1. Buried Pressure Piping: Except as otherwise indicated, conduct piping pressure test after trench has been backfilled to subgrade and compacted. Piping may be tested before or after final paving, at Contractor’s option.
  - 2. Encased Piping: Test before encasing pipe in concrete.
- E. Failed Tests: Make necessary corrections or remove defective pipe or defective appurtenances. Repeat pressure test until a successful test is achieved.

**PART 2 - (NOT USED)**

**PART 3 - EXECUTION**

3.01 GENERAL

- A. Comply with Section 505.01.00 of the City of Albany Standard Construction Specifications as modified herein.
- B. Test pipelines, appurtenances, hydrants, and valves and fittings in the pipeline system.
- C. Depending on the diameter, length, and number of appurtenances that comprise the new water line, the City may require the water line be tested for acceptance in sections rather than in its entirety. New valves shall be tested in the closed position against test pressure at some point during acceptance testing. The City Engineer will monitor all final testing of the completed system.
- D. Perform testing operations in the presence of the City Engineer. The contractor shall be reasonably sure the system will pass the required testing prior to scheduling an appointment with the City Engineer to witness testing.
- E. Prior to pressure testing, clean pipeline of debris, construction materials, dirt and other foreign material within the piping system.
- F. Backfill shall be in place and compaction requirements satisfactorily met and approved by the City Engineer prior to conducting final pressure and leakage testing.
- G. Do not test pipelines until thrust restraint devices have been installed. Concrete thrust blocking required for any reach of pipe shall be allowed a minimum of five days cure time prior to pressure testing. If high-early concrete is used, the time may be reduced to two days.

- H. The leakage test shall be conducted concurrently with the pressure test. The contractor shall furnish all necessary apparatus and shall conduct the test.
- I. Testing equipment shall be set up in a manner that will ensure an accurate method of measurement for the amount of water required to maintain the specified test pressure for the duration of the test.
- J. After testing has been completed, drain test water from pipelines to an approved location and leave in clean condition.

### 3.02 FILLING PIPING SYSTEMS WITH WATER

- A. Place temporary bulkheads in the pipe at the ends of the test section, and then slowly fill the pipeline with water at a rate which does not cause surges or exceed the rate at which the air can be released through the air valves.
- B. Ascertain that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe.
- C. Purge air within the pipeline during the filling operation. Check proper operation of air release valves and air vents during the filling operation to ascertain proper operation and venting of air from the pipeline.

### 3.03 PRESSURE TESTING EXPOSED PIPING

- A. Test exposed piping as follows:
  1. Fill section of piping under test with water and raise the system pressure to a test pressure of 150 psi.
  2. Visually inspect exposed pipe joints, joints at fittings, valves, hydrants, and other piping appurtenances for leaks.
  3. Correct leakage as necessary to eliminate the leakage.
  4. Duration of Pressure Test: 2 hours.
  5. Leakage Allowances: Zero leakage.
  6. Correct any visible leakage by tightening flanges and screwed joints, replacing gaskets or removing defective materials.
  7. Repeat test until no leakage is observed.
  8. Record results of pressure test on Pipe Test Record form, included in Section 01999.

### 3.04 PRESSURE TESTING BURIED PIPING-NON-HDPE

- A. For pressure testing of HDPE pipe, See Paragraph 3.05. For other buried pipe materials, pressure test as follows:
  1. Pressure test in compliance with the City of Albany Standard Construction Specifications.

2. Fill section of piping under test with water and raise the system pressure to a test pressure of 150 psi. The test pressure shall not be allowed to drop below 150 psi for the duration of the test. If the test pressure drops below 150 psi at any time, the test will be void.
3. The test pressure shall be calculated for the point of highest elevation of the water line but shall not exceed 200 psi at any point.
4. Visually inspect exposed pipe joints, joints at fittings, valves, hydrants, and other piping appurtenances for leaks.
5. Correct visible leaks necessary to eliminate the leakage. The use of bell repair clamps or other similar devices to stop leaks due to defective materials or poor workmanship will not be permitted.
6. Duration of Pressure Test: 2 hours.
7. Leakage Measurement:
  - a. Begin test once visible leaks have been eliminated.
  - b. Maintain test pressure during the test period by adding makeup water to a calibrated test reservoir.
  - c. Accurately measure the volume of makeup water introduced into the pipeline to maintain the test pressure to determine the leakage rate for the test.

The pipeline pressure test is successful when the makeup water added during the test is equal to or less than the allowable leakage rate (L) defined below:

8. Gasketed Ductile Iron Pipe (mechanical or push-on joint)

$$L = \frac{SD(P)^{1/2}}{148,000}$$

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Test pressure in pounds per square inch gauge.

9. Polyvinyl Chloride (PCV) pipe:

$$L = \frac{ND(P)^{1/2}}{7,400}$$

L = Allowable leakage in gallons per hour.

N = Number of joints in the length of pipeline to be tested.

D = Nominal diameter of the piping in inches.

P = Test pressure in pounds per square inch gauge.

10. Record results of pressure test on Pipe Test Record form, included in Section 01999.

### 3.05 PRESSURE TESTING HDPE PIPING

#### A. Pressure test as follows:

1. Tests should be conducted in accordance with Chapter 9 of AWWA M55 and the following:
  - a. HDPE and DI pipes shall be pressure tested separately before tie-in connections. All tie-in joints between HDPE and DI pipe shall be visually inspected at working pressure. Leaks at joints shall be repaired and re-inspected. Test all HDPE water mains and appurtenances including HDPE to DI transition fittings under a hydrostatic pressure equal to 150 psi.
  - b. The Contractor shall schedule pressure testing such that pressure changes due to thermal expansion or contraction of the pipe during the test period is minimized.
  - c. Fill section of piping under test completely. The test section is usually filled from the lowest point of the pipeline and at a slow fill rate to minimize air entrainment. After filling, allow time for the system to reach thermal equilibrium and allow for any dissolved air to exit the system air vents.
  - d. Gradually pressurize the test section to 150 psi and add make-up water as necessary to maintain pressure in the pipeline within 5 psi of the test pressure for a period of four (4) hours. During this initial expansion phase, polyethylene pipe will expand slightly due to elasticity and Poisson effects. Additional test liquid will be required to maintain pressure. The amount of additional test liquid will vary because expansion in the PE pipe is not linear.
  - e. If test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open valving, or the pressurizing equipment may be inadequate for the size of the test section. If such faults exist, discontinue pressurizing and correct them before continuing.
  - f. Immediately following the initial expansion phase, reduce test pressure by 10 psi and stop adding test liquid. Monitor the pressure for 1 hour.
  - g. If no visual leakage is observed and test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is indicated.
  - h. Under no circumstances should the total time for initial pressurization and time at test pressure exceed eight hours at 1.5 times the system pressure rating. If the test is not complete because of leakage, equipment failure, or any other reason within this total time, the test section should be depressurized and allowed to “relax” for at least eight hours before starting the next testing sequence.

- i. Record results of pressure test on Pipe Test Record form, included in Section 01999.

**END OF SECTION**



## SECTION 16000

### GENERAL PROVISIONS

#### PART 1 - GENERAL

##### 1.01 PERMITS, FEES AND SERVICE CHARGES

- A. The CONTRACTOR shall obtain all electrical permits required to complete the work and pay all associated fees.
- B. The CONTRACTOR shall coordinate and provide for the installation and operation of franchise utility service (including any telephone and/or leased lines specified) as required during construction, startup, testing, and operation of the work until substantial completion.

##### 1.02 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. Riser and other diagrams are schematic and are intended to show the approximate location of equipment, and the general alignment of conduits and piping, and shall not be used for obtaining quantities. Dimensions given on the plans shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.
- B. The electrical drawings do not show complete details of the site conditions. The CONTRACTOR shall check actual conditions.
- C. The exact location of apparatus, fixtures, equipment, conduit and piping shall be ascertained by the CONTRACTOR in the field, and the work shall be laid out accordingly. Should the CONTRACTOR fail to ascertain such locations or coordinate with work performed by other trades, the work shall be changed at no additional cost to the OWNER when so ordered by the ENGINEER. The ENGINEER reserves the right to make minor changes in the location of conduit, piping and equipment up to the time of installation without additional cost to OWNER.
- D. CONTRACTOR shall provide all labor, materials, equipment, machinery, and tools necessary to provide all electrical equipment specified and shown on the Drawings. All items not specified in detail or shown on the Drawings but necessary for complete installation shall be provided by the CONTRACTOR.

##### 1.03 SUBMITTALS

- A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.

2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16000.A01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Submittals shall be in accordance with the requirements of these Contract Documents and shall include the following:
1. Submittals shall include information and literature as required for all equipment and materials provided under this and related sections.
  2. Shop Drawings: Shop drawings shall include the following along with any special requirements listed in the individual Specification Sections:
    - a. Installation instructions and drawings
    - b. Wiring schematics with termination point identification
    - c. Motor information
    - d. Materials of construction
    - e. Manufacturer's name and model
    - f. Manufacturer's catalog data
    - g. Supplementary structural framing for electrical equipment including design loads, member size and location. When supplementary framing is indicated, verify that dimensions are suitable for the equipment furnished. Provide additional strength when equipment furnished is heavier than that specified.
  3. Manufacturers' Literature: Literature indicating the compliance of the products with the Specifications shall be included with all submittals. This shall include catalogs and other descriptive bulletins. Relevant portions of the literature shall be clearly identified by highlighting or underlining.
  4. Test Logs: The CONTRACTOR shall submit test logs as outlined below and as specified in subsequent electrical sections and drawings.
    - a. A log of the complete results of tests for shorts and grounds for each circuit. All circuits and tests shall be clearly identified.
    - b. A log of complete results of insulation resistance measurements of each circuit. All circuits and tests shall be clearly identified.
  5. Operation and maintenance information for all equipment furnished and/or installed.

6. Programming instructions for any controllers or other programmable equipment. Copies of the any required software, including registration cards, shall be provided with the O&M manuals.
- C. The CONTRACTOR shall indicate on the submittals all variances from the Specifications.
- D. Record Drawings. After the completion of construction, the CONTRACTOR shall provide one set of “as-built” drawings to the ENGINEER as specified herein showing the location of buried conduits and all changes or deviations from the original drawings.
- E. After the completion of construction, a printout and electronic copy of any programming and/or set-points for controllers, PLCs, meters or other programmable equipment, including VFDs.
- F. Final inspection certificates shall be submitted prior to final payment.

#### 1.04 COORDINATION OF WORK

- A. The CONTRACTOR shall plan his work in coordination with the other trades and with the power and telephone utility authorities.
- B. The CONTRACTOR shall field verify all dimensions of equipment to be installed or provided by others so that correct clearances and connections may be made between the work installed by the CONTRACTOR and equipment installed or provided by others.
- C. The CONTRACTOR shall arrange all conduit runs so that they do not interfere with piping, structural members, etc.
- D. All working measurements shall be taken from the sites, checked with those shown on the drawings, and if they conflict, reported to the ENGINEER at once, and before proceeding with the work. Should the CONTRACTOR fail to comply with this procedure, he shall alter his work at his own expense as directed by the ENGINEER.
- E. No additional payments will be allowed where obstructions in the work of other trades, or work under this contract requires offsets to conduit runs.
- F. The CONTRACTOR is responsible for all alterations in the work to accommodate equipment differing in dimensions or other characteristics from that shown or specified.
- G. The CONTRACTOR shall provide all temporary power necessary for existing site equipment and for all construction needs.

#### 1.05 SUPERVISION

- A. The CONTRACTOR shall maintain adequate supervision of the work and shall have a responsible person in charge at the site during all times that work under this contract is in progress, or when necessary for coordination with other work.

## 1.06 CODES

- A. Work shall conform to the National Electrical Code (NEC), and State Codes and other applicable codes, even though not specifically mentioned for each item. These shall be regarded as the minimum standard of quality for materials and workmanship.

## 1.07 CONTRACTOR'S RECORD DRAWINGS & AS-BUILTS

- A. The CONTRACTOR shall maintain a neatly marked set of record drawings showing the locations of all buried conduits and other utilities encountered or installed during construction. The final locations of panels, field mounted instruments and panels, terminal boxes, junction boxes, receptacles, light switches and other materials included in the work shall be shown, as well as conduit routing between them to the extent it differs from the design drawings. Record drawings shall be kept current with the work as it progresses and shall be subject to inspection by the OWNER's Representative at any time. Failure to keep field record drawings current may result in the issuance of a stop work order or delay in the processing of pay requests until the record drawings are made current.
- B. The CONTRACTOR shall provide one complete set of as-built electrical schematics for all panels and equipment provided, including PLC I/O schematics as applicable, panel elementary diagrams, interconnecting wiring diagrams, wire numbers, termination strip locations and numbers. These shall be in the same format and style as those in the Contract Documents and submittal requirements.
- C. All information shown on the CONTRACTOR's field record drawings and as-built schematics shall be subject to verification by the OWNER's Representative. If significant errors or deviations are noted by the OWNER's Representative, new as-builts shall be completed at the CONTRACTOR's expense.

## PART 2 - PRODUCTS

### 2.01 PORTABLE OR DETACHABLE PARTS

- A. The CONTRACTOR shall retain in his possession and shall be responsible for all portable and detachable parts or portions of installations such as fuses, key locks, adapters, blocking chips and inserts until completion of his work.
- B. These parts shall be delivered to the ENGINEER and an itemized receipt obtained. This receipt, together with 2 copies of the final inspection certificate, shall be attached to the CONTRACTOR's request for final payment.
- C. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendations.

### 2.02 NEW PRODUCTS

- A. All products shall be new without defects and covered by Manufacturer's warranty. Products shall be re-used only where indicated on the Drawings.

- B. All products shall be listed, labeled, and certified by a testing agency approved by the state of Oregon.
- C. All equipment of the same type and capacity shall be by the same manufacturer.

## **PART 3 - EXECUTION**

### **3.01 IDENTIFICATION**

- A. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.

### **3.02 WORKMANSHIP & COORDINATION**

- A. All work shall be performed by personnel skilled in the particular trade in a workmanlike manner. Workmanship shall conform to the standards of the NEC and the National Electrical Installation Standards (NEIS).
- B. The ENGINEER shall be the sole judge as to whether or not the finished work is satisfactory; and if in his judgment any material or equipment has not been properly installed or finished, the CONTRACTOR shall replace the material or equipment whenever required, and reinstall it in a manner entirely satisfactory to the ENGINEER without any increase in cost to the OWNER.
- C. The CONTRACTOR shall coordinate and verify the installation of all equipment furnished by him to other trades, or equipment provided and installed by other trades that is connected to the electrical or control systems. Work shall include the furnishing of all labor, materials, and equipment required for the installation of a complete and operable system as hereinafter specified and as indicated on the drawings. The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all. Unless otherwise specifically stipulated, the term "furnished and installed complete" shall be considered a part of this section.
- D. Controls and systems shall be complete with transformers, switches, relays, contactors, control valves, control devices, instrument piping, fittings, valves, control wiring, thermometers, pressure gauges, thermostats, damper operators, miscellaneous control cabinets to fill the intent of the Specifications and shall provide control for the various units and systems. All control valves and motorized dampers shall be provided with position indicators.
- E. Unless otherwise specified or shown on the drawings, switches or relays shall be installed in, or adjacent to the motor starter or other electrical device to which they are to be connected. Control and interlock wiring shall be included as necessary from breakers specified herein or shown on the drawings.
- F. Each control schematic intended to control a series of motor operated louvers, fans, and thermostats shall contain a switch for maintenance to meet the NEC requirements regarding disconnect switches for motors. This switch shall be local if any unit controlled is out of sight of the switch. This switch shall disconnect all power to all motor operated devices within the circuit.

### 3.03 TEMPORARY HEATING, LIGHTING AND POWER

- A. The CONTRACTOR shall provide all heat, lighting and power required to construct and protect the work until the work is placed in service by the OWNER for beneficial use of the OWNER. Temporary heaters shall be provided as required to keep the work area and all new electrical components dry.
- B. The source for temporary power shall be from the electric utility or OWNER approved CONTRACTOR supplied auxiliary power units. The installation for electric power shall meet the requirements of local authorities and of OSHA.
- C. The CONTRACTOR shall obtain all permits and pay all costs for connecting temporary power service at no expense to the OWNER.

### 3.04 SUPPORT BACKING

- A. Provide any necessary backing required to properly support all fixtures and equipment installed under this contract.

### 3.05 CUTTING, PATCHING AND FRAMING

- A. The CONTRACTOR shall determine in advance the locations and sizes of all sleeves, chases, and openings necessary for the proper installation of his work.
- B. Whenever practical, inserts or sleeves shall be installed prior to covering work. Cutting and patching shall be held to a minimum. All required holes in concrete construction shall be made with a core drill and patched with non-metallic non-shrink grout.
- C. Cutting, fitting repairing and finishing of carpentry work, metal work, or concrete work, and the like, which may be required for this work shall be done by craftsmen skilled in their respective trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors; and holes required to be cut in floors must be drilled without breaking out around the holes.

### 3.06 TESTS

- A. The CONTRACTOR shall furnish all labor, material, instruments and tools to make all connections for testing of the electrical and instrumentation installation. All equipment shall be demonstrated as operating properly prior to the acceptance of the work. All protective devices shall be operative during testing of equipment. The tests shall be made under the supervision of the ENGINEER. All deficiencies or unsatisfactory conditions as determined by the ENGINEER or inspecting authorities shall be corrected by the CONTRACTOR in a satisfactory manner at his own expense.
- B. After visual inspection of joints and connections and the application of tape and other insulating materials, all sections of the entire wiring system shall be thoroughly tested for shorts and grounds. A log of results for each circuit shall be kept by the CONTRACTOR and presented to the ENGINEER.

- C. A phase rotation check shall be made to demonstrate that all power receptacles, service feeders, main power feeders and auxiliary power generators have the same A - B - C phase rotation and ground relationships.
- D. Equipment shall be tested by operating all electric motors, relays, controls, switches, heaters, etc., sufficiently to demonstrate proper installation and electrical connections. Control and emergency conditions shall be artificially simulated where necessary for complete system or subsystem.

### 3.07 CLEANING AND TOUCH-UP PAINT

- A. Upon completion of work, all electrical equipment shall be cleaned.
  - 1. Vacuum all dirt, metal shavings, and foreign materials from all enclosures. The use of compressed air shall not be acceptable.
  - 2. All stains, dirt, and fingerprints shall be removed from switchboards, motor control centers, panelboards, light fixtures, enclosures, and all other electrical equipment covers.
- B. Provide touch-up paint on equipment that has been scraped, scratched, or chipped during construction. Paint color shall match color of equipment.

### 3.08 COORDINATION OF STARTUP AND ADJUSTING, COMMISSIONING, DEMONSTRATION AND TRAINING, AND OPERATION AND MAINTENANCE DATA.

- A. Reference Section 16001 - Commissioning, 16005 - Starting and Adjusting, 16010 - Operation and Maintenance Data, and 16015 - Demonstration and Training, for detailed requirements.

**END OF SECTION**

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**SECTION 16001**  
**COMMISSIONING**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. Section Includes.
  - 1. Definitions
  - 2. Requirements for commissioning.

1.02 DEFINITIONS

- A. Commissioning Verification Period.
  - 1. The commissioning period begins after the ENGINEER has approved the Functional Test Certification demonstration with the control software, the specified demonstration and training is complete, punch list deficiencies are corrected and the final operation and maintenance manuals are submitted and approved. The duration of the commissioning verification period is 14 days without significant interruption.
- B. Significant Interruption.
  - 1. Significant interruption may include any of the following events.
    - a. Failure of the CONTRACTOR to maintain qualified onsite start-up personnel as specified.
    - b. Failure of critical equipment unit, system, or sub-system that is not satisfactorily corrected within two (2) hours after the failure.
    - c. Failure of noncritical equipment unit, system, or sub-system that is not satisfactorily corrected within twenty-four (24) hours after the failure.
    - d. As may be determined by the ENGINEER.

1.03 REQUIREMENTS FOR COMMISSIONING

- A. Commissioning of the facility shall be completed prior to substantial completion.
- B. CONTRACTOR shall provide for realistic durations in the progress schedule for the commissioning activities.
- C. Provide the labor, medium, chemicals, tools, equipment, instruments and services required for, and incidental to, completing commissioning.
- D. Demonstrate satisfactory operation within the facility of the equipment and systems in actual operation as a functional unit.
- E. Conduct commissioning for a period of fourteen (14) continuous days without significant interruption.

- F. The commissioning verification period shall restart with the correction of each significant interruption.
- G. Correct defects in material and workmanship immediately following their discovery.
- H. Provide for maintenance until substantial completion. This includes the required maintenance activities during the commissioning verification period.
- I. Perform maintenance pursuant to the operation and maintenance data requirements for the new facility during and following the commissioning verification period and prior to issuance of a certificate of substantial completion.
- J. As of the date of substantial completion, OWNER's staff shall be responsible for operation and maintenance of the new facilities. This excludes any issues identified as warranty matters.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION – NOT USED**

**END OF SECTION**

## SECTION 16005

### STARTING AND ADJUSTING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes.
1. Definitions.
  2. Sequence of start-up activities.
  3. General requirements.
  4. Manufacturer's representative responsibilities.
  5. CONTRACTOR's independent process control test certification verification.
  6. CONTRACTOR's demonstration of the process control test certification to the ENGINEER.
  7. CONTRACTOR's independent functional test certification verification.
  8. CONTRACTOR's demonstration of the functional test certification to the ENGINEER.
  9. Record keeping.
  10. Supplements.

