

VENETA

oregon

Inc. 1962

City of Veneta

Lane County, Oregon

Contract Documents

VOLUME 2 – Technical Specifications

FOR THE CONSTRUCTION OF

City of Veneta Wastewater Treatment Plant: Air Piping and Efficiency Improvements

April, 2015
Project No. 3101-006

Civil West

Engineering Services, Inc.



Prepared By:

CIVIL WEST ENGINEERING SERVICES, INC.

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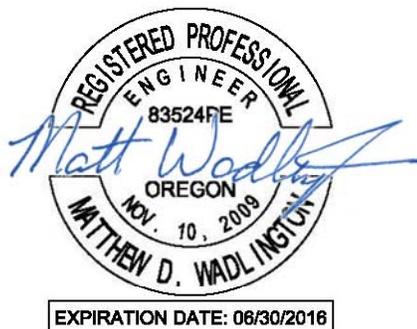
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SECTION 01010 – SUMMARY OF THE WORK

PART 1 GENERAL

- 1.01 WORK SUMMARY: City of Veneta Wastewater Treatment Plant air piping and efficiency improvements:
- A. The Contractor shall furnish all labor, equipment, and materials necessary to complete all work in accordance with the Contract Documents.
 - B. The work shall be performed within the City of Veneta Wastewater Treatment Plant property.
 - C. The Project Scope is briefly described below.
 - 1. Obtain permits as required. Coordinate with City of Veneta and other affected agencies.
 - 2. Offload and store shipped equipment and supplies, as needed.
 - 3. Construct new concrete trench as shown on the plans.
 - 4. Connect drain from new trench to appropriate storm drain pipe.
 - 5. Install new ductile iron air pipe, ensure that Wastewater Treatment Plant remains operational and functioning until a final cross over to the new air distribution system.
 - 6. Install flow meters and valves as part of the ductile iron piping system.
 - 7. Concurrently install dissolved oxygen sensors in each of the aeration basins as shown on the plans.
 - 8. Install the new 100A power disconnects and VFD's.
 - 9. Make final cross over to new air piping distribution system.
 - 10. Test equipment to ensure operation.
 - D. Work shall not begin until Engineer has issued the Notice to Proceed to the Contractor.
- 1.01 PROJECT INSPECTION
- A. Project inspection will be provided by Civil West Engineering Services, Inc. The Project Inspector, will be approved by the City prior to commencement of construction activities.
 - B. The Project Inspector will perform inspection services as the Project Engineer's authorized representative. However, all engineering decisions will be made by the Project Engineer.
 - C. In addition to the Project Inspector, the Project Engineer will also provide periodic inspections of construction and progress.
 - D. At completion of the project, the Project Inspector will certify in writing to the Owner and the Department of Environmental Quality (Department) that construction was inspected by him and found to be in accordance with the Plans and Specifications, including any changes therein approved by the Engineer and Department.
 - E. Record Drawings will be prepared at the conclusion of construction activities.

1.02 WORK PROGRESS

- A. It is the intent of these Contract Documents that the Work proceed in a systematic manner so that a minimum of inconvenience to the WTP results in the progression of the work. Suitable equipment will be required to properly execute the work with the least amount of disruption to services and access through the work area. Contractor shall contain operations to within the WTP property for this project.
- B. Order and schedule delivery of materials in ample time to avoid delays in construction. If any item is found to be unavailable, notify the Engineer immediately to permit the Engineer's selection of suitable substitute. Timely delivery of all materials and equipment is Contractor's responsibility. No extensions in Contract Time will be allowed due to delays caused by late delivery of items. Availability of items should be determined during bidding.
- C. The Contractor shall protect the work and materials from damage due to the nature of the work, the elements, carelessness of others, or from any other cause until the completion and final acceptance of the work. All loss or damage arising out of the nature of the work to be done under these Contract Documents, or from any unseen obstruction or defects which may be encountered in the execution of the work, or from the action of the elements, shall be sustained by the Contractor.
- D. The Contractor shall remove completely all materials designated for removal, to the extent specified and/or indicated in the drawings. For such materials, removal, hauling, disposal (including providing disposal location), and applicable precautions are entirely the Contractor's responsibility. Allow no excess accumulation of non-reusable material at job site(s).
- E. Contractor is responsible for the protection of all existing improvements that are to remain in place. This includes, but is not necessarily limited to: existing utilities, roads, driveways, drainage ditches, culverts, fencing, shrubbery, and all landscaping structures and vegetation. Temporary enclosures, walls, covers, or other protection shall be provided and maintained by the Contractor as required. Contractor shall cooperate with the owners of such improvements, and shall restore and/or replace all damaged items as directed, without any additional expense to the Owner or payments to the Contractor.
 - 1. The location and depth shown on the drawings for the existing pipelines are approximate only and are based on Record Drawings, valve locations and other information.
 - 2. Contractor shall pothole and locate the existing pipelines prior to placement of new pipelines. Minor field adjustments to the proposed pipeline routes may be required. Existing pipelines shall remain in service and shall be protected in place until completion of new pipelines. Contractor shall provide temporary service connections as required to maintain continued service until completion of new pipelines.
 - 3. After the completion of the airline and all testing and connections has been made, designated existing pipelines or portions thereof shall be abandoned in place. Contractor shall remove all temporary connections, valve covers, appurtenances and provide end caps or plugs as required for pipeline abandonment. Existing valves may remain in place at the discretion of the Contractor.
- F. To maintain the Owner's water supply, the Contractor shall phase the construction work for the new waterline, a Guideline for use as construction phasing is as follows;
 - 1. Pothole and confirm location of the existing waterline at tie in location.