##### 1.02 DEFINITIONS

- A. Manufacturer's Representative – Authorized service division employee of the manufacturer.

##### 1.03 SEQUENCE OF START-UP ACTIVITIES

- A. Develop a specific plan for testing and start-up activities required for the project and submit to the ENGINEER for approval no less than 21 days before the initial start-up of equipment begins. The plan shall, as a minimum, incorporate the activities itemized below.
1. Complete all work associated with the installations of the unit and related processes before start-up activities begin.
  2. Manufacturer's representative shall certify the installation meets manufacturer's recommendations and instructions.
  3. Manufacturer's representative shall certify equipment operates as specified and as shown in the Contract Documents.
  4. Calibrate instruments.

5. CONTRACTOR's independent process control test certification verification.
6. CONTRACTOR's demonstration of the process control test certification to the ENGINEER. Operation and maintenance manuals shall be available during this activity.
7. CONTRACTOR's independent functional test certification verification.
8. CONTRACTOR's demonstration of the functional test certification to the ENGINEER.
9. Submit records kept during start-up and adjusting activities.
10. Commissioning activities described in Section 16001 – Commissioning.
11. Demonstration and training described in Section 16015 – Demonstration and Training.
12. CONTRACTOR shall provide sufficient time in the progress schedule to accommodate the start-up sequences.

#### 1.04 GENERAL REQUIREMENTS

- A. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
- B. Demonstrate proper function of all equipment, systems and control devices.
- C. Furnish labor, process medium, chemicals, tools, equipment, instruments, and services required for, and incidental to, completing start-up and adjusting activities.
- D. Manufacturer's representative shall provide assistance for assembly and installation as well as testing guidance and troubleshooting during the start-up and adjusting activities.
- E. Complete Supplement 16005-A, "Process Control Test Certification" and submit the completed form to the ENGINEER for approval. The submission and approval of this form is required prior to commencing with the CONTRACTOR's demonstration to the ENGINEER that each process itemized in the Process Control Test Certification operates as specified and designed.
- F. Complete the following mechanical adjustments prior to, or during, the CONTRACTOR's initial start-up and adjusting activities and before demonstration to the ENGINEER.
  1. Remove rust preventatives and oils applied to protect equipment during construction.
  2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
  3. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.

4. Remove temporary supports, bracing and other foreign objects installed to prevent damage during shipment, storage and erection.
  5. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
  6. Perform cold alignment and hot alignment to manufacturer's tolerances.
  7. Adjust belt tension and variable pitch sheaves.
  8. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
  9. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
  10. Install gratings, safety chains, handrails, shaft guards and sidewalks prior to operational testing.
- G. Complete the following electrical and control adjustments prior to, or during, the CONTRACTOR's initial start-up and adjusting activities and before demonstration to the ENGINEER.
1. Perform insulation resistance tests on all conductors operating at or above 200 volts.
  2. Perform continuity tests on all conductors.
  3. Test and set circuit breaker relays and circuit breaker trip settings for proper operation. Coordinate the trip settings for all circuit breakers.
  4. Check and record motors for actual full load amperage draw on each phase and compare to nameplate value. Submit results to ENGINEER.
- H. Complete the following instrumentation adjustments prior to, or during, the CONTRACTOR's initial start-up and adjusting activities and before demonstration to the ENGINEER.
1. Field calibrate instruments and make required adjustments and control point settings.
  2. Leak test pneumatic controls and instrument air piping.
  3. Energize transmitting and control signal systems, verify proper operations, ranges and settings.

#### 1.05 MANUFACTURER'S REPRESENTATIVE RESPONSIBILITIES

- A. Manufacturer's representative shall inspect the installation and certify with a written report that the installation meets the requirements of the Contract Documents as well as the Manufacturer's recommendations. This shall be done before the equipment is energized.

- B. At completion of a manufacturer’s representatives’ start-up and testing activities, they each shall furnish a written report certifying the equipment installation meets the following conditions.
  - 1. Has been properly installed to meet the IBC seismic requirements and has been adjusted, aligned and lubricated as required.
  - 2. Is free of any stresses imposed by connecting piping or anchor bolts.
  - 3. Is suitable for satisfactory full time operation under full load conditions.
  - 4. Operates within the allowable limits for vibration.
  - 5. Controls, protective devices, instrumentation and control panels furnished as part of the equipment package are properly installed, calibrated and functioning.
  - 6. Control logic for start-up, shutdown, sequencing, interlocks and emergency shutdowns have been tested and are functioning properly.

1.06 CONTRACTOR’S INDEPENDENT PROCESS CONTROL TEST CERTIFICATION VERIFICATION

- A. Verify the equipment provided is installed correctly and functions properly.
- B. Complete Supplement 16005-A, “Process Control Test Certification” pursuant to the following.
  - 1. The supplement is not intended as a replacement for a systematic check of all the requirements specified.
  - 2. Complete the tests outlined in the Supplement, fill out the form and sign it certifying that the tests have been successfully performed and the results recorded.
  - 3. Where it is not possible to test a function without the software furnished, the CONTRACTOR shall verify the inputs/outputs (I/O’s) are terminated correctly by simulating the process as closely and to the extent possible and checking the I/O terminations for voltage and continuity.
- C. Submission of the completed Supplement to the ENGINEER and approval of the submission are a prerequisite to the CONTRACTOR’s demonstration of process control test certification to the ENGINEER.

1.07 CONTRACTOR’S DEMONSTRATION OF PROCESS CONTROL TEST CERTIFICATION TO THE ENGINEER

- A. The intent of the demonstration of the operation to the ENGINEER is to ascertain the installation, including the hardwired control, are in compliance with the Contract Documents. Successful completion of this step will facilitate efficient demonstration of the complete operations of the facilities when the configured control software is installed and tested as part of the Functional Test Certification.
- B. Demonstrate compliance with the items listed in Supplement 16005-A.

- C. ENGINEER may require the CONTRACTOR to demonstrate functions or processes in addition to those itemized in Supplement 16005-A.
- D. ENGINEER's approval of the demonstration of the process control test certification is required before the Functional Test Certification phase commences.

#### 1.08 CONTRACTOR'S INDEPENDENT FUNCTIONAL TEST CERTIFICATION VERIFICATION

- A. Complete Supplement 16005-B, "Functional Test Certification" pursuant to the following.
  - 1. Complete the tests outlined in the Supplement, fill out the form and sign it certifying that the tests have been successfully performed and the results recorded.
  - 2. This test will be conducted with the configured software installed and functional. Alarms, data logging, trending and control functions shall be verified
- B. Submission of the completed Supplement to the ENGINEER and approval of the submission are a prerequisite to the CONTRACTOR's demonstration of functional test certification to the ENGINEER.

#### 1.09 CONTRACTOR'S DEMONSTRATION OF THE FUNCTIONAL TEST CERTIFICATION TO THE ENGINEER

- A. The intent of the demonstration of the Functional Test Certification to the ENGINEER is to ascertain the installation, including the configured software program, is in compliance with the Contract Documents.
- B. Demonstrate items listed in Supplement 16005-B, "Functional Test Certification" to the ENGINEER.
- C. ENGINEER may require the CONTRACTOR to demonstrate functions or processes in addition to those itemized in Supplement 16005-B.
- D. ENGINEER's approval of the demonstration of the Functional Test Certification is a prerequisite to beginning the commissioning phase.

#### 1.10 RECORD KEEPING

- A. CONTRACTOR shall maintain, as a minimum, the following records generated during the start-up and adjusting activities.
  - 1. Daily logs of equipment and process testing, identifying all tests conducted and a summary of the results.
  - 2. Logs of time spent with manufacturer's representatives providing services for the project.
  - 3. Equipment lubrication records.
  - 4. Electrical phase voltage and amperage measurements for all equipment.

5. Insulation resistance measurements.
6. All completed test forms specified in Section 16080 Electrical Testing.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION**

3.01 SUPPLEMENTS

- A. Supplement 16005-A, “City of Albany, Riverfront Interceptor Sewer Lift Station and Force Main Process Control Test Certification”.
- B. Supplement 16005-B, “City of Albany, Riverfront Interceptor Sewer Lift Station and Force Main Functional Test Certification”.

**END OF SECTION**



**SUPPLEMENT 16005-A**

**City of Albany**

**Riverfront Interceptor**

**Sewer Lift Station and Force Main**

**Process Control Test Certification**

#	DESCRIPTION	PASS	FAIL	COMMENTS
	The OWNER will provide the CONTRACTOR with points of termination within the control panel CP-01. All conductors and cables for field devices shall be terminated before commencing this Process Test Certification.			
	<b>Existing Overflow I/O</b>			
1	Simulate an overflow fail alarm from the existing device in the overflow manhole and verify the signal input is received at the proper input at CP-01			
2	Simulate a flood alarm from the manhole and verify the signal input is received at the proper input at CP-01			
3	Simulate an intrusion alarm at the overflow site and verify the signal input is received at the proper input at CP-01			
4	Simulate a loss of echo alarm and verify the signal input is received at the proper input at CP-01			
5	Simulate the analog overflow site level signal and verify the signal input is received at the proper input at CP-01			
	<b>Diversion Structure I/O</b>			
6	FCV-01 Verify the limit switches and torque switch has been adjusted as per the manufacturer's instructions			
7	FCV-01 Simulate an open command and verify signal is received correctly at the actuated valve.			
8	FCV-01 When the valve is fully opened, verify the valve opened signal input is received at the proper input at CP-01			
9	FCV-01 Simulate a close command and verify the signal is received correctly at the actuated valve.			

#	DESCRIPTION	PASS	FAIL	COMMENTS
10	FCV-01 When the valve is fully closed, verify the valve opened signal input is received at the proper input at CP-01			
11	FCV-01 Simulate a high torque and verify the signal input is received at the proper input at CP-01			
12	FCV-01 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
13	FCV-02 Verify the limit switches and torque switch has been adjusted as per the manufacturer's instructions			
14	FCV-02 Simulate an open command and verify signal is received correctly at the actuated valve.			
15	FCV-02 When the valve is fully opened, verify the valve opened signal input is received at the proper input at CP-01			
16	FCV-02 Simulate a close command and verify the signal is received correctly at the actuated valve.			
17	FCV-02 When the valve is fully closed, verify the valve opened signal input is received at the proper input at CP-01			
18	FCV-02 Simulate a high torque and verify the signal input is received at the proper input at CP-01			
19	FCV-02 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
20	LSH-01 Simulate a flood alarm and verify the signal input is received at the proper input at CP-01			
21	LE-01 Simulate an analog signal from the radar level sensor and verify the signal input is received at the proper input at CP-01 and at the display.			
	<b>Wet Well I/O</b>			
22	Pump P-1 Simulate a high winding temperature and high moisture alarm and verify the signal input is received at the proper input at CP-01			

#	DESCRIPTION	PASS	FAIL	COMMENTS
23	Pump P-1 Simulate a speed command to the VFD and verify the signal is received correctly at the speed command terminals.			
24	Pump P-1 Simulate a pump start command and verify the signal is received correctly at the VFD			
25	Pump P-1 Simulate a VFD fail at the VFD and verify the signal input is received at the proper input at CP-01			
26	Pump P-1 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
27	Pump P-1 Simulate the VFD / Pump is running and verify the signal input is received at the proper input at CP-01			
28	Pump P-1 Simulate a speed feedback analog signal and verify the signal input is received at the proper input at CP-01			
29	Pump P-2 Simulate a high winding temperature and high moisture alarm and verify the signal input is received at the proper input at CP-01			
30	Pump P-2 Simulate a speed command to the VFD and verify the signal is received correctly at the speed command terminals.			
31	Pump P-1 Simulate a pump start command and verify the signal is received correctly at the VFD			
32	Pump P-2 Simulate a VFD fail at the VFD and verify the signal input is received at the proper input at CP-01			
33	Pump P-2 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
34	Pump P-2 Simulate the VFD / Pump is running and verify the signal input is received at the proper input at CP-01			
35	Pump P-2 Simulate a speed feedback analog signal and verify the signal input is received at the proper input at CP-01			

#	DESCRIPTION	PASS	FAIL	COMMENTS
36	Pump P-3 Simulate a high winding temperature and high moisture alarm and verify the signal input is received at the proper input at CP-01			
37	Pump P-3 Simulate a speed command to the VFD and verify the signal is received correctly at the speed command terminals.			
38	Pump P-3 Simulate a pump start command and verify the signal is received correctly at the VFD			
39	Pump P-3 Simulate a VFD fail at the VFD and verify the signal input is received at the proper input at CP-01			
40	Pump P-3 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
41	Pump P-3 Simulate the VFD / Pump is running and verify the signal input is received at the proper input at CP-01			
42	Pump P-3 Simulate a speed feedback analog signal and verify the signal input is received at the proper input at CP-01			
43	FE/FIT-01 Flow Meter. Simulate an analog signal from the flow meter and verify the signal input is received at the proper input at CP-01 and at the display			
44	FE/FIT-02 Flow Meter. Simulate an analog signal from the flow meter and verify the signal input is received at the proper input at CP-01 and at the display			
45	FE/FIT-03 Flow Meter. Simulate an analog signal from the flow meter and verify the signal input is received at the proper input at CP-01 and at the display			
46	PI-01 Pressure Indicator. Simulate an analog signal from the pressure indicator and verify the signal input is received at the proper input at CP-01 and at the display			
47	PI-02 Pressure Indicator. Simulate an analog signal from the pressure indicator and verify the signal input is received at the proper input at CP-01 and at the display			

#	DESCRIPTION	PASS	FAIL	COMMENTS
48	PI-03 Pressure Indicator. Simulate an analog signal from the pressure indicator and verify the signal input is received at the proper input at CP-01 and at the display			
49	LSL-02 Simulate a low level alarm and verify the signal input is received at the proper input at CP-01			
50	LSH-02 Simulate a flood alarm and verify the signal input is received at the proper input at CP-01			
51	LE-02 Simulate an analog signal from the radar level sensor and verify the signal input is received at the proper input at CP-01 and at the display.			
52	Simulate an intrusion alarm at the diversion structure by opening the hatch and verify the signal input is received at the proper input at CP-01 and at the display.			
53	Simulate an intrusion alarm at the Wet well by opening each hatch individually and verify the signal input is received at the proper input at CP-01 and at the display.			
54	Simulate an intrusion alarm at the valve vault by opening each hatch individually and verify the signal input is received at the proper input at CP-01 and at the display.			

**END OF SUPPLEMENT**

**SUPPLEMENT 16005-B**

**City of Albany**

**Riverfront Interceptor**

**Sewer Lift Station and Force Main**

**Functional Test Certification**

#	DESCRIPTION	PASS	FAIL	COMMENTS
	After the Owner has loaded their PLC program, the CONTRACTOR shall assist the OWNER by helping to simulate various I/O by tilting float switches, rotating selector switches, starting and stopping VFD's, actuators, etc.			
	<b>Existing Overflow I/O</b>			
1	Simulate an overflow fail alarm from the existing device in the overflow manhole while the OWNER verifies the signal input is received at the proper input at CP-01			
2	Simulate a flood alarm from the manhole while the OWNER verifies the signal input is received at the proper input at CP-01			
3	Simulate an intrusion alarm at the overflow site while the OWNER verifies the signal input is received at the proper input at CP-01			
4	Simulate a loss of echo alarm while the OWNER verifies the signal input is received at the proper input at CP-01			
5	Simulate the analog overflow site level signal while the OWNER verifies the signal input is received at the proper input at CP-01 and has the proper polarity where appropriate			
	<b>Diversion Structure I/O</b>			
6	FCV-01 Verify the limit switches and torque switch has been adjusted as per the manufacturer's instructions			
7	FCV-01 while the OWNER sends an open command verify the valve opens 100 %			
8	FCV-01 When the valve is fully opened, have the OWNER verify the open signal input is received at the proper input at CP-01			
9	FCV-01 while the OWNER sends a close command and verify the valve closes 100 %			

#	DESCRIPTION	PASS	FAIL	COMMENTS
10	FCV-01 When the valve is fully closed, have the OWNER verify the close signal input is received at the proper input at CP-01			
11	FCV-01 Simulate a high torque and verify the signal input is received at the proper input at CP-01			
12	FCV-01 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
13	FCV-02 Verify the limit switches and torque switch has been adjusted as per the manufacturer's instructions			
14	FCV-02 while the OWNER sends an open command verify the valve opens 100 %			
15	FCV-02 When the valve is fully opened, have the OWNER verify the open signal input is received at the proper input at CP-01			
16	FCV-02 while the OWNER sends a close command and verify the valve closes 100 %			
17	FCV-02 When the valve is fully closed, have the OWNER verify the close signal input is received at the proper input at CP-01			
18	FCV-02 Simulate a high torque and have the OWNER verify the signal input is received at the proper input at CP-01			
19	FCV-02 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
20	LSH-01 Simulate a flood alarm and verify the signal input is received at the proper input at CP-01			
21	LE-01 Verify the analog signal from the radar level sensor is reading the proper level in the vessel and verify the signal input is received at the proper input at CP-01 and at the display.			
	<b>Wet Well I/O</b>			
22	Pump P-1 Simulate a high winding temperature and high moisture alarm and have the OWNER verify the signal input is received at the proper input at CP-01			

#	DESCRIPTION	PASS	FAIL	COMMENTS
23	Pump P-1 While the Owner sends a speed command to the VFD verify that they are able to control the speed of the VFD through the entire scale of 1-100 %			
24	Pump P-1 When the OWNER sends a start command to the VFD, verify the VFD starts			
25	Pump P-1 Simulate a VFD fail at the VFD and have the OWNER verify the signal input is received at the proper input at CP-01			
26	Pump P-1 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
27	Pump P-1 Simulate the VFD / Pump is running and verify the signal input is received at the proper input at CP-01			
28	Pump P-1 Simulate a speed feedback analog signal and verify the signal input is received accurately at the proper input at CP-01			
29	Pump P-2 Simulate a high winding temperature and high moisture alarm and have the OWNER verify the signal input is received at the proper input at CP-01			
30	Pump P-2 While the Owner sends a speed command to the VFD verify that they are able to control the speed of the VFD through the entire scale of 1-100 %			
31	Pump P-2 When the OWNER sends a start command to the VFD, verify the VFD starts			
32	Pump P-2 Simulate a VFD fail at the VFD and have the OWNER verify the signal input is received at the proper input at CP-01			
33	Pump P-2 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
34	Pump P-2 Simulate the VFD / Pump is running and verify the signal input is received at the proper input at CP-01			
35	Pump P-2 Simulate a speed feedback analog signal and verify the signal input is received accurately at the proper input at CP-01			



#	DESCRIPTION	PASS	FAIL	COMMENTS
36	Pump P-3 Simulate a high winding temperature and high moisture alarm and have the OWNER verify the signal input is received at the proper input at CP-01			
37	Pump P-3 While the Owner sends a speed command to the VFD verify that they are able to control the speed of the VFD through the entire scale of 1-100 %			
38	Pump P-3 When the OWNER sends a start command to the VFD, verify the VFD starts			
39	Pump P-3 Simulate a VFD fail at the VFD and have the OWNER verify the signal input is received at the proper input at CP-01			
40	Pump P-3 Place the H-O-A switch in hand and verify the signal input is received at the proper input at CP-01. Now place the switch in off and then in hand and verify the signal is NOT present at CP-01			
41	Pump P-3 Simulate the VFD / Pump is running and verify the signal input is received at the proper input at CP-01			
42	Pump P-3 Simulate a speed feedback analog signal and verify the signal input is received accurately at the proper input at CP-01			
43	FE/FIT-01 Flow Meter. Simulate flow from the flow meter and verify the signal input is accurately received at the proper input at CP-01 and at the display			
44	FE/FIT-02 Flow Meter. Simulate flow from the flow meter and verify the signal input is accurately received at the proper input at CP-01 and at the display			
45	FE/FIT-03 Flow Meter. Simulate flow from the flow meter and verify the signal input is accurately received at the proper input at CP-01 and at the display			
46	PI-01 Pressure Indicator. Simulate pressure in the force main and verify the signal input is received at the proper input at CP-01 and at the display			
47	PI-02 Pressure Indicator. Simulate pressure in the force main and verify the signal input is received at the proper input at CP-01 and at the display			

#	DESCRIPTION	PASS	FAIL	COMMENTS
48	PI-03 Pressure Indicator. Simulate pressure in the force main and verify the signal input is received at the proper input at CP-01 and at the display			
49	LSL-02 Simulate a low level alarm and verify the signal input is received at the proper input at CP-01			
50	LSH-02 Simulate a flood alarm and verify the signal input is received at the proper input at CP-01			
51	LE-02 Simulate an analog signal from the radar level sensor and verify the signal input is received at the proper input at CP-01 and at the display.			
52	Simulate an intrusion alarm at the diversion structure by opening the hatch and verify the signal input is received at the proper input at CP-01 and at the display.			
53	Simulate an intrusion alarm at the Wet well by opening each hatch individually and verify the signal input is received at the proper input at CP-01 and at the display.			
54	Simulate an intrusion alarm at the valve vault by opening each hatch individually and verify the signal input is received at the proper input at CP-01 and at the display.			

**END OF SUPPLEMENT**

## SECTION 16010

### OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

##### SUMMARY

- A. Section Includes:
  - 1. Definitions.
  - 2. General requirements.
  - 3. Submittal procedures.
  - 4. Content requirements for manuals.
  - 5. Supplements.

##### DEFINITIONS

- B. Maintenance Operation.
  - 1. Routine operation required to ensure satisfactory performance and longevity of the equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands and other routine adjustments.

##### GENERAL REQUIREMENTS

- C. Provide operation and maintenance data for items listed in Supplement 16010 – A, “Schedule of Equipment Requiring Operation and Maintenance Data”.
- D. In addition to the composite of manuals for individual equipment items or systems, provide a consolidated summary of required routine scheduled maintenance and scheduled preventative and predictive maintenance for the project, with reference to where detailed information may be found. Include safety information and emergency plans and procedures. The summary shall be in a separate binder from the other equipment and system binders.
- E. Comply with the following format relating to the Operation and Maintenance Manual:
  - 1. All binders shall be “D” ring type with one-touch ring locking mechanism.
  - 2. Overlay material shall be crystal clear poly.
  - 3. Binders shall be black poly.
  - 4. Binders shall be nominally sized for 75 percent fill per volume with a maximum binder depth of four (4) inches and a minimum depth of one (1) inch.
  - 5. Submit example binder cover sheet for approval by ENGINEER.
  - 6. Submit example spine insert for approval by ENGINEER.

7. Paper: twenty (20) pound minimum, white for typed pages, 8.5 x 11 inches.
8. Text: Manufacturer's printed data, or neatly typewritten. Facsimiles transmitted via fax machine shall be unacceptable.
9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
10. Provide fly-leaf for each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment. Provide with heavy section dividers with numbered plastic index tabs.
11. Provide each manual with a title page, typed table of contents with consecutive page numbers. Plan contents of entire set, identified by volume number, in each binder.
12. Material shall be suitable for reproduction with quality equal to the original. Photocopying of material will be acceptable except for material containing photographs.
13. Table of contents shall be neatly typewritten, arranged in a systematic order, containing as a minimum the following data:
  - a. CONTRACTOR, name of responsible principle, address and telephone number.
  - b. List of each product required to be included and indexed to content of each volume.
  - c. List of each product, name, address and telephone number of subcontractor, supplier, installer and maintenance contractor as appropriate.
  - d. Provide local source and phone number of supply for parts and replacement.
  - e. Identify each product by product name, model number and other identifying numbers or symbols as set forth in the Contract Documents.
14. Product data:
  - a. Include only those sheets that are pertinent to the specific product provided.
  - b. Clearly annotate each sheet to identify specific product or part installed, data applicable to the installation and delete references to inapplicable information.
15. Drawings; supplement product data with drawings as necessary to clearly illustrate the following:
  - a. Relationship of component parts of equipment and systems.
  - b. Control and flow diagrams.

- c. Coordinate drawings with project record documents to assure correct illustration of completed installations.
- d. CONTRACTOR shall not use project record documents as maintenance manual drawings.
- e. Provide reinforced punched binder tabs.
- f. Reduced 11 x 17 inch drawings shall be folded to 8.5 x 11 inch format.
- g. Where reduction to 11 x 17 inch is impractical, fold and place the 8.5 x 11 inch envelopes that are bound in the binder.
- h. Identify specification Section and product on drawings and envelopes.

#### SUBMITTAL PROCEDURE

- F. Compile the required data, arrange as specified herein and insert data in the number of volumes necessary. The volumes shall be submitted as a complete set. Partial or incomplete manuals shall be rejected by the ENGINEER.
- G. Preliminary Manuals:
  - 1. Submit three copies to ENGINEER for review and approval well before the starting and adjusting activities commence.
  - 2. If accepted:
    - a. One copy will be returned to the CONTRACTOR.
    - b. One copy will be forwarded to the OWNER.
    - c. One copy will be retained in the ENGINEER's file.
  - 3. If rejected:
    - a. Two copies will be returned to the CONTRACTOR with ENGINEER's comments for revision.
    - b. One copy will be retained in the ENGINEER's file.
    - c. CONTRACTOR shall be required to resubmit three revised preliminary manuals for ENGINEER's review.
- H. Final Manuals:
  - 1. Submit two copies to ENGINEER for review and approval before final completion.
  - 2. If accepted:
    - a. CONTRACTOR will be so notified.
    - b. CONTRACTOR shall provide a complete set of the final manual on CD-ROM. Data written specifically for the manual will be presented in MS Word format. Manufacturer data (per-printed data) will be presented in Adobe PDF format.
  - 3. If rejected:

- a. At the ENGINEER's discretion either all but one copy of the manuals will be returned to the CONTRACTOR for revisions or all copies will be retained by the ENGINEER and the necessary revision data will be requested from the CONTRACTOR.

## CONTENT REQUIREMENTS FOR MANUALS

- I. The Operation and Maintenance Manuals shall normally consist of no less than four volumes outline below.
- J. Volume 1 – Facility Overview.
  1. All sheets in volume 1 shall have sheet protectors.
  2. All materials in volume 1 shall be copied onto a CD and provided to the ENGINEER.
  3. Include instructions and procedures for handling, storage, maintenance during storage, assembly, erection, installation, adjusting, testing, operating, shut down in emergency, troubleshooting, maintenance, interface with other equipment and as may otherwise be required.
  4. Organize in a consistent format under separate heading for each different procedure.
  5. Provide a logical sequence of instructions for each procedure.
  6. Provide an information sheet for the OWNER's personnel which include the proper procedures in the event of a failure and instances that might affect the validity of warranties or bonds.
  7. Content for each unit (or common units) and system:
    - a. Description of unit and component parts including controls, accessories and appurtenances. Detail their function, normal operating characteristics and limiting conditions. Provide performance curves, engineering data, nameplates data and test forms. Provide a complete commercial number and nomenclature for replaceable parts.
  8. Operating Procedures:
    - a. Start-up and break-in routine and normal operating instructions.
    - b. Test procedures and results of factory tests where required.
    - c. Regulation, control, stopping and emergency instructions.
    - d. Description of operation sequence by control manufacturer.
    - e. Shutdown instructions for both short and extended durations.
    - f. Summer and winter operating instructions as applicable.
  9. Maintenance and Overhaul Procedures:
    - a. Routine operations
    - b. Guide to troubleshooting.

- c. Disassembly, removal, repair, reinstallation and reassembly.
  - 10. Installation Instructions including alignment, adjusting, calibrating and checking.
  - 11. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list and diagrams required for maintenance.
  - 12. Parts list by generic title and manufacturer's part number.
  - 13. Name, location and telephone number of nearest supplier and spare parts warehouse.
  - 14. Where applicable identify installed spares and other provisions for future work (e.g. reserved panel space, unused components, wiring and terminals).
  - 15. Manufacturer's printed operating and maintenance instructions.
  - 16. Charts of valve tag numbers along with the location and function of each valve.
  - 17. Manufacturer's certifications including calibration data sheets and specified calibration procedures or methods for installed equipment.
  - 18. Warranty forms and information for all installed equipment provided by the CONTRACTOR.
  - 19. Circuit directories for all panels including electrical, control and communication.
  - 20. List of adjustable electrical relay settings, control and alarm settings.
- K. Volume 2 – Equipment Manuals.
- 1. Table of contents shall have a sheet protector
  - 2. Table of contents and index sheets shall be of colored card stock.
  - 3. Manuals for individual equipment shall not be divided between separate binders.
  - 4. List function, normal operation, characteristics and limiting conditions.
  - 5. Complete commercial part number and nomenclature of replaceable parts.
  - 6. Maintenance procedures including routine operations, guide to troubleshooting and adjustments.
  - 7. Manufacturer's printed operation and maintenance instructions.
  - 8. List of manufacturer's spare parts and recommended quantities to be maintained in storage.
  - 9. Contents for Maintenance Summary Manual:
    - a. Compile individual maintenance summaries for each applicable equipment item, respective unit or system and for components or subunits.

- b. Format shall include use of the Supplement 16010 – B “Maintenance Summary” provided. Each Maintenance Summary may take as many pages as required. Supplement shall be typewritten and shall include detailed lubrication instructions and diagrams showing points to be greased or oiled, recommended type, grade and temperature range of lubricants and frequency of lubrication.
    - c. Include a list and quantity of manufacturer’s recommended consumable and spare parts that should be stored on site.
  - L. Volume 3 – Drawings
    - 1. As-built drawings associated with the project shall be provided. This includes, but is not limited to, manufacturers supplied drawings. All drawings shall be provided on 11 x 17 inch sheets folded to 8.5 x 11 inch size and bound in this volume. A complete and detailed index shall be provided that includes a list of all drawings in the volume and the drawings shall be tabbed in a fashion that provides clear and concise identification.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION**

**SUPPLEMENTS**

- A. Supplement 16010 – A, “Schedule of Equipment Requiring Operation and Maintenance Data”.
- B. Supplement 16010 – B, “Maintenance Summary Form”.

**END OF SECTION**



**SUPPLEMENT 16010 – A**  
**SCHEDULE OF EQUIPMENT REQUIRING OPERATION AND MAINTENANCE**  
**DATA**

<b>ITEM NO.</b>	<b>SECTION</b>	<b>MANUAL (M) DATA SHEET (D)</b>	<b>DESCRIPTION</b>
1	13420.L01	M	RADAR LEVEL SENSOR AND DISPLAY
2	13420.F50	M	MAGNETIC FLOWMETER AND TRANSMITTER
3	13420.F01	D	FLOAT SWITCH SYSTEM
4	13420.P43	M	PRESSURE TRANSDUCER / TRANSMITTER
5	13420.H05	D	VAULT INTRUSION LIMIT SWITCH
6	16057	M	ELECTRICAL SYSTEM ANALYSIS FINAL REPORT
7	16410.D01	D	MAIN SERVICE DISCONNECT
8	16410.M01	D	MANUAL TRANSFER SWITCH
9	16447.M10	M	LOW VOLTAGE MOTOR CONTROL CENTER
10	16511	D	INTERIOR LUMINAIRES
11	16512	D	EXTERIOR LUMINAIRES

**END OF SUPPLEMENT**



## SECTION 16015

### DEMONSTRATION AND TRAINING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes.
  - 1. Definitions.
  - 2. General Requirements.
  - 3. Supplements.

##### 1.02 DEFINITIONS

- A. Training Requirements.
  - 1. The following topics shall be covered at a minimum:
    - a. Equipment schematics.
    - b. Control strategy.
    - c. Troubleshooting procedures.
    - d. Recommended maintenance and periodic testing procedures.
    - e. Advanced start-up procedures.
    - f. Control Input/Output (I/O) and communications review.
    - g. Operator Interface Terminals (OIT) operating characteristics and navigation between various screens and functions.
    - h. Proper use and function of selector switches, reset buttons, speed controls, E-stops, etc.
  - 2. Training shall require one session for each type of process equipment.
- B. Manufacturer's Representative / Factory Trained Technician.
  - 1. Shall be an authorized service division employee of the manufacturer.

##### 1.03 GENERAL REQUIREMENTS

- A. Provide training for OWNER's personnel for items listed in Supplement 16015 – A, "Schedule of Equipment Requiring Demonstration And Training".
- B. Utilize Manufacturer's Representative to conduct training sessions.
- C. CONTRACTOR shall have an employee familiar with the details of the installation attend the training sessions.
- D. The Manufacturer's Representative and CONTRACTOR shall provided the demonstration and training required to meet the performance specified herein. No costs in addition to the original Bid shall be incurred by the OWNER to meet this requirement.

- E. Schedule and coordinate training sessions to accommodate the following:
1. Provide fourteen (14) day written notice to the ENGINEER for approval prior to proposed training sessions.
  2. Do not schedule training sessions for Monday, Friday, Saturday, Sunday or a Holiday.
  3. No more than two (2) different types of equipment training sessions shall be scheduled for any one (1) day.
  4. The Manufacturer's Representative shall utilize the operation and maintenance manuals as a basis for instruction. Should the need for additional data become apparent during instruction, CONTRACTOR shall prepare and insert the additional data into the operation and maintenance manual within seven (7) business days.
  5. OWNER reserves the right to video tape the training session. The OWNER agrees that the video tape shall only be used for training employees.
  6. Provide the material, data, and training aids including, but not limited to, the copying of any documents, screens, viewers, etc. required for training session.
  7. Provide an outline of the topics for discussion during the training session and copies of the operation and maintenance manuals for all training session participants.
  8. OWNER will provide the CONTRACTOR with the number of participants at each training session seven (7) days after receipt of the proposed training session schedule.
- F. ENGINEER shall not authorize the commencement of the demonstration and training sessions until after successful demonstration of the Functional Test Certification, approval of the test reports submitted from Section 16080 – Electrical Testing and the successful demonstration of the Process Test Certification in Section 16005 – Starting And Adjusting.
- G. Should the CONTRACTOR fail to meet the scheduled training session date, OWNER shall be entitled to notification of a new date complying with the requirements indicated herein.
- H. Training sessions shall be scheduled to allow for appropriate progression of the training material. If knowledge of certain equipment is necessary to adequately comprehend the operational and maintenance aspects of another piece of equipment, the training session shall be scheduled to provide for this requirement.
- I. Training sessions shall meet the following general requirements:
1. Training sessions shall be completed before commissioning.
  2. CONTRACTOR shall provide the labor, process medium, chemical, tools, equipment and instruments necessary to accommodate demonstration of the

equipment. CONTRACTOR may not rely on adequate water, wastewater, storm water or other normal process flows, etc. as they may not be available.

3. The content of the training sessions shall be specific to the products installed.
4. The training sessions shall be developed to allow for appropriate presentation of information and hands-on operation and maintenance opportunities for the OWNER's staff.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION**

### **3.01 SUPPLEMENTS**

- A. Supplement 16015 - A, "Schedule of Equipment Requiring Demonstration And Training".

**END OF SECTION**



## SECTION 16057

### ELECTRICAL SYSTEMS ANALYSIS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. The section includes the requirements for a Short-Circuit Study, Protective Device Coordination Study, Arc Flash Study, and Arc Flash Warning Labels.

##### 1.02 REFERENCES

###### A. Referenced Standards:

1. American National Standards Institute (ANSI).
2. Institute of Electrical and Electronics Engineers (IEEE):
  - a. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
  - b. 399, Recommended Practice for Industrial and Commercial Power System Analysis.
  - c. 1584, Guide for Performing Arc Flash Hazard Calculations.
3. National Electrical Manufacturers Association (NEMA): Z535.4, Product Safety Signs and Labels.
4. National Fire Protection Association (NFPA):
  - a. 70, National Electrical Code (NEC).
  - b. 70E, Standard for Electrical Safety in the Workplace.
5. Occupational Safety and Health Standards (OSHA): 29 CFR, Part 1910, Subpart S, Electrical.

##### 1.03 SUBMITTALS

###### A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16057.S21) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals

not containing the Reference Keynote Number will be rejected as incomplete.

3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data:

1. Pursuant to 01330 Submittal Procedures.
2. Arc Flash Warning Label templates.

1.04 QUALITY ASSURANCE

- A. Short circuit, protective device coordination, and arc flash studies shall be provided by a NETA certified, corporately and financially independent, unbiased, testing authority. The testing authority shall be independent of manufacturers, suppliers, and installers of equipment being tested. The testing authority shall have a minimum of five (5) years experience testing similar projects.

1.05 SEQUENCING AND SCHEDULING

- A. Initial complete protective device coordination and arc flash studies shall be submitted within 90 days after approval of initial short circuit study.
- B. Revised short circuit, protective device studies, arc flash studies, and arc flash labels shall be submitted 10 days before energizing electrical equipment.
- C. Final short circuit, protective device studies, and arc flash studies shall be completed prior to project completion. Final version of study shall include as-built equipment, materials, and parameter data or settings entered into equipment based on study.
- D. Submit final arc flash labels described herein and in compliance with NEMA Z535.4 prior to project completion.

1.06 GENERAL STUDY REQUIREMENTS

- A. The CONTRACTOR shall be responsible for providing all information to the Agent responsible for performing the Study. At minimum, the CONTRACTOR shall provide the following:
  1. Service transformer nameplate information
  2. Service entrance feeder conductor size, type, length and feeder conduit size, type, and length.
  3. Service entrance equipment nameplate information.
  4. Motor load nameplate information.
  5. Distribution feeder size, type, and length.



6. Overcurrent protection device nameplate information and trip settings.
  7. Panelboard nameplate information.
  8. Any other information requested by the testing Agent.
- B. Equipment and component titles used in the studies shall be identical to equipment and component titles shown on the Drawings.
- C. Perform studies using one of the following electrical engineering software packages:
1. SKM Power Tools for Windows
  2. ETAP
  3. EDSA
  4. Easy Power
- D. Perform complete fault calculations for all new and future loads indicated on the Drawings.
- E. Provide individual protective device time-current characteristics for the low voltage distribution system.

## **PART 2 - STUDIES AND PRODUCTS**

### **2.01 SHORT CIRCUIT STUDY**

- A. General
1. Prepare a Short Circuit Study in accordance with IEEE 39.
  2. Cable impedances shall be based on copper conductors.
  3. Bus impedances shall be based on copper buses.
  4. Cable and bus resistances shall be calculated at 25 degrees Celsius.
  5. Medium voltage cable reactance shall be based on typical dimensions for standard cables with 133% insulation levels.
  6. 600-volt cable reactance shall be based on the typical dimensions of THWN-2 conductors.
  7. Transformer impedances shall be 92.5% of nominal impedance based on tolerances specified in IEEE C57.12.00.
- B. The Short Circuit Study final report shall include the following:
1. Basic description, purpose, and scope of the study.
  2. Descriptions of the scenarios evaluated and identification of the scenario used to evaluate short circuit ratings.
  3. Explanation of bus and branch numbering system.
  4. Prevailing conditions.
  5. Selected base per unit quantities.

6. Source impedance data, including electric utility system, generator, and motor fault contribution characteristics.
  7. Impedance diagrams.
  8. Zero-sequence impedance diagrams.
  9. One line diagrams and associated tabulations of data used to model the system components.
  10. Calculation methods and assumptions.
  11. Typical calculations.
  12. Tabulation of calculation quantities.
  13. Results, conclusions, and recommendations.
- C. The short circuit interrupting and momentary (when applicable) duties for an assumed three-phase bolted fault shall be calculated at each:
1. Utility Service point.
  2. Medium Voltage Switchgear.
  3. Low Voltage Switchgear.
  4. Switchboard.
  5. Motor Control Center.
  6. Automatic Transfer Switch.
  7. Distribution Panel.
  8. Branch Circuit Panelboard.
  9. Future load contributions as shown on the One-Line Diagram.
  10. Any additional point within the power distribution system as specified by the Engineer.
- D. The Short Circuit Study shall be used to verify the following:
1. Equipment and protective devices are applied within their ratings.
  2. Adequacy of distribution equipment bus bars to withstand short circuit stresses.
  3. Cable and bus way sizes for ability to withstand short circuit heating, in addition to normal current loads.
- E. Provide a tabulation of equipment short circuit versus available fault duties. The tabulation shall identify percentage of rated short circuit current and clearly identify equipment with insufficient ratings.
1. General Data
    - a. Short circuit reactance of rotating machines.
    - b. Cable and conduit material data.

- c. Bus data.
    - d. Transformer data.
    - e. Circuit resistance and reactance values.
  - 2. Short Circuit Data
    - a. Fault impedances.
    - b. X/R ratios.
    - c. Asymmetry factors.
    - d. Motor contributions.
    - e. Short circuit kVA.
    - f. Symmetrical and asymmetrical fault currents.
  - 3. Equipment Evaluation
    - a. Equipment bus bracing, equipment short circuit rating, transformer, cable, busway.
    - b. Maximum fault current available.
- F. Provide a written summary at the end of the Short Circuit Study, which shall include the following:
- 1. Selected equipment deficiencies.
  - 2. Results of short circuit study.
  - 3. Conclusions and recommendations.
- G. The Contractor shall be notified in writing of existing circuit protective devices improperly rated for new fault conditions.
- H. The Short Circuit Study data shall be revised for as-built conditions.

## 2.02 ARC FLASH STUDY

- A. Perform an Arc Flash Hazard Study after short circuit and protective device setting recommendations have been completed, reviewed, and accepted by the Engineer. Perform the analysis under worst-case arc flash conditions for all modes of operation. Provide an analysis of all operating scenarios which will be or have been influenced by the proposed or completed additions to the subject system.
- B. The Arc Flash Hazard Study shall be performed in accordance with NFPA 70E, OSHA 29 CFR, Part 1910 Subpart S, and IEEE 1584.
- C. The Arc Flash Hazard Study shall include the following:
  - 1. Basic description, purpose, and scope of the study.
  - 2. One Line Diagram.
  - 3. Short Circuit Study.
  - 4. Protective Device Settings Study.
  - 5. Calculation methods and assumptions.

6. Typical calculation.
  7. Evaluation summary spreadsheet.
  8. Conclusions and recommendations.
- D. Base Calculation: For each major part of the power distribution system, the following shall be determined:
1. Flash hazard protection boundary.
  2. Limited approach boundary.
  3. Restricted approach boundary.
  4. Prohibited approach boundary.
  5. Incident energy level.
  6. Personal protection equipment (PPE) hazard/risk category.
  7. Type of PPE required.
- E. Produce arc flash warning labels that list items in Part C above and provide the following additional items:
1. Bus name.
  2. Bus voltage.
- F. Produce detail sheets that list items in Part C above and the following items:
1. Bus name.
  2. Upstream protective device name, type, and settings.
  3. Bus-to-line voltage.
- G. Produce arc flash evaluation summary sheet listing the following additional items:
1. Bus name.
  2. Upstream protective device name, type, and settings.
  3. Bus-to-line voltage.
  4. Protective device bolted fault current.
  5. Arcing fault current.
  6. Protective device trip/delay setting.
  7. Breaker opening time.
  8. Solidly grounded column.
  9. Equipment type.
  10. Gap.
  11. Arc flash boundary.
  12. Working distance.