2. Construct new Waterline, taking care to avoid existing waterline. Location of existing waterlines is not specifically known and may be in close proximity or conflict with the placement of the new concrete trench. Contractor will provide temporary bypass to keep waterlines operational during construction of the new trench if the
 3. New waterlines shall be flushed, tested and chlorinated. After the new waterlines have been successfully tested, including bacteriological testing and results as required by the State Drinking Water Program. Chlorinated water shall be disposed of and dechlorinated in accordance with Oregon DEQ requirements.
 4. Abandon existing waterlines or portions thereof that are designated for abandonment, provide end caps, plugs as required.
 5. Complete surface restoration and replacement.
- G. To facilitate the Contractor's cleaning and pressure testing of the new waterlines, existing water from the Owner's distribution system can be used for these purposes. The contractor shall provide all required temporary connections to existing waterlines and other approved locations for this work.

END OF SECTION

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SECTION 01025 – MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Wherever in these Specifications an article, device or piece of equipment is referred to in the singular, such reference shall include as many such items as are shown on the Drawings or are required to complete the installation.
- B. Miscellaneous items required in the project that do not have a corresponding Section in the Bid Form are to be considered incidental costs to the project. Compensation for such items and/or work shall be incorporated into other related bid items or total costs. No separate measurement and payment will occur for such incidental costs.
- C. Monthly progress payments and final payment will be made in accordance with the Contract, the General Conditions, and the Supplementary General Conditions. A portion of all progress payments will be withheld as “retainage” in accordance with the General and Supplementary General Conditions.
- D. Additional detail on measurement and payment may be found in other Sections detailing specific items.

1.02 UNIT PRICES

- A. Payment will be made on a unit price basis according to the prices provided by the Contractor in the accepted Bid Form (Proposal). Payment will be made for the actual quantity of individual items (units) incorporated and installed in the project.

1.03 LUMP SUMS

- A. Payments on lump sum contracts and/or bid items will be made based on the percentage of work complete at the end of the particular payment period.
- B. Percentage of work complete will be recorded and submitted by the Contractor and estimated by the Engineer based on inspection. Payment will be based on the Contractor’s approved schedule of values.

1.04 PROGRESS PAYMENTS

- A. Monthly progress payments will be made as set forth in the Agreement, in accordance with the General Conditions and Supplementary General Conditions.
- B. At the stated day of the month, submit a monthly payment request in accordance with the General Conditions and Supplementary General Conditions. Base request on actual quantities installed and completed, and/or approved schedule of values with percent complete of each item. Show payment requested for each item, and total payment requested.
- C. Engineer will review payment requests and compare with inspection records to verify quantities and completed items. Engineer will recommend payment amounts for Owner approval and payment.

END OF SECTION

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SECTION 01028 – CHANGE ORDER PROCEDURE

PART 1 GENERAL

1.01 SUMMARY

- A. Make such changes in the Work, in the Contract Sum, in the Contract Time of Completion, or any combination thereof, as described by Change Orders signed by the Owner, Engineer, and the Contractor.
- B. See also applicable sections of the General Conditions and applicable portions of the Supplementary General Conditions.

1.02 PROCESSING CHANGE ORDERS

- A. Change Orders will be numbered in sequence and dated. The Change Order will describe the changes and will be signed by the Owner, Engineer and the Contractor. Request for estimates for possible changes are not to be considered Change Orders or direction to proceed with the proposed changes.
- B. Change Orders will be prepared by the Engineer.
- C. Contractor may request that the Owner consider a Change Order by sending a written Change Order Request to both Owner and Engineer.