13. Incident energy.
  14. Required protective fire rated clothing type and class.
- H. Analyze short circuit, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated or causes incident energy values greater than 40 cal/cm<sup>2</sup>. Provide proposals to reduce energy levels.
- I. Provide a written summary at the end of the Arc Flash Hazard Study, which shall include the following.
1. Equipment manufacturer's information used to prepare study.
  2. Assumptions made during study.
  3. Copy of one line diagram.
  4. Arc flash evaluations summary spreadsheet.
  5. Bus detail sheets.
  6. Arc flash warning labels printed in color on adhesive backed labels.

#### 2.03 ARC FLASH WARNING LABELS

- A. Provide arc flash warning labels per NEC 110.16
- B. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.

### **PART 3 - EXECUTION**

#### 3.01 GENERAL

- A. Adjust relay and protective device settings according to reduce arc flash while maintaining coordination between downstream circuit breakers and the upstream main circuit breaker.
- B. Perform minor modifications to equipment as required to accomplish conformance with short circuit study.
- C. Notify Contractor in writing of required major equipment modifications.
- D. Provide laminated one-line diagrams (minimum size 11" x 17") to post on interior of electrical room doors.
- E. Provide arc flash warning labels on equipment as specified on this Section.

**END OF SECTION**

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## SECTION 16060

### GROUNDING AND BONDING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. The section includes requirements for grounding electrodes, equipment grounding and electrical bonding.

##### 1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16060.G01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data

1. Pursuant to Section 01330 Submittal Procedures.
2. Manufacturer's data including materials of construction, methods of installation and related information for each item specified in PART 2 PRODUCTS.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

A. **Ground Rods (16060.G01).**

1. Ground rods shall be provided as shown on the drawings.
2. Ground rods shall be copper clad.

3. Ground rods shall be a minimum of 5/8 inch diameter.
4. Ground rods shall be a minimum of 8 feet long.

**B. Compression Connectors (16060.C20).**

1. Compression connections shall be provided as shown on the drawings and as required for bonding end-use equipment.
2. Compression connections shall be compress-deforming type, extruded copper material.
3. Compression connections shall be tin electroplated for corrosion resistance.
4. Compression connections shall be ring-type connectors. Forked connectors shall not be used on grounding conductors.
5. Provide Burndy products, or approved equal.

**C. Welded Connections (16060.C10).**

1. Welded connections shall be provided as shown on the drawings and as required for bonding ground rods, re-bar, building steel and like connections on the grounding electrode system.
2. Welded connections shall be exothermic welded type connection with materials and equipment manufactured by a single manufacturer for that purpose.
3. Provide Cadweld products, or approved equal.

**D. Mechanical Connectors (16060.C21).**

1. Mechanical connectors shall be provided as shown on the drawings and as required for bonding to pipes.
2. Mechanical connectors shall be UL 467 Listed, copper material.
3. Mechanical connectors shall be sized to match the pipe being bonded.
4. Mechanical connector clamps shall permit parallel or 90° cable connection.
5. Mechanical connectors installed below-grade shall include silicon bronze hardware.
6. Provide Burndy GAR3902 series for above-ground installations, or approved equal.
7. Provide Burndy GAR-BU series for below-grade installations, or approved equal.

**E. Ground Bars (16060.B01).**

1. Ground bars shall be provided as shown on the drawings.
2. Provide Cutler-Hammer model GBK21, GE model TKG42, Square D model PK27GTA, or approved equal.



## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General.**

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
2. Maintain equipment ground continuity throughout the facility by means of a grounding conductor routed in all raceways.
3. Provide grounding conductors pursuant to Section 16121. Conductors shall be copper and shall be sized per the Drawings or the NEC, whichever is greater.
4. Provide ground bushings for all conduits that do not terminate in a hub type fitting and install at the source of power with a bonding conductor fastened to the ground bushing.
5. Provide ground bar kits as shown on the Drawings and where two (2) or more grounding conductors are terminated in a box or enclosure.
6. Install ground rods at the locations and in the number shown on the Drawings or per the NEC, whichever is greater.
7. Bond the grounding electrode system to all metallic water and wastewater piping.

#### **B. Grounding Conductors.**

1. Brush grounding conductors clean of debris before connections are made.
2. Strip insulated conductor insulation in a neat, workman like manner where insulated conductors are used.
3. Fasten all conductors securely.

#### **C. Connections.**

1. Install connectors according to the manufacturer's directions, using the proper dies, tools, molds, shots, loads, etc. designed specifically for this purpose.
2. Provide irreversible welded type connections to ground rods, re-bar, lightning protection box, building steel etc.
3. Provide compression connector type connections to end use equipment and bolt to the equipment using washers and split lock washers for secure fastening. Bolts shall be grade 5 for grounding connections and shall be tightened to the manufacturer's recommend torque.

**END OF SECTION**

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## SECTION 16070

### HANGERS AND SUPPORTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes:

1. This section includes requirements pertaining to electrical equipment anchoring and electrical equipment hanging and support.

##### 1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16070.H01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.

1. Pursuant to Section 01330 Submittal Procedures.
2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

A. **Stainless Steel Hardware (16070.H01).**

1. Bolts shall be 316 or 304 stainless steel and sized for the load served and have a hex head unless specifically specified otherwise elsewhere.
2. Nuts shall be 316 or 304 stainless steel hex nut.

3. Washers shall be 316 or 304 stainless steel, USS pattern flat washers.
  4. Split lock washers shall be 316 or 304 stainless steel.
  5. Threaded rods and couplings shall be 316 or 304 stainless steel.
  6. Eye-bolts, u-bolts, bent-bolts and similar connecting hardware shall be 316 or 304 stainless steel.
- B. Stainless Steel Anchors (16070.A01).**
1. Wedge or stud anchors installed in concrete or masonry shall be 316 or 304 stainless steel and sized for the load served.
  2. Toggle type fasteners shall only be used in hollow sheetrock wall. The wing part of the fastener may be mild steel, but the bolt shall be stainless steel.
- C. Stainless Steel Beam Clamps (16070.B01).**
1. Beam clamps shall be 316 or 304 stainless steel and sized for the load served.
- D. Stainless Steel Strut Channel (16070.S16).**
1. Stainless steel strut channel shall be 316 or 304 stainless steel and shall be a minimum of 12 gauge.
  2. Stainless steel strut channel shall have factory pre-drilled holes.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General.**
1. Hardware shall be set to a torque as recommended by the manufacturer.
  2. Washers and split lock washers shall be installed on all bolts, threaded rods and anchors.
  3. Lead or plastic type anchors are prohibited from use on the project.
  4. When threaded rods are installed in drop-in type anchors, a washer, split lock washer and a jamb nut shall be installed at the anchor to ensure stability.
  5. When channel (strut) is installed as a hanger or support from threaded rod, washers, split lock washers and jamb nuts shall be installed on both sides of the strut to lock it in place.
  6. Cut ends of channel, strut, threaded rods or other cut fittings shall be filed smooth before installation.
  7. Concrete anchors shall be installed as per the manufacturer's directions and set using the manufacturer's supplied tool.
  8. Threaded rod shall not extend more than one (1) inch beyond the channel, strut or other material it is supporting.

9. Hangers and supports shall be installed level and plumb.
10. Hangers and supports shall be installed per the National Electrical Code, Building Code and Structural Code and shall be designed to safely support the load. The ENGINEER may request the CONTRACTOR provide a copy of their design calculations for the seismic requirements and the load served.

**END OF SECTION**

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## SECTION 16075

### ELECTRICAL AND CONTROL IDENTIFICATION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes

1. Requirements for identification of electrical, safety, measurement, data, fire alarm, security, monitoring, control and related components and equipment.

##### 1.02 SUBMITTALS

###### A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16075.S21) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

###### B. Product Data

1. Pursuant to Section 01330 – Submittal Procedures.
2. The initial submittal shall contain all the products, samples and data base specified. An initial submittal that does not contain all the specified data shall be returned as incomplete.

###### C. Samples

1. Provide a sample of each type and size of nameplate, label, tag and means of attachment specified for approval by the OWNER.

###### D. Quality Assurance / Quality Control Submittals

1. The CONTRACTOR shall be responsible for submitting a data base of all identification nameplates, labels, panel schedules and tags required for the

Work. The data base shall be developed in the most current edition of Microsoft Excel for the OWNER's future use.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. Circuit Breaker Panel Schedules (16075.S21).**

1. Shall be created in Microsoft Excel software. One copy of each schedule shall be included in the closeout submittals.
2. Shall be printed on 60 - 70 lb white card stock.

#### **B. Heat Sealing Lamination Products (16075.L11).**

1. Provide documents in laminate when specified. Laminate shall be clear, non- yellowing and sized for various sized documents.
2. Shall be 5 mil in thickness.

#### **C. Velcro (16075.V15).**

1. Provide white Velcro.

#### **D. Plastic Nameplates (16075.P05).**

1. Shall have a black background with white engraved letters. Nameplates for emergency functions shall be red background with white engraved letters. The nameplates shall have self adhesive rated for the environment which they are installed. The font type shall be consistent on all nameplates.
2. Provide products supplied by E.R. Perry Signs & Engraving, or approved equal.

#### **E. Stainless Steel Nameplates (16075.S15).**

1. Shall be 316 or 304 stainless steel.
2. 1.5 inches high by 6.0 inches long minimum.
3. The nameplate shall be between .025 - .050 inches thick.
4. Text shall be as large as possible, shall be center justified and shall be stamped.
5. The stainless steel nameplate shall be attached with stainless steel rivets. No less than four (4) rivets shall be used to securely fasten the nameplate.
6. Provide products supplied by E.R. Perry Signs & Engraving, or approved equal.

#### **F. Stainless Steel Component and Device Tags (16075.S25).**

1. Shall be stainless steel.
2. Two (2) inch round.
3. The tag shall be between .025 - .050 inches thick.



4. The text shall be center justified and shall be stamped.
5. Standard size for characters shall be 0.25 inches high.
6. The stainless steel tags shall be attached to devices with stainless steel beaded chain which shall be provided with two (2) to three (3) inches of slack when the tag is attached to the device. The hole in the tag for the beaded chain shall be at the top and centered on the tag. The hole shall be large enough that the chain will not bind in the hole.
7. Provide products supplied by E.R. Perry Signs & Engraving, or approved equal.

**G. Conduit Tags (16075.S35).**

1. Shall be 316 or 304 stainless steel.
2. Nominally 0.75 inches high by 3.0 inches long.
3. Characters shall be 0.25 inches high. And shall be machine punched or durably embossed.
4. Conduit tags shall be products readily available and manufactured for this purpose.
5. The stainless steel conduit tags shall be attached with stainless steel cable ties.
6. Provide Panduit Permanent Identification System products, or approved equal.

**H. Epoxy Gel (16075.E05).**

1. Shall be a two component, 100 % solids, moisture tolerant, high modulus, high strength, structural epoxy paste adhesive.
2. Provide Sika type Sikadur 31, Hi-Mod Gel, or approved equal.

**I. Conduit Trench Marker Tape (16075.T21).**

1. Shall be a minimum of six (6) inches wide, polyethylene tape manufactured for this purpose.
2. Color code for tape shall be as listed below and the verbiage on the tape shall identify the type of system i.e. "Caution Buried Electric Line Below".
  - a. Electric Power – RED
3. Provide products manufactured by Seaton Identification Products, Harris Industries, or approved equal.

**J. Conductor and Cable Identification Sleeves (16075.T31).**

1. The identification sleeves shall be properly sized for the cable or conductor.
2. Sleeves shall be white with black machine generated characters.
3. Provide Brady wire and cable sleeves, or approved equal.

**K. Flexible Identification Tape (16075.T56).**

1. Shall be white, red, yellow, clear or as otherwise specified tape with black characters.
2. Standard tape size shall be 0.5 inch high unless specified otherwise and shall have extra strength adhesive rated for indoor and outdoor use.
3. Provide products manufactured by Brother, or approved equal.

**L. Arc Flash Labels (16075.A11).**

1. Reference Section 16057 – Electrical Systems Analysis for additional details.
2. Shall be self adhesive and manufactured specifically for this purpose.
3. Shall be four (4) inches high by six (6) inches wide minimum.
4. Shall be based on the latest edition requirements of the National Fire Protection Association (NFPA) 70E – Standard for Electrical Safety.
5. At a minimum the label shall contain the following information.
  - a. Date calculation was performed and who did the calculation.
  - b. Danger or Warning level based on the incident energy. When above 40 cal/cm sq. the label shall read “Danger”.
  - c. Shall identify the hazard as being both arc flash and shock hazard.
  - d. Shall clearly state the incident energy and the level of personal protective equipment (PPE) required.
  - e. Provide labels manufactured by Dura Label, SKM System Analysis, Inc., or approved equal.

**M. Terminal Blocks (16075.B12).**

1. Terminal blocks shall mount on DIN rail and the standard color shall be gray.
2. Grounding terminal blocks shall be green and yellow.
3. Terminal blocks shall be identified two (2) sides with machine generated plastic labels manufactured specifically for that purpose. Labels shall be white with black font.
4. Each terminal strip shall also be identified as shown on the Drawings.

**N. Indicator Light Lens Colors (16075.L33).**

1. Indicator lights lens shall be 30 mm.
2. Shall be red for running or open indication.
3. Shall be green for stopped or closed indication.
4. Shall be amber for fault condition.
5. Shall be white for power on indication.

6. Shall be as identified on the Drawings
- O. **Conductor Color Coding (16075.C89).**
1. Conductors shall be colored as specified in the table below. The technical specification requirements for the conductors are specified elsewhere.

### Conductor Color Coding

System	Conductor	Color
All Systems	Equipment Grounding	Green
IT / Data	Data Cable Sheath (outer cover)	Blue
24 Volt DC	Positive	Blue
	Negative	White w/Blue Stripe
24 Volt AC	Discrete Input Line (hot leg) Side	Blue
	Discrete Input Switch Leg	Blue w/White Stripe
	Discrete Output Line (hot leg) Side	Blue
	Discrete Output Switch Leg	Blue w/Orange Stripe
	Hot Leg	Red
	Neutral	White
120 Volt AC Control	Discrete Input Line (hot leg) Side	Red
	Discrete Input Switch Leg	Red w/Blue Stripe
	Hot Leg	Red
	Neutral	White
	Discrete Input Line (hot leg) Side	Red
	Discrete Input Switch Leg	Red w/White Stripe
120/240 Volt Single Phase	Discrete Output Line (hot leg) Side	Red
	Discrete Output Switch Leg	Red w/Orange Stripe
	Hot Leg # 1	Black
	Hot Leg # 2	Red
	Neutral	White
120/208 Volt Three Phase	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Neutral	White

120, 208, 277 Volt	Switch Legs	Pink
480 Volt Three Phase	Phase A	Brown
Wye or Delta Corner Tap	Phase B	Purple
	Phase C	Yellow
	Neutral	Gray
120/240 Delta Three Phase	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
	Neutral	Gray

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

##### **A. Circuit Breaker Panel Schedules**

1. CONTRACTOR shall request panel schedules in Microsoft Excel software and printing instructions from ENGINEER. CONTRACTOR shall update the panel schedules to reflect as-built conditions. Print schedules on 60 - 70 lb white card stock with black ink.
2. Schedules shall be neatly trimmed with 1/8" white space borders.
3. The finished schedules shall be laminated and neatly trimmed with 1/8" of laminate border.
4. A sample layout shall be submitted to OWNER for approval prior to installation.
5. Attach white Velcro to the panel door and the back of the panel schedule. Velcro shall, at a minimum, be attached to all four corners of the panel schedule.

##### **B. Plastic Nameplates**

1. Provide plastic nameplates for panelboards, motor control centers, motor starters, disconnects, variable frequency drives, control panels and similar equipment. The verbiage on the nameplate shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available on the Contract Drawings.
2. In addition to the nameplate identifying the equipment, a second nameplate shall be provided that identifies the source of power for the equipment i.e. "Fed From PNL208-1".
3. Typically the nameplates shall be centered and installed near the top of the equipment.

4. Nameplates shall be black with white characters unless specified otherwise.
  5. Nameplates on emergency panels shall be red with white characters.
- C. Stainless Steel Nameplates
1. Provide stainless steel nameplates for in-ground boxes, cast-in concrete boxes, electrical boxes larger than four (4) inches in any direction, boxes installed outdoors and vaults.
  2. The nameplates shall be installed on the lid/cover and attached with 1/8 inch, stainless steel rivets in all four corners at a minimum.
  3. The verbiage on the nameplate shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available on the Contract Drawings.
- D. Stainless Steel Component and Device Tags
1. Provide stainless steel component and device tags for instruments, valves, pipes and similar equipment.
  2. The tag shall be attached with a stainless steel beaded chain and attached in a manner and location which enables it to be read without interfering with the operation of the component or device. Whenever possible it shall not be attached to a removable part of the equipment.
  3. The verbiage on the tag shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available on the Contract Drawings.
- E. Conduit Tags
1. Provide stainless steel conduit tags at each point that a conduit terminates at or within an enclosure or box. The stainless steel tag shall be attached with stainless steel cable ties.
  2. Where conduits enter a vault and are installed flush with the walls, the conduit tag shall be installed directly above the conduit entry and attached to the wall of the vault with epoxy gel.
  3. The verbiage on the tag shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available on the Contract Drawings.
  4. Where conduits terminate at a box in an inaccessible location such as behind a sheetrock wall, conduit labels are not required.
- F. Conduit Trench Marker Tape
1. Provide conduit trench marker tape for single or multiple buried conduits. The color and verbiage shall match the type of system installed. If the trench contains several systems, one of which is electric power, the tape shall be for electric power.

2. The tape shall be installed 12 inches below finished grade and shall be laid flat and parallel to the conduits.
3. Provide # 14 AWG, red, THWN-2 tracer wire fastened to one of the conduits. Tracer wire shall be fastened to the conduit with nylon cable ties at five (5) foot spacing or less. The tracer wire shall be brought up with the conduit to points where it terminates or enters in-ground boxes and vaults. The tracer wire shall be fastened above ground with stainless steel cable ties. Label the wire “tracer wire” and seal the end so water cannot penetrate with a heat shrink tubing type cap.

G. Conductor and Cable Identification Sleeves

1. Provide heat shrink, machine generated, white labels with black characters for all cables and conductors. Explanation is provided below on how various systems shall be identified. In many cases the information necessary to develop the unique identification labels will be provided on the Contract Drawings. The verbiage required for the identification shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available or clear based on the information provided on the Contract Drawings.
2. The labels shall be installed between 6 to 8 inches from the end and shrunk. Conductors shall be labeled at all splices and points of termination.
3. Power conductors and cables, including the neutral and the ground conductors shall all be identified individually. The identification label will be developed as follows: The first set of characters will be the equipment code identifying the source of power “PNL208” followed by the circuit number “CKT 12” and a forward slash followed by the room number where the utilization is located and then the utilization equipment. Using the first sequential unit heater in room 2334 as an example, the label would read “PNL208-CKT 12/ 2334-UH-1”.
4. Control conductors, including grounds, shields, etc. shall be identified individually. The label shall identify the point of origin and the utilization equipment it serves. The identification label will be developed as follows: An sample label for a conductor fed from terminal strip 2, terminal block 33 in control panel # 1 (CP-1) to an terminal strip 1, terminal block 4 in automatic transfer switch # 1 (ATS-1) would read CP-1 TS2-TB33 / ATS-1 TS1-TB4.
5. Security conductors and cables shall be identified in the same manner as control conductors.

H. Device and Faceplate Identification Labels

1. Devices, faceplates, security devices, fire alarm & life safety devices, small electrical boxes 4 inches or less located indoors and similar equipment shall be identified utilizing flexible identification tape. Typically the CONTRACTOR shall provide machine generated, white labels with black

characters except as specified otherwise. Explanation is provided below on how various systems shall be identified. In many cases the information necessary to develop the unique identification labels will be provide on the Contract Drawings. The verbiage required for the identification shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available or clear based on the information provided on the Contract Drawings.

2. Power receptacles faceplates (cover plates) shall state the panel and circuit number. A typical label might read “PNL208-1-CKT 15”.
3. Light switches faceplate shall state the panel and circuit number(s). A typical label might read “PNL208-2-CKT 15&17”.
4. Light fixture labels shall be attached adjacent to the ballast and shall follow the same requirements of listing the panel and circuit number. A typical label might read “PNL480-1-CKT 9&11”.
5. Exterior light fixtures shall be uniquely identified to facilitate tracking of routine maintenance. The identification shall be shown on the Contract Drawings. The identification label will be developed as follows: The first set of characters will be the facility code “SLC-012” followed by the equipment code “LGT” and then a sequence number such as “14”. A typical label might read “SLC-012-LGT-14”. The labels shall be self adhesive, yellow vinyl with black characters. The label shall be installed on the bottom of the fixture when mounted 5 feet above finished grade (AFG) or higher and on the top when mounted lower than 5 feet. Labels shall be 0.5 inches high with 0.375 inch characters when mounted lower than 10 feet AFG. Labels shall be 0.75 inches high with .0.5 inch characters when mounted between 10 and 20 feet. Labels shall be 1.0 inches high with .0.75 inch characters when mounted higher than 20 feet AFG.

#### I. Arc Flash Labels

1. The CONTRACTOR shall install arc flash labels on all electrical equipment as required by the NEC and National Fire Protection Association (NFPA) 70E – Standard for Electrical Safety. The minimum requirements for the labels are itemized in PART 2 Products.
2. The CONTRACTOR shall be responsible for providing the coordination study and arc flash analysis necessary to calculate the incident energy and personal protective equipment (PPE) data required on each label.
3. An as-built coordination study and arc flash analysis shall be prepared at the Contractor’s expense and be performed by a Professional Engineering licensed in the State of Oregon. The calculations shall utilize SKM Power Tools software and an electronic and hard copy shall be submitted to the Owner for approval. Arc Flash Labels with all data specified by the current edition of the NFPA 70E (Standard for Electrical Safety) and Occupational

Safety & Health Administration (OSHA) shall be provided by the Contractor.

4. The CONTRACTOR is responsible to make the adjustments to the protective devices and circuit breakers as specified in the coordination study.

J. Terminal Blocks and Terminal Strips

1. Terminal blocks shall be mounted on DIN rail and gray with the exception of the grounding terminal blocks which shall be green and yellow.
2. The terminal blocks shall be identified on both the line and load side with machine generated white labels with black font. Terminal strips shall be labeled with machine generated white labels with black font attached to label blocks manufactured for specifically for this purpose.
3. The verbiage on the tag shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available on the Contract Drawings.

**END OF SECTION**



## SECTION 16080

### ELECTRICAL TESTING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes

1. Electrical and control testing forms and requirements.

##### 1.02 SEQUENCING

A. ENGINEER shall issue written acceptance of the following certifications submitted by the CONTRACTOR before utility power is supplied to conductors, cables, or equipment.

1. Megger Test
2. Continuity Test

B. CONTRACTOR shall verify to ENGINEER that every function of the electrical, measurement, and control systems are operating properly.

#### PART 2 - PRODUCTS – NOT USED

#### PART 3 EXECUTION

##### 2.01 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. CONTRACTOR shall be responsible to become familiar with the test and certification requirements of the Contract Documents for this project. It is the intent of these requirements that the Work will be systematically checked to verify that the functions required or implied, work properly to insure safety for the personnel, environment, and equipment associated with the Work.
2. CONTRACTOR shall complete the certification forms that are supplemental to this section and submit the forms to ENGINEER for approval.
3. All site test and inspection certificates and schedules shall be contained in a 3-ring binder(s).
  - a. Size 8½ inches by 11 inches.
  - b. Paper: 20-pound minimum, white for typed pages.
  - c. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.

- d. Provide each manual with title page to include “Process Electrical Testing”, typed table of contents with consecutive page numbers. Where more than one binder is used, consecutively title each with a volume number. The first binder shall be labeled Volume 1 and consecutively numbered as required to include all test documentation.
  - e. Tab sections for each required section of testing and acceptance certification.
4. CONTRACTOR shall notify ENGINEER seven days in advance of scheduled testing and facilitate the witnessing of those tests by ENGINEER.
5. CONTRACTOR shall provide ENGINEER with current as-built documentation for electrical and measurement and control commissioning with submittal of test certification.
- a. Systems operating at or above 200-volts to ground or more shall be included in the Megger Test Certification. Minimum duration for each test shall be one minute, at 1000 VDC, and minimum acceptable results shall be 50 mega ohms.
  - b. Conductors and cables shall be included in the Continuity Test Certification. No continuity to ground is the only acceptable result of the test.
  - c. Conductors, cables, or equipment failing to meet the minimum requirements shall be replaced with new. Repair will not be acceptable.
  - d. Each individual instrument shall have an Instrument Calibration Certificate. The calibration shall operate within the tolerances specified by the manufacturer of the instrument and the Contract Documents.
  - e. Installed motors shall have a written Motor Insulation Certificate for all the motors listed in the Drawings for the Work. Motors failing test shall be tagged and locked out from operation.

## 2.02 SUPPLEMENTS

- A. Schedule 16080 - A; Megger Test Certificate.
- B. Schedule 16080 - B; Continuity Test Certificate

**END OF SECTION**

SUPPLEMENT 16080 - A  
MEGGER TEST CERTIFICATE

				Project Number:					
Test Equipment Manufacturer:		Model Number:		Project Name:					
Test Equipment Last Calibration Date:		Serial Number:		Accepted By: Date:					
Testing Personnel:		Calibration Certificate		Drawing Reference:					
Test Voltage:		Test Date:		Title:					
				Tag:					
Title	Tag Identification	A-Ø/ B-Ø	A- Ø / C- Ø	A- Ø / Ground	B- Ø / Ground	C- Ø / Ground	A- Ø / Neutral	B- Ø / Neutral	C- Ø / Neutral

SUPPLEMENT 16080 - A  
MEGGER TEST CERTIFICATE

		Project Number: <i>12345</i>							
Test Equipment Manufacturer: <i>APC</i>		Model Number: <i>GH-1</i>							
Test Equipment Last Calibration Date: <i>8/13/02</i>		Serial Number: <i>346321</i>							
Testing Personnel: <i>John Doe</i>		Accepted By: <i>S.E. Davis</i>							
Test Voltage: <i>1000 Volts</i>		Date: <i>01/01/2003</i>							
		Calibration Certificate: <i>Yes</i>							
		Drawing Reference: <i>E-006</i>							
		Test Date: <i>12/17/02</i>							
		Title: <i>Power Distribution Diagram</i>							
		Tag: <i>016</i>							
Title	Tag Identification	A-Ø/ B-Ø	A- Ø / C- Ø	A- Ø / Ground	B- Ø / Ground	C- Ø / Ground	A- Ø / Neutral	B- Ø / Neutral	C- Ø / Neutral
<i>Main Feeder</i>	<i>016-CO3</i>	∞	∞	∞	∞	∞	∞	∞	∞
<i>PNL-07</i>	<i>016-CO7</i>	∞	∞	∞	∞	∞	∞	∞	∞
<i>PNL-12</i>	<i>016-C12</i>	∞	∞	∞	∞	∞	∞	∞	∞

**END OF SUPPLEMENT**



SUPPLEMENT 16080 - B  
CONTINUITY TEST CERTIFICATE

				Project Number: <i>12345</i>	
Test Equipment Manufacturer: <i>Fluke</i>		Model Number: <i>53G</i>		Project Name: <i>Water Division</i>	
Test Equipment Last Calibration Date: <i>Unknown</i>		Serial Number: <i>638842</i>		Accepted By: <i>S.E. Davis</i> Date: <i>01/01/2003</i>	
Testing Personnel: <i>John Doe</i>		Calibration Certificate: <i>No</i>		Drawing Reference: <i>E-501</i>	
		Test Date: <i>12/30/02</i>		Title: <i>Conduit Schedule</i>	
S A M P L E					
Permanent Tag Number	Function	Temporary Tag Number	Device ID Number	Ohms to Ground	
<i>016-34-PNL</i>	<i>Level Indicator</i>	<i>34</i>	<i>016-34</i>	$\infty$	

**END OF SUPPLEMENT**

## SECTION 16121

### 600 VOLT CONDUCTORS AND CABLES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. The section includes the requirements for conductors and cables used to conduct potentials of 600 volts and less.
2. All conductors and cables shall be installed in conduit or approved raceways regardless of which Division the conductors or cables are specified.

##### 1.02 REFERENCES

A. The following is a list of Standards which may be referenced in the Section.

1. American Society for Testing and Materials (ASTM).
  - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
2. National Electrical Contractors Association, Inc. (NECA): National Electrical Installation Standards (NEIS).
3. National Electrical Manufacturers Association (NEMA).
  - a. WC 3, Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - b. WC 5, Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - c. WC 7, Cross Linked-Thermosetting Polyethylene Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - d. WC 55, Instrumentation Cables and Thermocouple Wire.
4. National Fire Protection Association (NFPA). 70, National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL).
  - a. 13, Standard for Power-Limited Circuit Cables.
  - b. 44, Standard for Safety Rubber-Insulated Wires and Cables.
  - c. 62, Standard for Safety Flexible Cord and Fixture Wire.
  - d. 510, Standard for Safety Insulating Tape.
  - e. 854, Standard for Safety Service-Entrance Cables.
  - f. 910, Standard for Safety Test Method for Fire and Smoke Characteristics of Electrical and Optical Fiber Cables Used in Air Handling Spaces.
  - g. 1277, Standard for Safety Electrical Power and Control Tray Cables.

- h. 1581, Standard for Safety References for Electrical Wires, Cables and Flexible Cords.

### 1.03 SUBMITTALS

- A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16121.C01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  - 3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data.
  - 1. Pursuant to Section 01330 Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, weight, and related information for each item specified in PART 2 PRODUCTS.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. **Single Conductors (16121.C01).**
  - 1. Conductors shall be rated for 600 volts and conform to applicable requirements of NEMA.
  - 2. Conductors shall be stranded copper.
  - 3. Insulation type shall be THWN-2. XHHW-2 in #10 AWG or smaller.
  - 4. Conductors shall be sized per the Drawings and the NEC, whichever is greater.
  - 5. Rome Cable Corporation, Southwire Company, Okonite Company, or approved equal.



**B. Flexible Cords (16121.C05).**

1. Conductors shall be rated for 600 volts and conform to applicable requirements of NEMA.
2. Conductors shall be stranded copper.
3. Flexible cord sheath shall be type SOOW, rated for 90 degree C and high-visibility yellow.
4. Southwire Company, General Cable, Electri-Cord Manufacturing Company, or approved equal.

**C. Twisted Shielded Pair (TSP) Cables (16121.C25).**

1. TSP cable shall be rated for 600 volts and conform to applicable requirements of NEMA.
2. Conductors shall be stranded copper. The gauge shall be 16 AWG unless specifically stated otherwise in the Drawings for a particular instance.
3. Overall jacket type shall be PVC.
4. Conductors shall be twisted and bonded along their length to maintain uniform twists. The number of pairs shall be as identified in the Drawings with a drain wire and overall aluminum foil shield.
5. Belden, General Cable, AFC Cable Systems, or approved equal.

**D. 12-Conductor Shielded Pilot Sensor Cable (16121.C12).**

1. Provide Flygt 12-conductor shielded pilot sensor cable, no equal.

**E. VFD Cable – Tray Type (16121.C22).**

1. Provide VFD cable rated for use in cable tray.
2. Rated for up to 2,000-volt, with copper conductors in RHW-2 insulation and PVC sheath.
3. The cable shall have a 5-mil, minimum, copper shield
4. Cable shall be rated for direct bury.
5. Shall be rated for 90 degree C and wet or dry applications.
6. Shall be sized for the load or per the conduit schedule, whichever is greater.
7. Provide with a VFD termination kit for each termination.
8. Provide cable Service Wire Co. Part Number VFD2KTCP3/03 with termination kit, or approved equal.

**F. Industrial Grade CAT5E Cable and Connectors (16121.C33).**

1. Provide CAT5E, 4 pair, # 24 AWG, solid copper, shielded industrial rated cable.
2. Cable shall be TIA 568.C.2 compliant.

3. Cable shall be UL rated for 600-volt.
4. Cable shall be rated for damp or wet locations for use in underground conduits.
5. Cable shall have a rip cord.
6. Provide Industrial cable rated RJ45 connectors design for use with the approved CAT5E cable compatible with the managed and unmanaged switches specified for the Project.
7. Provide Belden, or approved equal.

## 2.02 ACCESSORIES

### A. **Colored Tape (16121.T01).**

1. Colored tape shall be used to identify individual conductors larger than # 6 AWG.
2. 3M colored tape, or approved equal.

### B. **Cable Ties (16121.T05).**

1. Cable ties shall be nylon, adjustable, self-locking, and properly sized for the bundle and force implied.
2. Thomas and Betts, Panduit, or approved equal.

### C. **Pulling Compound (16121.P01).**

1. Pulling compound shall be non-corrosive, noncombustible, nonflammable waxed based lubricant listed for this use.
2. Ideal Company, Polywater, Inc., or approved equal.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. General.

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
2. Conductor and cable installations shall meet or exceed the NECA National Electrical Installation Standards.
3. Twisted Shielded Pair (TSP) cable installation and termination methods are specified in Section 13410 Basic Measurement and Control Instrumentation Materials and Methods and Section 13430 Boxes, Control Panels and Control Centers.
4. CONTRACTOR shall not exceed the manufacturer's recommendations for maximum pulling tensions or minimum bending radii for respective conductors or cables.

5. Pulling compound is recommended for all conductor or cable installations and shall be used on all installations requiring a mechanical pulling device.
6. CONTRACTOR shall furnish and use a dynamometer on all conductor or cable installations requiring the use of a mechanical pulling device. The dynamometer shall be used to verify the maximum pulling tensions are not exceeded. Should the pulling tensions be exceeded, the conductor or cable shall be removed from the raceway and discarded. It shall not be reused under any circumstance on the project. The CONTRACTOR shall be responsible to make the alterations necessary before attempting to re-pull new conductors or cables.
7. Immediately after pulling in conductors or cables, the pulling compound shall be completely removed from the conductors or cables, from boxes, enclosures, floors, walls, etc.
8. Conductor and cable installations shall be continuous without splices or intermediate terminations unless specifically identified on the Drawings or prior written approval from the ENGINEER.
9. Where conductors or cables are routed in boxes, enclosures or cable tray they shall be neatly bundled with cable ties at intervals not to exceed 12 inches on center. The tension for the cable ties shall be set with a tool specifically manufactured for that purpose and of the same manufacturer as the cable tie. Side cutters, linemen pliers and similar tools shall not be used to cut the tail end of the cable tie. The CONTRACTOR shall only use the tool specifically manufactured for this purpose and of the same manufacturer as the cable tie.
10. Conductors and cables shall not be installed until the raceway, boxes, enclosures, conduit bushings, etc. have all been installed. Where conductors or cables have been installed prior to meeting this requirement, the ENGINEER shall at their discretion elect to have the conductors or cables removed, disposed of and replaced with new product.
11. Should the outer jacket of any conductor or cable be damaged in any way, they shall be removed, disposed of and replaced with new product.
12. An equipment grounding conductor shall be installed in all raceways. Size shall be as identified on the Drawings or the NEC, whichever is greater, but in no case shall it be less than # 16 AWG for under 50 volts and no less than # 14 for 50 volts or above.
13. Install VFD cable as per the cable manufacturer's requirements.
14. Provide 12-conductor shielded pilot sensor cable between intrinsically safe barrier in the Pump Disconnect Panel (PDP) and the MAS711 unit.
15. Ground and bond the VFD cable as recommended by the cable manufacturer.
16. Install the CAT5E industrial cable and connectors per TIA Standards.

**END OF SECTION**

## SECTION 16131

### CONDUIT AND FITTINGS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes

1. The Section includes the requirements pertaining to conduits and fittings used to contain electrical conductors and cables.
2. All conductors and cables shall be installed in conduit or approved raceways regardless of which Division the conductors or cables are specified.

##### 1.02 REFERENCES

###### A. The following is a list of standards which may be referenced in this Section.

1. American National Standards Institute (ANSI).
  - a. C80.1, Rigid Steel Conduit-Zinc Coated.
2. American Society for Testing Materials (ASTM).
  - a. A123 E1, Standard Specification for Zinc-Coated (Galvanized) Coatings on Iron and Steel Products.
3. National Electrical Contractors Association (NECA).
  - a. National Electrical Installation Standards (NEIS).
4. National Electrical Manufacturers Association (NEMA).
  - a. RN 1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Coated and Intermediate Metal Conduit.
  - b. TC 3, PVC Fittings for use with Rigid PVC Conduit and Tubing.
  - c. TC 6, PVC and ABS plastic Utilities Duct for Underground Installation.
5. Nation Fire Protection Association (NFPA).
  - a. 70, National Electrical Code (NEC).
6. Underwriters Laboratories, Inc. (UL).
  - a. 6, Standard for Safety Rigid Metal Conduit.
  - b. 514B, Standards for Safety Fittings for Conduit and Outlet Boxes.
  - c. 651, Standard for Safety Schedule 40 and 80 PVC Conduit.
  - d. 651A, Standard for Safety Type EB and Rigid PVC Conduit and HDPE Conduit.
  - e. 1660, Standard for Safety Liquid-Tight Flexible Nonmetallic Conduit.
  - f. 360, Standard for Safety Liquid-Tight Flexible Metallic Conduit.

- g. 797, Standard for Safety Electrical Metallic Conduit.

### 1.03 SUBMITTALS

- A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16131.C01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  - 3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product data
  - 1. Pursuant to Section 01300 - Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.

### 1.04 QUALITY ASSURANCE

- A. PVC Coated Galvanized Rigid Steel Conduit Installation Training and Certification.
  - 1. All installers of PVC Coated Galvanized Rigid Steel Conduit shall be factory trained and certified prior to the installation of any PVC Coated Galvanized Rigid Steel Conduit. CONTRACTOR shall provide written proof of current factory certification for all installers.
- B. All PVC Coated Galvanized Rigid Steel Conduit shall be warranted for three (3) years, minimum.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. **Galvanized Rigid Steel Conduit (GRC) (16131.C01).**
  - 1. Shall be mild steel, hot dipped galvanized inside and out.

2. Shall be manufactured in accordance with ANSI C80.1 – Rigid Steel Conduit, Zinc Coated, and UL-6.
3. Conduit fittings shall be hot dipped galvanized malleable iron.
4. Condulets shall form 7 type.
5. The use of three-piece couplings shall be incorporated only when unavoidable and not simply due to poor planning and layout.
6. The use of compression, setscrew and split conduit fittings is unacceptable.
7. Gaskets shall be installed on all conduit covers regardless of the environment they are installed in.
8. Conduit straps shall be hot dipped galvanized malleable iron and incorporate matching conduit spacers when attached directly to walls, ceilings and floors.
9. LTV steel, Triangle PWC, or approved equal.

**B. PVC Coated Galvanized Rigid Steel Conduit (PVC-GRC) (16131.C10).**

1. Shall meet the manufacturing specification of GRC before PVC coating is applied.
2. Shall be manufactured in accordance with NEMA RN1 Standard for PVC coated GRC.
3. Exterior PVC coating shall not be less than 40 mils thick.
4. The exterior coating shall be sufficiently flexible to permit field bending the conduit without cracking or flaking the coating.
5. Chemically cured two-part urethane coating, at a nominal 2 mil thickness shall be applied to the interior of all conduit and fittings.
6. Female conduit or fitting opening shall have a PVC sleeve extending one-conduit diameter or 2 inches; whichever is less, beyond the opening.
7. The inside diameter of the sleeve shall be the same diameter as the outside diameter of the conduit before the coating is applied.
8. The wall thickness of the sleeve shall be 40 mil minimum.
9. Conduit fittings, condulets, mounting hardware and accessories shall be PVC coated to the same specifications as the conduit.
10. Condulets shall be form 7 type.
11. Gaskets shall be installed on all conduit covers regardless of the environment they are installed in.
12. The screw heads on condulets shall be encapsulated by the manufacturer with a corrosion resistant material, or shall be stainless steel. All condulets shall have the same type of type of screw heads, stainless steel or encapsulated.

13. The use of three-piece couplings shall be incorporated only when unavoidable and not simply due to poor planning and layout.
14. The use of compression, setscrew and split conduit fittings is unacceptable.
15. Ocal Inc., Perma-coat, or approved equal.

**C. Liquid-Tight Flexible Aluminum Conduit (LFAC) (16131.C20).**

1. Shall be constructed of a flexible aluminum core with a sunlight resistant thermoplastic outer jacket.
2. Conduit fittings shall be manufactured to the PVC-GRC fitting specifications. Galvanized or non-metallic conduit fittings are unacceptable unless written approval is obtained from the ENGINEER for specific locations before installation.
3. No couplings shall be installed.
4. Sealing rings shall be installed where conduit terminates at an enclosure.
5. Conduit shall be Anaconda, Electriflex, T & B, or approved equal.
6. Sealing ring shall be OZ Gedney 4Q-G, or approved equal.

**D. Rigid Non-metallic Conduit (PVC) (16131.C30).**

1. Shall be schedule 40 PVC unless specifically called out otherwise on the Drawings.
2. Shall be sunlight resistant.
3. Shall be manufactured in accordance with UL-651 Standard.
4. Conduit and fittings shall be securely glued.
5. Provide conduit bell ends at vaults unless specifically called out otherwise on the Drawings.
6. Provide PW Pipe, Carlon, or approved equal.

**E. Hazardous Location Flexible Coupling (16131.C40).**

1. Shall be listed for Class 1, Division Hazardous Locations.
2. Shall be constructed of flexible brass tubing, insulating wire duct, bronze outer braid, bronze end fittings, and protective PVC coating.
3. Shall be liquid-tight.
4. Shall be Crouse Hinds EC Series, or approved equal.

## 2.02 ACCESSORIES

**A. Conduit Thread Lubricant (16131.L01).**

1. Shall be an electrically conductive with copper particles suspended in the product.
2. Provide Kopr-Shield Catalog number CP8-TB, or approved equal.



**B. Glue (16131.G01).**

1. Glue shall be the wet/dry rated cement commonly referred to as “Blue Glue”.

**C. Modular Floor and Wall Sleeves (16131.S01).**

1. Seals shall be rated at 20 PSIG minimum.
2. Shall have stainless steel hardware.
3. Shall be properly sized for the conduit.
4. Provide modular sealing system resistant to acids and alkalis. Temperature range of – 40 to 210 degrees F.
5. Provide link-seal Model number S-316, or approved equal.

**D. Cord Grip (CGB) (16131.C89).**

1. Provide stainless steel bodied cord grips with NPT mounted in conduit couplings as identified on the Drawings.
2. Provide Hubbell, Kellems, or approved equal.

**E. Pulling Twine (16131.T31).**

1. Provide 200 pound tensile strength pulling twine in spare conduits and as called out elsewhere on the Drawings.
2. Greenlee twine, or approved equal.

**F. Cord Connector (16131.C90).**

1. Provide stainless steel cord grip with integrated stainless steel mesh.
2. Provide Hubbell SCH1000 Series, or approved equal.
3. Provide cord grip with stainless steel integrated mesh for any unsupported cord longer than 59 inches to provide adequate support of the cord.

**G. Bushing Plug (16131.P90).**

1. Provide OZ Gedney type PPC bushing plug, or approved equal.

**H. Conduit System Drain (16131.D33).**

1. Provide a conduit system drain designed specifically for the purpose of draining accumulated condensate and to provide ventilation designed to minimize condensation.
2. The device shall UL Standard 514B certified.
3. The bodies and locknut shall be copper-free aluminum construction. The device shall be supplied with a stainless steel screen which may be removed and cleaned as required.
4. Provide a Cooper Crouse-Hinds 0.75 inch drain catalog number CD2-SA, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General Requirements**

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification
2. Install conduit runs in accordance with the schematic representation shown on the Drawings.
3. Provide conduit drains installed as shown on the Drawing details and in conduit systems as identified on the Drawings. Discuss the installation details with the ENGINEER before underground conduits are covered. Changes that may become necessary in the conduit system resulting from a lack of coordination with the ENGINEER prior to covering underground conduits shall be completed by the CONTRACTOR at no additional expense to the OWNER.
4. Minimum conduit size shall be .75 inch unless specifically called out otherwise on the drawings.
5. Where raceways are indicated, but the routing is not identified, the routing shall be the CONTRACTOR'S choice and in accordance with the rest of the Contract Documents and the National Electrical Code (NEC).
6. Raceways shall be electrically and mechanically complete before the conductors are installed.
7. Routing of conduits may be adjusted to avoid obstructions. Coordinate with other trades prior to installation of raceways. Lack of such coordination shall not be justification for extra compensation and removal and reinstallation to resolve conflicts shall be at the CONTRACTOR's expense.
8. Conduit joints shall be wrench tight, thoroughly grounded, secure and free of obstructions.
9. Conduits shall be reamed.
10. Strap wrenches and vises shall be used to install PVC-GRC conduit to prevent wrench marks and damage to the outer PVC coating. Conduits with damaged coating shall be replaced, repair is unacceptable.
11. Metallic threads shall all be coated with conduit thread lubricant before assembly. Failure to install the lubricant will result in removal of all conduit and reassembly with the conduit lubricant.
12. Exposed conduits shall be installed parallel or perpendicular to the structural members and surfaces and shall be level and or plumb.
13. When two or more conduits are routed in the same general direction their routing shall be parallel with symmetrical bends.

14. Conduits shall be bent with equipment specifically designed for this purpose and for the specific size and type of conduit.
15. Conduits that are creased or crushed shall be replaced.
16. Install conduits such that they do not interfere with the proper and safe operation of equipment and do not block or otherwise interfere with the ingress and egress and installation of removable hatches and covers.
17. Install expansion joints as needed across expansion joints in the structure and at other locations where necessary to compensate for thermal or mechanical expansion or contraction.
18. Conduits shall be routed at least six (6) inches from high temperature piping, ducts and flues.
19. Conduits installed in exposed areas indoors shall be GRC type unless the area contains potentially corrosive elements.
20. Within all Class 1, Division 1 and Division 2 Hazardous Locations, provide conduit seal offs and boxes and fittings listed for Class 1, Division 1 or Division 2 Hazardous Locations per the NEC.
21. Conduits installed in all outdoor locations, corrosive areas and vaults shall be PVC-GRC. PVC-GRC conduit with damaged PVC coating shall be replaced. Repair is unacceptable.
22. Flexible connections to motors within a Hazardous Location shall be made with a Hazardous Location Flexible Coupling. Lengths shall not exceed three (3) feet.
23. Conduits that terminate at an enclosure that does not have a threaded hub shall be installed with a Myers type hub and ground ring. No exceptions shall be permitted without prior written approval for specific locations issued by the ENGINEER. Conduits that are permitted to terminate without a Myers type hub or a threaded hub shall have a ground bushing installed. A separate bonding conductor shall be routed to all ground bushings within an enclosure and be bonded to the enclosure and grounding conductor if present.
24. Final connections to dry type transformers, motors, instruments and other equipment requiring a flexible connection shall be made with LFAC conduit. Lengths shall not exceed three (3) feet.
25. All conduits shall be capped throughout construction to prevent entrance of dirt, trash, water, etc.
26. All conduits that are trade size 2.5" and larger which are routed through floors, ceilings or walls below grade shall include a large enough opening to accommodate the installation of Link-Seal. After installation and inspection of the Link-Seal, the CONTRACTOR shall install non-shrink type grout that matches the color of the surrounding material. The grout shall be installed on both sides of the Link-Seal installation.

27. All power conduits routed to or from an adjustable frequency drive or a variable frequency drive shall be metallic conduit. Conduits installed underground shall meet the requirements listed below under part B; underground and concrete encased conduit installation.
28. Spare conduits shall be provided with a coupling and threaded male plug that matches the makeup of the conduit for the area they are installed in. The conduit shall terminate at an enclosure when one is called out and exists as part of the Work. Where the spare conduit is stubbed up in a concrete slab for future equipment, it shall be installed flush with the finished floor. Where spare conduits are routed to other areas such as outside a building envelope, in an attic, to a vault, etc., the conduit shall have a female conduit cap installed.
29. All conduits shall be individually identified at every point they terminate. The conduit identification shall be the same as that which is used on the conduit /conductor schedule in the Drawings. Should conduits be installed that are not listed on the conduit schedules, the CONTRACTOR shall add conduit callouts to the as-built conduit schedules and label the conduits accordingly.

B. Underground and Concrete Encased Conduit Installation.

1. Underground conduits shall be PVC except as specifically noted differently elsewhere.
2. Conduits routed under a concrete slab shall be routed under the vapor barrier. The conduits shall be routed deep enough so the radius of the conduit stubbed up through the slab is completely below grade. The vapor barrier shall be sealed at every point a conduit penetrates the barrier as per the requirements specified for the vapor barrier.
3. All power conduits routed to or from an adjustable frequency drive or a variable frequency drive shall be metallic conduit. Where routed underground these conduits shall be PVC-GRC type conduit.
4. Underground conduits shall be routed as shown on the Drawings.
5. Power conduits shall be separated from all other conduits by a minimum of 12 inches and when required to cross other conduits it shall be done at a 90 degree angles.
6. Conduit bends greater than 45 degrees shall utilize PVC-GRC conduit for the bend.
7. Conduit runs stubbed out of concrete shall make a transition to PVC-GRC at least six (6) inches before leaving the encasement.
8. Conduits routed in structural concrete shall be routed in such a manner as to not interfere with the structural integrity of the concrete. The ENGINEER shall approve CONTRACTOR's proposed conduit routing before installation. It is the CONTRACTOR's responsibility to coordinate conduit

routing with the ENGINEER well before it is scheduled to be installed. Conduits shall be stubbed up directly under the enclosure or device they will serve. The CONTRACTOR is responsible to coordinate with the other trades prior to installation of raceways. Lack of coordination shall not be justification for extra compensation and removal and re-installation of conduits to resolve conflicts shall be done at the CONTRACTOR's expense.

9. Where conduits are stubbed up out of a concrete floor or slab, the PVC-GRC conduit shall extend two (2) inches above finished floor or grade including housekeeping pads before transitioning to any other type of conduit.
10. Underground conduit shall have a minimum of 24 inches of cover unless specifically called out differently on the Drawings.
11. Conduits routed from or to buildings or structures shall be concrete encased unless specifically called out differently on the Drawings.

C. Miscellaneous

1. Provide cord grip for any unsupported cord.

**END OF SECTION**

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## SECTION 16135

### BOXES AND ENCLOSURES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. This Section includes requirements for electrical device boxes, enclosures, in-ground boxes and vaults.

##### 1.02 REFERENCES

A. The following is a list of Standards that may be referenced in the Section.

1. American Society for Testing and Materials (ASTM).
  - a. A123 E1 Standard Specifications for Zinc-Coated Coatings on Iron and Steel Products.
2. National Electrical Contractors Association, Inc. (NECA).
  - a. 5055 National Electrical Installation Standard.
3. National Fire Protection Association (NFPA).
  - a. 70 National Electrical Code (NEC)
4. Underwriters Laboratory, Inc. (UL).
  - a. 514C Standard for Safety Non-Metallic Outlet Boxes, Flush Device Boxes and Covers.
  - b. 50 Enclosures for Electrical Equipment.

##### 1.03 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16135.B01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are

being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

- B. Product Data.
  - 1. Pursuant to Section 01330 Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.

## **PART 2 - PRODUCTS**

### 2.01 DEVICE BOXES

- A. **Cast Iron Boxes (16135.B01).**
  - 1. Shall be cast iron galvanized boxes, have tapered threaded hubs and be the deep FD type in all cases.
  - 2. Boxes shall have internal grounding screw.
  - 3. Shall have external mounting tabs.
  - 4. Whichever manufacturer is submitted and approved, all like boxes on Project shall be of the same manufacturer.
  - 5. Provide OZ Gedney, Crouse-Hinds, or approved equal.
- B. **PVC Coated Cast Iron Boxes (16135.B10).**
  - 1. Shall comply with the specification for cast iron boxes.
  - 2. Shall be coated to the same specifications as the PVC-GRC conduit.
  - 3. Shall have external mounting tabs.
  - 4. Whichever manufacturer is submitted and approved, all like boxes on Project shall be of the same manufacturer.
  - 5. Provide Ocal, Perma-Coat, or approved equal.
- C. **General Enclosures (16135.E01).**
  - 1. Shall be NEMA 4X stainless steel.
  - 2. Shall have an aluminum interior mounting panel (backpanel).
  - 3. Shall be constructed of stainless steel with hinged and gasketed door.
  - 4. Provide with necessary accessories and those shown on the Drawings.
  - 5. Provide a grounding kit.
  - 6. Whichever manufacturer is submitted and approved, all like boxes on Project shall be of the same manufacturer.



## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General.**

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
2. Install boxes and enclosures in accordance with the schematic representation as indicated on the Drawings.
3. Boxes and enclosures shall be mounted level and plumb.
4. Boxes and enclosures shall not be altered, holes drilled, etc. in any way that may compromise the NEMA rating of the enclosure or box.
5. Boxes and enclosures shall be mounted with stainless steel hardware.
6. Boxes and enclosures shall be bonded to the equipment grounding conductor.
7. Surface mounted enclosures and boxes shall be spaced off the surface at least ¼ inch in damp or wet locations.
8. Boxes and enclosures with threaded hubs or punched holes shall have the opening match the conduit size. The use of reducing bushings or reducing washers is unacceptable.
9. Galvanized cast iron boxes are permitted only where GRC conduit is permitted.
10. PVC-coated boxes shall be used wherever PVC-GRC conduit is required.
11. Enclosures shall be provided whenever a junction or pull box larger than 4 inches square is required.
12. Provide a divider whenever a box contains conductors of different potentials that the code requires separation.
13. Install vaults and in-ground box tops (lids) such that they are ½ inch above finished grade to prevent water ingress.
14. Conduits entering or exiting vaults shall do so at via the precast ducts or knock-outs only. Conduits shall not enter or exit through the floor or any other area not design specifically for that purpose and pre-approved by the ENGINEER.

**END OF SECTION**

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## SECTION 16140

### WIRING DEVICES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. This Section includes the requirements for wiring devices such as receptacles, toggle switches and devices plates.

##### 1.02 REFERENCES

A. The following is a list of Standards which may be references in the Section.

1. National Electrical Contractors Association (NECA): National Electrical Installation Standards (NEIS).
2. National Electrical Manufacturers Association (NEMA).
  - a. WD1 – General Requirements for Wiring Devices.
  - b. WD6 – Wiring Device Dimensional Requirements.
3. National Fire Protection Association (NFPA): 70.
4. Underwriters Laboratories, Inc. (UL): 1070.

##### 1.03 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16140.R01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

- B. Product Data.
  - 1. Pursuant to Section 01330 Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.

## **PART 2 - PRODUCTS**

### 2.01 MATERIALS

#### **A. Ground Fault Circuit Interrupter Receptacles (16140.R10).**

- 1. Shall be heavy duty hospital grade, two-pole, three wire grounding type with screw type terminals suitable for number 10 American Wire Gauge (AWG).
- 2. Shall be NEMA 5-20R, rated for 20 amperes, 125 volt configuration.
- 3. Provide duplex or single receptacles as shown on the Drawings.
- 4. Shall be gray in color unless fed from an emergency circuit and in that case the receptacle shall be red in color.
- 5. Provide Hubbell GFR8300SGGY, Hubbell GFR8300SGR for gray receptacles, or approved equal. Red receptacles shall be sample model number except for color designation.

#### **B. General Purpose Toggle Switches (16140.S01).**

- 1. Shall be heavy duty specification grade with grounding screw, 20 amperes, 120-277 volt rated with screw type terminals suitable for number 10 American Wire Gauge (AWG).
- 2. Single or double throw, single pole, three-way or four-way as shown on the Drawings.
- 3. Shall be gray in color.
- 4. Provide Hubbell CSB120 Specification Grade Commercial Series, or approved equal.

#### **C. Weatherproof Receptacle Device Plates (16140.P11).**

- 1. Weatherproof receptacle device plates shall be provided as shown on the drawings and in all locations that may be subjected to damp or wet conditions.
- 2. Weatherproof receptacle device plates shall be in-use type weatherproof receptacle device plates that allow for weatherproof protection even when a cord is plugged into the device.
- 3. Weatherproof receptacle device plates shall be metallic.
- 4. Weatherproof receptacle device plates shall be gasketed.
- 5. Weatherproof receptacle device plates shall be lockable.

6. Weatherproof receptacle device plates shall be UL Listed.
7. The device plate shall be PVC-coated and of a similar design when installed on PVC-coated boxes.
8. Provide Red Dot model CKMUV, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General.**

1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
2. Devices shall be bonded to their enclosure and the equipment grounding conductor with a separate grounding conductor attached to the device which will allow the device to be detached from the enclosure without disconnecting the equipment grounding conductor from the enclosure.
3. The use of the mounting yoke as the only method for bonding is unacceptable.
4. Devices that are not installed at the end of the line (circuit) shall be pig-tailed out and the pig-tails shall be connected to the line and load conductors.
5. After the pigtailed conductors are terminated on the device and before it is installed in the enclosure the exposed energized parts shall be wrapped with electrical insulating tape with a minimum of three wraps.
6. As the device is installed in the enclosure, care shall be taken to neatly fold the conductors inside the enclosure so as to not kink, bind or otherwise damage the sheath of the conductors.
7. Terminations on all devices shall be via pressure or compression type connectors. Wrapping conductors around a termination screw and tightening is unacceptable.
8. Mounting heights for receptacles shall be 18 inches to center from finished floor unless called out otherwise on the Drawings or specified at different height to meet minimum code requirements. Where countertops are present, receptacles shall be mounted horizontally and mounted 4 inches to center above the back-splash. The CONTRACTOR is responsible to coordinate with the approved casework submittals. Failure to do so will require the CONTRACTOR to relocate devices at their expense.
9. Mounting height for switches shall be 46 inches to center above finished grade unless called out otherwise on the Drawings or specified at different height to meet minimum code requirements. Where countertops are present, switches shall be mounted 5 inches to center above the back-splash. The CONTRACTOR is responsible to coordinate with the approved casework

submittals. Failure to do so will require the CONTRACTOR to relocate devices at their expense.

10. Coordination is the responsibility of the CONTRACTOR. If a conflict exists for the mounting location of devices, the CONTRACTOR shall bring it to the ENGINEER's attention during the rough-in phase and the ENGINEER shall provide direction. Failure to coordinate conflicts during the rough-in phase will result in relocation of devices at the CONTRACTOR's expense.
11. Devices shall be installed level and plumb. Devices shall be brought out plumb with the wall surface via UL listed spacers approved for this purpose if necessary.
12. Devices shall be tested for voltage, polarity, ground integrity and in the case of GFCI receptacles, that they operate as intended.
13. The position of devices, as shown on the Drawings, are general locations only unless dimensioned. The CONTRACTOR is responsible to coordinate with various trades to ensure no conflict exists.

#### **END OF SECTION**

## SECTION 16150

### WIRING CONNECTIONS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes.

1. This Section includes requirements for conductor termination methods.
2. Additional conductor termination means and methods are specified in Sections 13410 Basic Measurement and Control Instrumentation Materials and Methods and Section 13430 Boxes, Control Panels and Control Centers.

##### 1.02 SUBMITTALS

###### A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16150.C01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

###### B. Product Data.

1. Pursuant to Section 01330 - Submittal Procedures.
2. Manufacturer's data including materials of construction, applications and related information for each item specified in PART 2 PRODUCTS.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. Small Compression Connectors (16150.C01).**

1. Insulated fork, ring or splicing (butt) connectors shall be provided for # 10 AWG or smaller conductors that splice together or terminate with a screw other than in a terminal block.
2. Connectors shall be properly sized for the conductor and for the stud used.
3. Burndy, Panduit, Thomas and Betts, or approved equal.

#### **B. Insulated Wire Ferrules (16150.F10).**

1. For all conductors terminating on terminal blocks, install crimp-on, insulated plastic sleeve ferrules on each conductor. Install ferrules with a crimping tool provided by the ferrule manufacturer for that purpose.
2. Wire ferrules shall be color coded to match the DIN color code.
3. Weidmuller, Panduit, American Electric, Inc., or approved equal.

#### **C. Medium and Large Compression Connectors (16150.C10).**

1. Non-insulated copper compression connectors shall be provided for # 8 AWG and larger conductors.
2. The connector shall have a voltage and current rating equal to or exceeding the conductor.
3. The barrel shall be long enough to accommodate a minimum of two (2) circumferential crimps.
4. The connectors shall be properly sized for the conductor.
5. Burndy, Panduit, Thomas and Betts, or approved equal.

#### **D. Electrical Spring Connectors (Wire Nuts) (16150.W01).**

1. Provide properly sized spring connectors for the size and number of conductors spliced.
2. Ideal, 3M, Thomas and Betts, or approved equal.

#### **E. Insulated Mechanical Multi-Tap Connectors (16150.M01).**

1. Provide properly sized, insulated, mechanical, multi-tapped connectors for splices.
2. Burndy, Panduit, Thomas and Betts, or approved equal.

### **2.02 ACCESSORIES**

#### **A. Electrical Tape (16150.T40).**

1. General electrical tape shall be premium grade, all weather vinyl electrical insulating tape.



2. 3M – Scotch 33+, or approved equal.
- B. Thin Wall Heat Shrink Tubing (16150.T01).**
1. Thin walled heat shrink tubing shall be flame retardant and made of cross-linked polyolefin.
  2. The tubing shall have a minimum operating temperature of – 55 to + 135 degrees Celsius.
  3. Burndy, Panduit, or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General**
1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
  2. Care shall be taken when terminating conductors to avoid kinking, cutting or puncturing the jacket or allowing contamination by grease, oil or water.
  3. Care shall be taken when terminating conductors to properly support the conductors and to avoid undue pressure on the connector or utilization equipment.
  4. Conductors shall be terminated by use of lugs, pressure type connectors wire nuts or terminal blocks. Wrapping conductors around a screw type terminal is not acceptable.
  5. Compression connectors shall be installed using the tool and die provided by the same manufacturer as the connectors and as per their directions.
  6. Compressions on connectors used for # 8 AWG conductors and larger shall have a minimum of two (2) circumferential crimps.
  7. Indenter type crimps on compression connectors shall not be used on conductors larger than # 10 AWG.
  8. Additional conductor termination means and methods including terminal blocks and control conductors are specified in Sections 13410 Basic Measurement and Control Instrumentation Materials and Methods and Section 13430 Boxes, Control Panels and Control Centers.
  9. Connectors shall be installed as per the manufacturer's directions.
  10. Insulated wire ferrules shall be provided for conductors terminated on terminal blocks utilizing a crimping tool provided by the ferrule manufacture specifically for this purpose.
  11. Where wire ducts in enclosures exist, conductors shall be grouped together and routed in the wire ducts and shall be fanned out to the terminals.

12. Wire nuts shall be used on conductors # 10 AWG or less and only for splicing conductors at light fixtures, at receptacles and motors. No other splicing of conductors with wire nuts are permitted unless specifically identified on the Drawings.
13. All spare conductors shall be identified individually, neatly coiled and fastened with cable ties. The coil shall be labeled to describe its origin. Spare conductors shall be left long enough to be neatly routed and terminate anywhere within the enclosure.
14. Thin wall heat shrink tubing shall be installed over splices or over the barrel of connectors installed indoors.
15. Thin wall heat shrink tubing shall be installed over twisted shielded pair cable where the cable is stripped back. Reference Section 13410 Basic Measurement and Control Instrumentation Materials and Methods for specifics on this installation.
16. As connections are set with a torque wrench, a black felt marker shall be used to mark across the bolt, nut or screw indicating the torque has been set.
17. Insulated Mechanical Multi-Tap Connectors shall be utilized for splices located at in-ground lighting and power boxes. It may also be used for motor terminations.

B. Terminations For Motors.

1. Conductors sized # 10 AWG or less for phase conductors shall be connected with wire nuts set tight. The wire nuts shall be wrapped with premium grade electrical tape with a 50 percent overlap, installed in a clockwise rotation to hold the connector in place and to keep debris out of the connector.
2. The equipment grounding conductor shall be terminated on a lug identified for this use. If the motor is not supplied with a lug, a ring or compression type lug shall be used.
3. Conductors sized larger than # 10 AWG shall be terminated with compression connectors properly sized. The connectors shall be bolted together in a pigtail type fashion using stainless steel bolts, flat washers, lock washers and nuts. They shall have a torque as recommended by the bolt manufacturer for the bolt size used.
4. The bolt shall not be longer than the minimum necessary for the connection. The connectors shall be wrapped with varnished cambric tape with a 50 percent overlap covering the end of the connectors and extending one inch beyond the connector barrel. The varnished cambric tape shall be held in place by two layers of premium quality electrical tape, each layer with a 50 percent overlap.
5. Insulated Mechanical Multi-Tap Connectors may be used for motor terminations in lieu of the compression connectors and varnished cambric tape method.

6. Conductors shall be left as long as practical for termination in the motor terminal box.

**END OF SECTION**

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## SECTION 16210

### ELECTRICAL UTILITY SERVICES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. The Section includes electrical utility requirements and contact information.

##### 1.02 SYSTEM DESCRIPTION

###### A. Electrical Service

1. The CONTRACTOR shall coordinate all work and inspections with the ENGINEER, the local jurisdiction having authority, Pacificorp, and the OWNER.
2. The CONTRACTOR is responsible for all costs for this work including fees for permits.
3. The fees for the electric utility shall be paid by the OWNER.
4. The CONTRACTOR shall provide all necessary installation services that are not provided by the electric utility.
5. The CONTRACTOR shall provide all necessary components that are not provided by the electric utility. All components shall be as specified by the electric utility. Components include conduits, pull rope, vaults, pull boxes, transformer pads, current transformer cabinets, meter socket enclosures, bollards, and ancillary items.
6. The CONTRACTOR shall comply with the electric utility's electric service requirements.

###### B. Temporary Service.

1. The CONTRACTOR shall be responsible to coordinate work with the local electrical utility serving the facility.

#### PART 2 - PRODUCTS

###### A. Transformer Vault and Top (16210,V02).

1. Provide Oldcastle Precast Vault Base # 776-57-B-PCORP and Top # 7992958, no equal, Pacificorp Standard.

#### PART 3 - INSTALLATION

##### 3.01 QUALITY CONTROL

- A. Install the vault and top oriented as shown on the drawings. Coordinate the location and installation with the ENGINEER and the electric utility.

- B. Reference the Civil drawings and specifications for the requirements for boring the primary conduit under the railroad tracks.
- C. Coordinate, provide and install per the utility's latest standards.
- D. All work shall comply with the electric utility's electrical service requirements, electric utility's specifications, and the Contract Documents.
- E. CONTRACTOR shall coordinate work with other trades to avoid conflicts, delays and unnecessary interference with operation of the facility during construction.
- F. CONTRACTOR shall provide all materials and incidentals required for a complete and operable system, even if not indicated explicitly by the Contract Documents.
- G. The routing of the conduit is critical and shall be coordinated with the utility, ENGINEER and OWNER.

**END OF SECTION**

## SECTION 16410

### ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes the following enclosed low voltage components rated at 600 VAC or less:
1. Main Service Disconnect.
  2. Manual Transfer Switch (MTS).
  3. Generator Termination Box.
  4. Utility Meter Socket.
  5. Current Transformer (CT) Can.

##### 1.02 REFERENCES

- A. National Fire and Protection Association (NFPA)
1. 70 - National Electrical Code (NEC)
- B. National Electrical Manufacturers Association (NEMA).
1. B 3-2001 - Molded Case Circuit Breakers and Their Application.
  2. AB 4-2001 - Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
  3. KS 1-2001 - Enclosed and Miscellaneous distribution Equipment Switches (600 Volts Maximum).

##### 1.03 SUBMITTALS

- A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16410.S21) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.

3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data

1. Pursuant to Section 01330 - Submittals.
2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.

C. Shop Drawings

1. Back panel and enclosure layouts including interior and exterior front and side exterior view details showing maximum overall dimensions.
2. For enclosure weighing 150 pounds and over, provide physical properties, handling and mounting data including total weight, lifting instructions, height, and floor space required. Mounting requirements for seismic zone 4.
3. All drawings shall list the equipment number.
4. Component designations, shall match those shown on the Drawings.

D. Quality Assurance/Control Submittals

1. Manufacturer's Instructions
  - a. List special requirements or restrictions of the motor/load combination.
  - b. Submit copy of the manufacturer's operating and maintenance manuals and, installation instructions.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements

1. Products shall be UL listed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. Products shall be stored and installed in a dry environment maintained at 65 degrees F or above.

## **PART 2 - PRODUCTS**

2.01 MANUFACTURED UNITS

A. **Main Service Disconnect (16410.D01).**

1. Main service disconnects shall be provided as shown on the Drawings.



2. Main service disconnects shall be rated 3 Phase, 4 Wire, 600 AMP, 480 VAC.
3. Main service disconnects shall be UL listed as “Suitable for use as Service Entrance Equipment”.
4. Main service disconnect enclosures shall be surface mounted, NEMA 1, indoor rated.
5. Main service disconnect enclosures shall not have factory pre-punched knock-outs.
6. Main service disconnect breaker and enclosure shall be rated for fault current as called out on the Drawings.
7. Main service disconnect breaker shall be thermal, adjustable magnetic trip, molded case.
8. Main service disconnect breaker shall be 600 ampere trip unit.
9. Main service disconnect breaker terminals shall be rated for use with 75° C. wire.
10. Main service disconnect breaker handle shall be capable of being locked out in the OFF position.
11. Main service disconnect breaker shall indicate on/ tripped/ off status according to the position of the operating handle.
12. Main service disconnect grounded conductor connection shall be copper.
13. Provide Siemens, Eaton Cutler Hammer, or approved equal.

**B. Manual Transfer Switch (16410.M01).**

1. Manual transfer switches shall be provided as shown on the Drawings.
2. Manual transfer switches shall be rated for the load served and shall switch all the phase conductors and the neutral.
3. Manual transfer switches shall be fused type and provided with type “J” fuses rated for AIC noted on the Drawings.
4. Manual transfer switch ground bus shall be large enough to accommodate terminations for all grounding conductors.
5. Manual transfer switch enclosures shall be painted steel, NEMA 1 rated.
6. Provide Siemens, Eaton Cutler Hammer, or approved equal.

**C. Generator Termination Box (16410.G01).**

1. Provide a 14-gauge minimum type 304 or 316L stainless steel enclosure with the following features:
  - a. The seams shall be continuously welded and ground smooth.
  - b. Provided with a seamless foam-in-place gasket.

- c. Enclosure shall have a rolled lip around three sides of door.
  - d. Stainless steel door clamp assembly.
  - e. Hasp and staple for padlocking.
  - f. Bonding provisions on door and grounding stud on body.
  - g. Provide a Hoffman catalog number A30H2408SSLP with a conductive steel panel A30P24G, or approved equal.
2. Provide enclosed power distribution blocks for terminating the portable generator cables.
- a. Provide connectors dual rated for aluminum or copper conductors. The connectors shall be rated for up to 600 volts AC.
  - b. Enclosed Block provides IP-20 touch protection.
  - c. Manufactured from high strength 6061-T6 aluminum alloy.
  - d. Electro-tin plated.
  - e. High Short-Circuit Current Rating (SCCR) with fuse protection up to 100,000 SYM Amps.
  - f. Provide a terminal block for all phase conductors, grounded conductors and grounding conductors.
  - g. Provide IlSCO model number PDE-22-250, or approved equal.
3. Provide welding cable as specified below.
- a. Provide 4/0 AWG Class K, copper, with 30 AWG flexible copper stranding conductors and EPR insulation – jacket.
  - b. Temperature rating shall be 90 degrees C.
  - c. Resistant to chemicals, oils, abrasion, heat and flame.
  - d. Passes VW-1 flame test.
  - e. Provide USA wire and cable, inc. part number 4/0-01WELD, or approved equal.
4. Provide Cam-Lok Single Pole Devices as specified below.
- a. Shall be rated for use with 2/0 – 4/0 AWG cables.
  - b. Shall be provided with insulators.
  - c. Provide two (1) complete sets of male connectors.
  - d. Shall be provided with set screw connector bodies.
  - e. Provide Hubbell parts as follows, no equal, City Standard.
    - 1) White male plug part # HBL400MW
    - 2) Brown male plug part # HBL400MBN
    - 3) Orange male plug part # HBL400MO
    - 4) Yellow male plug part # HBL400MY
5. Provide a four (4 inch) stainless steel knockout seal with the stud and wingnut oriented inside the closure for security. Do not provide a knockout seal which can be removed without opening the enclosure door for access.

Provide plastic, non-metallic edging material and install in the 4-inch punched hole.

**D. Utility Meter Socket (16410.M95).**

1. The meter socket shall comply with the specifications of the local electric utility servicing the project.
2. The meter socket enclosure shall be stainless steel.

**E. Current Transformer (CT) Can (16410.C95).**

1. The CT Can shall comply with the specifications of the local electric utility servicing the project.
2. The CT Can shall be stainless steel.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
- B. Install switches and circuit breakers as indicated on the Drawings.
- C. Install the CT can and meter socket as shown on the Drawings and as per the utilities requirements.
- D. The CONTRACTOR shall provide one full sets of welding cable with color coded cam-lok pigtails.
  1. A set will consist of a pigtail in each of the four colors (white, brown, orange and yellow). Each pigtail shall be a 4/0 welding cable 36 inches in length with a color coded, insulated female cam-lok installed on one end. The Cam Lok set will be installed on the mechanical lugs of the generator termination box. The Owner has a portable generator outfitted with the matching female Cam-Lok.
  2. Punch a 4-inch hole in the bottom of the generator terminal box and line the lip with door edging material. Install knockout seal after installing edging material.
- E. Install equipment level and plumb.
- F. Provide nameplates as indicated on the Drawings.
  1. Manual transfer switch positions shall be clearly labeled Normal Power, Off & Emergency Power respectively.

**3.02 ADJUSTING**

- A. Adjustable features such as the trip setting for a circuit breaker shall be adjusted pursuant to the manufacturer's instructions.

**END OF SECTION**

## SECTION 16447

### LOW VOLTAGE MOTOR CONTROL CENTERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes
  - 1. This section includes requirements for Low voltage (600 VAC or less) Motor Control Centers (MCC).
- B. Variable frequency drives (6 Pulse) shall be factory installed by the motor control center manufacturer as shown in the Contract Documents.

##### 1.02 REFERENCES

- A. The following is a list of Standards that may be referenced in the Section.
  - 1. NEMA Standard ICS-2 Industrial Control and System Controllers, Contactors, and Overload Relays Rated 600 Volts.
  - 2. Underwriters Laboratories (UL) Standard No. UL-508C Power Conversion Equipment.
  - 3. Underwriters Laboratories (UL) Standard No. UL-845 Motor Control Centers.
  - 4. American National Standards Institute ANSI C19.3 Compressors for Process Industries.
  - 5. National Electric Code (NEC).
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

##### 1.03 SUBMITTALS

- A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16447.S21) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.

3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data
1. Provide product data on all components specified.
  2. Manufacturer's data including material of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.
  3. Certified copies of manufacturer's test reports shall be submitted.
- C. Shop Drawings
1. Dimensional drawings showing the overall length, width and height of the assembled MCC. Included on these drawings shall be individual bucket locations and conduit entry areas.
  2. Physical properties, handling, mounting and, if applicable, shipping break point locations shall be shown in the drawings. This shall include total weight, lifting instructions, height and floor space required.
  3. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between units and to remotely mounted devices. Show all field devices, switches, lights, wire and terminal numbers, and grounding requirements. Indicate special identifications for electrical devices per the Contract Documents including internal and external interlocking, all components, overload settings, ratings, wire tags, terminal blocks, and devices for each load. Each drawing shall be circuit specific for the load submitted on. No typical schematic drawings shall be approved.
  4. All drawings shall list the equipment number of the connected motor(s) for each MCC submitted on.
  5. Component designations, e.g., relays, fuses, etc. shall match those shown in the Contract Documents.
  6. Complete Bills of Materials shall be included with and shown on the Schematic or panel construction drawings for each MCC. Include list of spare parts provided.
  7. The equipment drawings, summary tables, elementary drawings/diagrams, spare parts list and bill of materials list shall be computer generated. Hand drawings, sketches, or lists are not acceptable.
  8. Manufacturer's seismic certificate.
  9. Seismic bracing calculations and drawings by a qualified licensed Civil or Structural Engineer.

#### 1.04 QUALITY ASSURANCE

##### A. Qualifications

1. The motor control center shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches and motor starters included in the motor control center and who has produced the same type of equipment for a period of at least 15 consecutive years.
2. Motor control center[s] shall be designed, assembled and tested by the manufacturer of the motor control equipment included in the control center assembly.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

##### A. Equipment Handling

1. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

#### 1.06 COMMISSIONING

1. Provide commissioning in accordance with Section 16001.

#### 1.07 MAINTENANCE

##### A. Maintenance Service

1. Pursuant to 16010 requirements.

##### B. Maintenance Manuals

1. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

##### C. Extra Materials

1. One dozen each size of cover bolts, cage nuts and door fasteners.
2. Two cans of aerosol touch-up paint.
3. 50 percent replacement fuses, each type and size.
4. Ten (10) replacement lamps for pilot lights.
5. Two (2) of each color replacement lens caps for pilot lights.

- D. Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturers name, description and part number on the exterior of the package.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Allen Bradley Centerline 2100 with Intellicenter, no equal, Owner Standard.
  - 1. Provide proposal #5195870-1, no equal, Owner Standard.

### **2.02 MANUFACTURED UNITS**

- A. Low Voltage Motor Control Centers.
  - 1. Ratings
    - a. The motor control center shall be rated as shown on the Drawings.
    - b. All MCC units shall have a full short-circuit rating that meets or exceeds the available fault current shown on the Drawings.
    - c. All units and sections shall be UL labeled. Motor control centers containing service entrance equipment shall be UL labeled "Suitable For Use As Service Equipment."
    - d. MCC shall be bottom fed.
  - 2. Enclosure
    - a. The enclosure shall be rated NEMA Type G. Structures shall be totally enclosed, dead-front, free-standing assemblies. They shall be 90 inches high and 20 inches deep. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference.
    - b. Compartments for mounting control units shall be incrementally arranged such that not more than six (6) Size 1 or Size 2 starters can be mounted within each vertical structure. Guide rails shall be provided.
    - c. The structure shall be designed to allow for the addition of future sections at either end and to permit the interchanging of units.
  - 3. Vertical Sections
    - a. Each vertical section shall be approx. 90 in high and 20 inches deep.
    - b. Vertical sections shall have internal base mounting angles at the bottom and external lifting angles at the top running continuous within each shipping block.
    - c. Each vertical section shall have side sheets extending the full height and depth of the section to minimize the chance of fault propagation to adjacent sections.
  - 4. Incoming Line Compartments
    - a. Conduit and cable entries shall be as shown in the Contract Documents.



- b. The size and quantity of incoming cables shall be as shown in the Contract Documents.
- c. The cover of the main circuit breaker compartment shall be painted yellow to clearly identify the compartment from all other parts of the motor control center.

5. Wireways

- a. Structures shall contain a horizontal wireways of standard sections, at both the top and bottom of the structure. Horizontal wireways shall be not less than 6 inches high. The horizontal wireways shall be isolated from the horizontal bus via metal barriers and be readily accessible through hinged covers. To prevent damage to cable insulation, the wireway opening between sections shall have rounded corners and the edges shall be rolled back. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference.
- b. A full height vertical wireway with minimum of 35 square inches of cross-sectional area and hinged door shall be provided in each standard vertical section. Wireways shall contain steel rod cable supports. A permanent vertical wireway wall shall separate the buckets from the vertical wireway, and remain intact even when the buckets are removed.

6. Horizontal and Vertical Power Bus Bars

- a. The power bus system shall be supported, braced, and isolated by a bus support molded of a high strength, non-tracking glass-reinforced polyester material.
- b. Bus bracing shall be rated to withstand the fault current specified.
- c. The horizontal bus shall be rated at 65 degrees C temperature rise over a 40 degrees C ambient in compliance with UL standards.
- d. The horizontal bus shall be connected to the vertical bus with a minimum of two (2) bolts and each bolt shall be capable of handling the load.
- e. Horizontal Bus
  - 1) The horizontal bus shall be continuously braced within each section.
  - 2) The horizontal bus shall be copper with tin plating.
  - 3) Both ends of the horizontal bus splices shall have a minimum of (2) bolts up to 1200A, and four (4) bolts 1600A and above and each bolt shall be capable of handling the load.
  - 4) Bus ratings shall be as shown on the Drawings.
- f. Vertical Bus
  - 1) The vertical bus shall be copper with tin plating.
  - 2) The vertical bus shall be continuously braced.

- 3) The bus shall be encapsulated and isolated from the user by a red non-metallic molded cover.
- 4) Back-to-back sections shall utilize the same vertical bus to accommodate front and rear sections/ buckets.
- 5) The vertical bus shall accommodate plug-in loads totaling a minimum of 300 amps. Provide higher rated vertical bus if required by the MCC load layout.
- 6) A center horizontal bus shall be constructed with a top and bottom vertical bus. The ampacity of each vertical bus shall be 300 amperes for an effective ampacity of 600 amperes per section.
- 7) Vertical bus safety protection shall consist of shutters that automatically open when buckets are inserted and automatically close when buckets are removed. Shutters shall prevent personnel exposure to live vertical bus bars. Shutters shall isolate the bus from arcing faults.

7. Grounding and Ground Bus

- a. A tin-plated copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the motor control center. The ground bus shall be located in the horizontal wireway.
- b. The size of the horizontal ground bus shall be sized for the load served.
- c. Each structure shall contain a tin-plated vertical ground bus rated 300 amperes. The vertical ground bus shall be directly connected to the horizontal ground bus via a tin-plated copper connector.
- d. A grounding stab shall be provided on each plug-in unit, such that the stab engages onto a copper vertical ground bus prior to the power stabs engaging.
- e. A grounding point shall be provided at each starter unit for purposes of landing the ground wire coming from the motor. This grounding point shall be directly tied to the horizontal ground bus.

8. Bucket (Unit) Construction

- a. Bucket Mounting
  - 1) After insertion, each plug-in unit shall be held in place by a latch that is located at the front of the unit.
  - 2) Multi-turn latches requiring more than 1/4 turn per latch shall not be acceptable.
  - 3) Plug-in stabs shall be mounted in a glass reinforced plastic insulation block at the rear of the unit.

- 4) Wiring from the unit disconnecting means to the plug-in stabs shall be routed into this insulation block such that the wiring is not exposed at the rear of the unit.
- 5) Size 1 through Size 5 non-reversing starters (FVNR) shall be plug-in buckets.
- 6) Where shown in the Contract Documents, provide buckets configured to accommodate the variable frequency drives (VFD). VFDs mounted in motor control centers shall be factory integrated and shipped fully configured and fabricated to the job site. Site installation of the VFDs within the motor control centers is not acceptable.
- 7) The unit door shall be fastened to the stationary structure (not the unit itself), so that the door can be closed when the unit has been removed.
- 8) The door shall be hinged on the left-hand side so that it opens away from the vertical wireway.
- 9) Minimum bucket height shall be 13 inches nominal.
- 10) A heavy-duty, non-conductive, industrial duty, flange mounted handle mechanism for control of each disconnect switch or circuit breaker shall be provided.

9. Removable Power Stabs

- a. Plug-in unit shall have the capacity of withdrawing the power stabs, allowing the primary voltage to be disconnected with the unit door closed.
- b. The withdrawable assembly shall accept a standard 1/4' hex-style drive socket.
  - 1) A complete power engagement shall occur when turning the mechanism 1/4 turn in clockwise direction.
- c. The withdrawable stabs design shall include a set of stab assembly-mounted shutters.
  - 1) Shutters shall automatically open before the power stabs can extend and connect to the vertical bus.
  - 2) Shutters shall close as soon as the power stabs are disconnected from the vertical bus and are completely inside the stab housing.
  - 3) The withdrawable stabs design shall include interlock mechanisms.
  - 4) A through-the-door mechanism shall allow the unit to be locked in the 'Power Stabs Disconnected' position.
    - a) This mechanism shall be such that it can be padlocked to prevent the connection of the stabs to

the vertical bus even when the unit is inserted into the vertical section.

- b) Unit door shall be capable of opening with the padlock and lockout engaged.
- 5) Unit disconnect handle must be in the OFF position (load side of the disconnect device removed from line power) before the stabs can be disconnected from the vertical bus.
  - a) Mechanism shall also allow the removal of the unit from the vertical section but only after the disconnect handle has been turned OFF and the power stabs have been disconnected from the vertical bus.
  - b) Unit stabs have to be disconnected (withdrawn) before the unit can be re-inserted into the vertical section.
- 6) The withdrawable stabs design shall include feedback mechanisms that are verifiable with the unit door closed.
  - a) A two-position indication system shall be provided (Power Stabs Connected/Disconnected) and shall be visible from the door.
  - b) Connected with Red Indication—Primary voltage stabs fully engaged and connected to the vertical bus.
  - c) Disconnected with Green Indication—Primary voltage stabs fully disconnected from the vertical bus.
- 7) A set of test points shall be located on the front of the unit for identification of:
  - a) Power stabs position: a positive continuity check between these probes shall verify that all three power stabs have been disconnected from the vertical bus and completely withdrawn inside the stabs housing.
  - b) Stab-mounted shutters position: a positive continuity check between these probes shall verify that the shutters are closed, meaning that all three power stabs have been disconnected and withdrawn inside the stab housing.
- 8) Withdrawable power stabs with door closed mechanism shall not increase the original unit height design so total space in the motor control center is optimized.

10. Power Supplies

- a. Power supplies shall provide 24V DC power for all devices within the MCC as required.

- b. The MCC Manufacturer shall size the power supplies based on the power consumption requirements of MCC.
- c. Shall be provided with a buffer module to allow a minimum 500 ms ride-through at full load.
- d. Power supplies shall be redundant (dual source).
- e. Line voltage power shall be derived from the MCC. Overcurrent protection and control power transformers shall be provided by the Manufacturer.
- f. Power supplies shall be Allen Bradley Bulletin 1606-XLSDNET8.
- g. Buffer shall be Allen Bradley Bulletin 1606-XLBUFFER.

11. Overcurrent Devices

- a. The operator handle of all buckets shall be interlocked with the MCC frame, so that a unit insert cannot be withdrawn or inserted when the operator is in the ON position.
- b. The operating handle of all buckets shall be capable of being pad locked in the open (off) position.

c. Main Circuit Breakers

- 1) Shall be molded case breakers with electronic trip units and have a short circuit rating as indicated on the Drawings. The electronic trip units shall have the following adjustable trip settings:
  - a) Long time delay
  - b) Short time delay
  - c) Instantaneous trip
- 2) Shall be provided with Arc Flash Reduction Maintenance Mode capability.
  - a) A remote selector switch shall be provided on the door of the main circuit breaker compartment. The switch shall allow the user to put the circuit breaker into maintenance mode.

d. Motor Circuit Protectors

- 1) Starter buckets shall have full-voltage, non-reversing, motor circuit protectors (HMCP) with magnetic trip only and a short circuit rating as indicated on the Drawings. The HMCP shall provide adjustable magnetic protection and be adjustable up to 1700% of motor nameplate full load current to comply with NEC requirements. All HMCP combination starter units shall have a 'tripped' position on the unit disconnect and a push-to-test button on the HMCP. Type HMCP motor circuit protectors through size 4 shall include transient override feature for motor inrush current.

e. Feeder Circuit Breakers

- 1) VFDs and feeder circuit breakers shall be protected by molded case with electronic trip units and have a short circuit rating as indicated on the Drawings. The electronic trip units shall have the following adjustable trip settings:
    - a) Long time delay
    - b) Short time delay
    - c) Instantaneous trip
12. Combination Across the Line Starters
- a. Shall be NEMA rated. NEMA sizes shall be as shown on the Drawings.
  - b. Shall be full voltage non-reversing (FVNR) as shown on the Drawings.
  - c. Shall be protected by motor circuit protector molded case circuit breakers.
  - d. Shall be provided with control power transformer with a secondary rated for 120 VAC. The control power transformer will be provided with primary and secondary fusing.
  - e. Shall be Allen Bradley Bulletin 509.
  - f. Shall be provided with lugs suitable for terminating #8 AWG wire for owner furnished power factor correction capacitors, where shown on the Drawings.
13. Variable Frequency Drives (VFDs)
- a. Shall be six-pulse.
  - b. Shall be rated normal duty (110% overload capacity for one minute and 150% overload capacity for up to 3 seconds).
  - c. Shall include internal class 10 adjustable overload protection. The overload protection shall be speed sensitive and adjustable.
  - d. Shall be provided with Ethernet/IP network protocol. An embedded Ethernet port for direct network cable connections shall be provided.
    - 1) Below is a list of I/O that the OWNER wants to monitor from the three (3) VFD's to their PLC via ethernet/IP:
      - a) SPEED command
      - b) START command
      - c) FAIL alarm
      - d) HOA in auto
      - e) RUNNING
      - f) SPEED Feedback
  - e. Provide 30W, 24 VDC power supply in each of three (3) VFD's with primary fusing. Provide field terminal blocks from secondary for use to power MAS711 Base relays mounted remotely.

- f. The pump supplier will provide one CT to be installed on one leg of 480 VAC power supply of each VFD. VFD shall be supplied with two (2) field terminal blocks for the CONTRACTOR's use to monitor this field installed CT.
- g. Provide field terminal blocks for a "MAS GO Interlock," which is a remote set of dry contacts, from the remote MAS relay to enable pump VFD to start.
- h. Provide field terminal blocks for a "DS OK," which is a remote set of dry contacts, monitoring that both parallel pump motor receptacles are connected to allow the pump to start. That signal shall energize a control relay which closes a set of contacts to enable the pump to start and a second set of dry contacts which energizes a control relay for monitoring FAIL conditions. The "DS OK" contacts shall be N/C and open when energized so, under normal conditions, this FAIL control relay is not energized.
- i. Provide field terminal blocks for a remote set of N/O dry contacts from the MAS711 which close on alarm. These alarm contacts shall energize the FAIL control relay mentioned above. *PLEASE NOTE:* These two fail conditions energizing a FAIL control relay will have to be tied into the VFD manufacturers fail monitoring to generate the signal to the OWNER's PLC via ethernet/IP.
- j. Provide field terminal block which will monitor a dry set of contacts which close when the VFD (pump) is RUNNING.
- k. Provide field terminal blocks for a remote START signal (hardwired in addition to the one provided via ethernet/IP) for remote hardwired START. This signal will be generated by a high level float located in the wet well via a control relay in the control panel. This START signal must latch-in until STOP signal is generated.
- l. Provide field terminal block for a remote STOP signal (hardwired in addition to the one provided via ethernet/IP) for remote hardwired STOP. This signal will be generated by a low level float located in the wet well via a control relay in the control panel.
- m. Shall be provided with a drive input line reactor.
  - 1) Input impedance shall be 3%.
- n. Shall be provided with human interface module (HIM).
  - 1) Shall include LCD display, operating keys and programming keys. Display shall be seven line by twenty-one character backlit LCD display.
  - 2) Shall be door mounted.
- o. Inputs and Outputs
  - 1) Shall be fully programmable.
- p. Shall be protected by molded case circuit breakers with electronic trip units.

- q. Shall be Allen Bradley PowerFlex 755.
- 14. Operator Control Stations
  - a. Each across the line starter shall be equipped with a minimum of three (3) indicating lights, Hand-Off-Auto (HOA) selector switch, and two (2) normally open contacts, unless otherwise scheduled on the drawings. A unit-mounted device panel shall have space to accommodate six (6) 30 mm oil-tight pilot-control devices or indicating ammeters, voltmeters, or elapsed time meters. In order to improve maintenance capabilities, the device panel shall withdraw with the unit. Door-mounted pilot devices are not acceptable. Indicating lights shall be as follows;
    - 1) GREEN = RUNNING
    - 2) RED = FAULT
    - 3) WHITE = OFF
  - b. Drive Disable Mushroom Push Button
    - 1) For VFD applications, provide a maintained mushroom style push button, mounted on the enclosure door that when pushed, will open the drive enable input.
  - c. Indicator lights: LED type full size, full voltage, with push-to-test feature. Colors and quantities shall be as shown in the Contract Documents.
  - d. Selector switches and mushroom push buttons shall be Allen Bradley Bulletin 800T (30mm).
- 15. Terminal Blocks
  - a. Terminal blocks shall be mounted within the unit and located near the front for accessibility. They shall not be located at the rear of the vertical wireway.
  - b. Power terminal blocks shall be provided.
  - c. On plug-in units, control terminal blocks shall be pull-apart style.
- 16. Internal Wiring shall be NEMA Class IIS, Type B. All internal wires shall be clearly labeled at each termination and the label identification shall be clearly present on the record drawings submitted. Manufacture installed wires shall be green for grounds, white for neutrals, and red for control power. All terminal blocks shall be identified with labels showing the terminal block identification and individual terminal numbers. Control wiring shall be 600V, 90 °C, 16 AWG minimum machine tool wire (MTW). Power wiring shall be 600V, 90 °C, 10 AWG minimum.
- 17. Metering
  - a. MCC's shall include a plug-in metering unit.
  - b. Units shall include a fusible disconnect with fuses and fused control power transformer.



- c. Current transformers shall be shipped loose to be installed by the Contractor on the incoming line sections.
  - d. A solid-state power monitor with door mounted display shall be provided.
    - 1) Power monitors shall be capable of displaying the following:
      - a) Line currents for all three phases with +/- 0.2% full-scale accuracy.
      - b) Average three phase current +/- 0.2% full-scale accuracy.
      - c) Current and voltage unbalance +/- 0.2% full-scale accuracy.
      - d) Real, reactive, apparent, and true power +/- 0.4% full-scale accuracy.
      - e) KWH, KVARh, and kVAHnet.
      - f) True RMS to the 45th harmonic.
      - g) Frequency at +/- 0.5%.
      - h) Power factor at +/- 0.4%
  - e. Shall include min/max logs and trend logs with up to 45,867 data points.
  - f. Shall be capable of performing distortion analysis with THD, Crest Factor (I, V) and Distortion power factor.
  - g. Shall include an EtherNet/IP communication port.
  - h. Shall include two Form C relays.
  - i. Shall be Allen-Bradley PowerMonitor 5000.
18. Surge Protection Devices (SPD)
- a. Shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels.
  - b. Shall be provided with a circuit breaker disconnect.
  - c. Minimum withstand current shall be as follows:
    - 1) 250kA per phase.
    - 2) 125kA per mode
19. Finishes
- a. Surfaces shall be painted according to the manufacturers standard color scheme. All unpainted parts shall be plated for resistance to corrosion.
20. Identification Requirements
- a. Equipment and internal and external components shall be identified pursuant to Section 16075.

B. Ethernet / IP Communication

1. The MCC shall have factory installed industrial Ethernet cabling incorporated throughout the vertical section across the entire lineup.
2. Each motor starter, electronic overload relay, power monitor, AC drive, and soft starter unit in the MCC shall be supplied with a means to communicate via EtherNet/IP network.
3. Plug-in units should be able to move around without impacting the network.
4. Maintenance activities should be able to be performed without impacting the network
5. Network Topology
  - a. The MCC Ethernet network switches shall be configured in a ring topology. The motor control center intelligent devices shall be connected to network switches in a star topology.
6. Industrial Ethernet Switch
  - a. The MCC shall have a managed industrial Ethernet switches mounted in fixed mounted units within the lineup. Reference the Drawings for locations.
  - b. The managed industrial Ethernet switch shall deliver optimal network security, network resiliency (if needed), and flexibility. The functionality should include port-based control/prioritization, switch-level ring support, VLAN segmentation, and other Layer-2 switch features.
  - c. The switch shall be suitable for use in a switch-level ring network topology.
  - d. The switch shall be provided with a minimum of two (2) spare Ethernet ports.
  - e. The spare Ethernet ports shall be wired to spare Industrial Ethernet RJ45 connectors within the vertical wireways of the motor control center, located as shown on the Drawings. The spare Ethernet ports shall be located in vertical wireways that are adjacent to SPACE compartments.
  - f. The switch shall be located in the top horizontal wireway or within it's own bucket, as shown on the Drawings.
  - g. The switch shall accept redundant fiber optic cable connectors. The redundant fiber optic cable shall be used to network the switch to the Plant's PLC control panels.
  - h. The switch shall be provided with single mode LC type fiber optic connectors.
  - i. The size and quantities of switches shall be determined by the Manufacturer.
  - j. The switch shall be Allen Bradley Stratix 5700 Full Version.

7. Industrial Ethernet Cable
  - a. Shall be rated 600-volt UL Category 5E PLTC.
8. Layout
  - a. The industrial Ethernet cable through the MCC section shall be routed from the top or bottom horizontal wireways. To prevent accidental mechanical damage during MCC installation, the cable shall be located behind barriers to isolate the cable from the unit space and wireways.
  - b. Up to eight (8) Ethernet adapters/ports shall be installed in each vertical wireway.
  - c. Each Ethernet adapter in the vertical wireway shall be connected to a port on the industrial Ethernet switch by using an industrial Ethernet cable.
  - d. Each Ethernet/IP device within each unit shall be factory connected to the industrial Ethernet switch.
9. Ethernet/IP Interface for Motor Starter Units
  - a. Motor starters shall be provided with an electronic overload relay with built-in Ethernet/IP communication. The overload relay shall have the following features:
    - 1) Shall operate at 24V DC.
    - 2) Shall have LED status indicators.
    - 3) Test/reset button.
    - 4) Selectable trip of NEMA Class 5 to 30. Unless indicated, the trip class shall be set for NEMA Class 20 operation.
    - 5) Up to six (6) inputs and three (3) outputs of direct I/O. Additional I/O can be provided with an add-on module to the overload relay. Input voltage shall match the overload relay power voltage.
    - 6) Protective functions shall include programmable trip level, warning level, time delay, and inhibit level. Protective functions shall include thermal overload, phase loss, stall, jam, underload, current imbalance, remote trip.
    - 7) Current monitoring functions shall include phase current, average current, full load current, current imbalance percent, percent thermal capacity utilized, and ground fault current (if required).
    - 8) Voltage, energy, and frequency measuring capabilities shall be included when voltage protection is required.
    - 9) Diagnostic information shall include device status, warning status, time to reset, trip status, time to overload trip, and history of last five trips.

- 10) Preventive maintenance information shall include Allowable starts per hour, required Time between starts, Starts counter, Starts available, Time until next start, total operating hours, and elapsed operating time.
  - 11) Overload relay shall include an on-board logic processor to allow basic logic to be performed within the overload relay based on network data and the status of the inputs to the overload relay.
  - 12) The overload relay shall support the following CIP messaging types: Polled I/O messaging, Change-of-state/cyclic messaging, Explicit messaging, Group 4 offline node recovery messaging, and Unconnected Message Manager (UCMM).
  - 13) The overload relay shall provide the following functions to minimize network configuration time: Full parameter object support, Configuration consistency value, and Add-on Profile.
- b. Shall be Allen Bradley E300.

C. Data CD

1. The Owner owns a copy of the latest Allen-Bradley Intellicenter software. A data CD will be provided, which contains the following:
  - a. Database file for MCC lineup
  - b. User manuals and instruction sheets
  - c. Spare parts list
  - d. Wiring diagrams
  - e. Form 385s.
  - f. .DNT and EDS files.

D. Nameplates

1. Provide nameplates as show on the Drawings and as specified in Specification Section 16075.

## 2.03 SOURCE QUALITY CONTROL

A. Tests, Inspections

1. All factory testing and inspections shall be performed with corrections made for noted discrepancies before the assembled MCC can be shipped to the job site.
2. The completely assembled MCC shall be given dielectric tests in accordance with the governing UL and NEMA standards.
3. The completed MCC assembly shall be inspected at the factory for conformity with the Drawings.

4. Control Design Testing
  - a. After dielectric tests and manufacturing inspections are complete, the assembled MCC shall be operated under conditions that simulate actual control connections as specified in the Drawings.
  - b. All local control switches shall be operated and contact closures/ jumpers shall be used to simulate field devices that are not installed as of the shop testing date.
- B. Verification of Performance
  1. The CONTRACTOR shall give the PROJECT MANAGER and the OWNER a minimum of 2 weeks notice prior to commencement of testing.
  2. An authorized representative of the PROJECT MANAGER may witness the testing.
  3. The manufacturer shall submit signed and dated certification that all of the factory inspection and testing described in this specification has occurred with successful results prior to shipment of the assembled MCC equipment.
  4. Failure of testing shall result in rejection of the MCC equipment until corrections are made and the performance is demonstrated in compliance with this Section.
- C. Ethernet/IP Programming and Testing
  1. The MCC manufacturer shall load the IP Address and Subnet Mask into each unit.
  2. The IP address shall be as provided by the Owner.
  3. The MCC manufacturer shall test the MCC to ensure that each unit communicates properly prior to shipment.
  4. Each unit shall have a label showing the IP Address for the devices within it.
  5. The IP address shall be visible on the unit nameplate for all Ethernet/IP enabled devices.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
- B. Motor control center floor sills shall be bolted directly a concrete equipment pad. The equipment pad shall be 4” high with a minimum 2” reveal on each side of the switchboard enclosure.

- C. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed.
- D. In general, all conduits entering or leaving a motor control center or switchboard shall be stubbed into the bottom or top horizontal wireway directly below or above the vertical section in which the conductors are to be terminated.
- E. Housekeeping pads shall be included for the motor control centers or switchboards as detailed in the Contract Documents.
- F. Install the equipment in accordance with the manufacturer's instructions. TVSS installation shall be integrated into the MCC lineup with leads close coupled to busses to limit transient voltages as recommended by the manufacturer.
- G. Remove temporary lifting angles, lugs and shipping braces. Touch-up damaged paint finishes.
- H. Make wiring interconnections between shipping splits.
- I. Install bus splice plates and torque connections.
- J. Seal all seams, cracks, or openings.

### 3.02 SEISMIC BRACING

- A. The Manufacturer shall provide a seismic certificate.
- B. CONTRACTOR shall provide seismic anchor bolts.
- C. The seismic anchor bolts shall be designed by the Owner's Structural Engineer. The Engineer shall provide wet stamped and signed seismic calculations and drawings.
- D. The Contractor shall provide approved shop drawings to the Engineer. The shop drawings shall indicate the weight and dimensions of the motor control center. The Contractor shall provide any additional information required by the Engineer to perform the seismic calculations.

### 3.03 MANUFACTURER'S SERVICES

- A. The Manufacturer shall provide on-site start-up and commissioning of the MCC installation. The start-up and commissioning shall include configuring the network communications and VFD and power monitor configurations for project specific conditions. The Manufacturer shall provide at minimum two person-days for start-up and commissioning. The Manufacture shall provide at minimum one person-days for training.

### 3.04 INDEPENDENT TESTING

- A. The Contractor shall arrange and pay for the services of an independent, third-party Testing Agent. The Agent shall be NETA Level IV Certified. A copy of the Agent's certification shall be provided.
- B. The Agent shall provide Acceptance Testing:

1. Testing shall be in accordance with the most current NETA Acceptance Testing Standards.
2. Testing shall include the following switchboard circuit breaker tests:
  - a. Circuit breaker primary injection testing.
    - 1) Long-time pick-up and delay
    - 2) Short-time pick-up and delay
    - 3) Instantaneous pick-up and delay
  - b. Circuit breaker insulation resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed and across each open pole.
  - c. Verification and adjustment of overcurrent protection device trip settings based on the Power Distribution Study.
3. Testing shall include the following motor control center tests:
  - a. Insulation-resistance testing on each bus section, phase-to-phase and phase-to-ground.
  - b. Ground resistance testing.
  - c. Insulation-resistance testing of all bolted connections.
  - d. Verification of tightness of accessible bolted connections using a calibrated torque-wrench.
  - e. Exercise all active components.
  - f. Visual inspection of installation and anchorage.

3.05 SUBMIT ONE PRINTED AND ONE ELECTRONIC (PDF) OF THE TEST RESULTS TO THE OWNER. SUBMIT ONE ELECTRONIC (PDF) COPY OF THE TEST RESULTS TO THE ENGINEER. THE PRINTED VERSION SHALL BE IN 8-1/2" X 11" AND 11" X 17" FORMAT IN A 3-RING BINDER WITH PRINTED TABS

### 3.06 FIELD QUALITY CONTROL

- A. The CONTRACTOR shall have complete responsibility for field quality control. This includes the following responsibilities:
  1. Coordinate MCC installation and testing with other equipment installation and testing per Section 16080.
  2. Ensure protection of the equipment from damage during construction. This includes the provision of adequate on site storage facilities prior to installation.
  3. Ensure that the area of installation is fully prepared according to the Contract Documents prior to the commencement of the MCC installation.
4. Provide complete and accurate as-built schematic drawings.
- B. Site Tests, Inspection

1. In accordance with Section 16080.

### 3.07 CLEANING

- A. After testing is complete, the CONTRACTOR shall inspect and clean the MCC equipment and remove any material introduced during the testing and/ or left from the initial installation. Remove all rubbish and debris from inside and around the control center. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

**END OF SECTION**



## SECTION 16511

### INTERIOR LUMINARIES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. This Section includes the requirements for the interior illumination fixtures and controls.

##### 1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16511.I01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.

1. Pursuant to Section 01330 Submittal Procedures.
2. Manufacturer's data including materials of construction, fixture dimensions, options provided and related information for each item specified in PART 2 PRODUCTS.

##### 1.03 QUALITY ASSURANCE

A. Regulatory Requirements.

1. All products shall be UL listed for the environment they are installed in.

## **PART 2 - PRODUCTS**

### **2.01 FIXTURES**

- A. See interior luminaire schedule in Drawings.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General.
  - 1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.

**END OF SECTION**

## SECTION 16512

### EXTERIOR LUMINARIES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes.

1. This Section includes the requirements for exterior illumination fixtures and control.

##### 1.02 SUBMITTAL

A. Contractor shall submit all the product data in Division 16 at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 16512.E01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.

1. Pursuant to Section 01330 Submittal Procedures.
2. Manufacturer's data including materials of construction, fixture dimensions, options provided and related information for each item specified in PART 2 PRODUCTS.

##### 1.03 QUALITY ASSURANCE

A. Regulatory requirements.

1. Products provided shall be UL listed for the environment in which they are installed.

## **PART 2 - PRODUCTS**

### **2.01 FIXTURES**

- A. See exterior luminaire schedule in Drawings.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General.
  - 1. All identification labeling shall be in compliance with Section 16075 Electrical and Control Identification.
  - 2. Fixtures mounted above doors shall be centered unless specifically called out otherwise on the Drawings.
  - 3. Fixtures mounted on the exterior of split face block shall be fed with a conduit entering the back of the fixture routed from the interior of the building. Mounting the fixture on a box is unacceptable.
  - 4. Use stainless steel mounting hardware.
  - 5. Mount at the height shown on the Drawings.

**END OF SECTION**