END OF SECTION

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SECTION 01040 – COORDINATION

PART 1 GENERAL

1.01 SUMMARY

- A. Restrict work to within City of Veneta Wastewater Treatment Plant property. IF additional area is needed, Contractor shall receive approval from the City of Veneta and any property owners affected by additional property use.
- B. The Contractor shall coordinate his work with the following:
 - 1. City of Veneta
 - 2. Other affected utilities and agencies
- C. Coordinate with Owner for site access and any required water or wastewater service shut-downs. Notify Owner at least 2 days in advance of when shutdowns of water service are needed. Contractor shall not operate system valves without Owner approval
- D. Permit and maintain access for the Owner to any adjacent facilities that are not part of work included within the project.
- E. Coordinate with Owner to determine the locations of underground piping, vaults, valves and other items that could be damaged during construction.
- F. Do not allow water service to be interrupted for more than 8 hours. The Contractor shall make every reasonable effort to minimize any inconvenience to the public.
- G. The City of Veneta owns and operates the wastewater treatment plant. The operation of the plant, to the full extent required to meet discharge requirements identified in the National Pollution Discharge Elimination Permit (NPDES) issued by the Oregon Department of Environmental Quality, shall continue during construction. It shall be the responsibility of the Contractor to coordinate any interruptions to the wastewater treatment system with the City and its plant operators in order to remain in full compliance with the above referenced permit during construction.
- H. Restoration and cleanup work shall be completed with each phase of the construction project. Parking lots and properties shall be maintained and kept clean and clear of excess excavation, debris, dirt and other materials.

END OF SECTION

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SECTION 01046 – PROTECTION OF EXISTING IMPROVEMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Where Contractor's operations are near utility systems, structures, or are adjacent to other property, no work shall be started until Contractor has made all arrangements necessary for protection thereof have been made. Contractor shall exercise all possible precautions to prevent damage to existing structures, improvements, and underground utilities which are to remain.
- B. Approximate locations of known underground utilities are shown on the Plans. Exact location or extent of such utilities is not guaranteed, and utilities may exist which are not shown on the Plans. Contractor shall call for utility locates prior to any digging. Contractor shall also pothole as required ahead of the work to verify the location and depths of affected utilities. No additional compensation will be given for such work or for utilities being different from shown on the plans.
 - 1. All trench excavations and structure excavations within two (2) feet of any existing underground utility shall be performed by hand methods in accordance with state laws.
- C. The Contractor shall be solely and directly responsible to the owner's and operator's of such properties and services for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the carrying out of the work to be done under this Contract.
- D. Restoration of Existing Improvements. Except as shown on the Plans or as provided elsewhere in these specifications, the Contractor shall, at their own expense, repair and/or replace all utilities, services, landscaping, structures, substructures and other improvements damaged by the operations associated with this project, as directed. These repairs and replacements shall all be suitable and proper for intended use and in every respect acceptable to the Owner, Engineer and appropriate governing body or owner of such improvement. At minimum, restoration will be required to match the existing adjacent structure/improvement in thickness, finish, quality, quantity, and aesthetics.
 - 1. In the event of interruption of domestic water, electric, telephone, sewer, or other utility services, the Contractor shall promptly notify the proper authority and the Owner. The Contractor shall cooperate with the proper authority in restoration of service as promptly as possible and shall bear all costs of repair.
- E. The Contractor shall pothole existing waterlines or other utilities ahead of his work so that potential conflicts can be minimized or that minor relocation of the new waterline routes can be made. Potholing is defined as exploratory excavation of existing waterlines or other utilities to verify their depth and location.

1.02 INTERFERING STRUCTURES, IMPROVEMENTS AND LANDSCAPING

- A. It shall be entirely the responsibility of the Contractor to locate and protect all existing structures, landscaping, and other improvements in advance of the work. Neither the Owner, Engineer, nor any of their officers or agents shall be responsible to the Contractor for damages as a result of any structures or improvements being located differently than indicated in the drawings, nor which exist and are not indicated on the drawings.

- B. If interfering power poles, telephone poles, guy wires, or anchors are encountered, the Contractor shall notify the affected utility and the Engineer at least seven (7) days in advance of construction to permit arrangements for protection or relocation of the structure. However, failure of utility to respond shall create no obligation on Owner, and Contractor shall protect all utilities against damage, or shall stand all costs involved thereof.
- C. Landscaping, Tree and Plant Protection. Provide adequate protection of existing landscaping against damage from construction operations, including all structures and vegetation. Protect roots, trunk and foliage of existing and new shrubs and trees from all damage including that possible from compaction and dust. Contractor shall be entirely responsible to remove and replace all property which is damaged by work related to the project. Contractor shall bear all costs associated with replacement of existing landscaping, and shall cooperate with the owner of such improvements, the Owner, and the Engineer in all protection and restoration/replacement that is required. In specific circumstances, Contractor may make special arrangements with property owners for removal of landscaping without replacement. Copies of written agreements for all such arrangements shall be furnished to the Engineer.
- D. When construction operations will affect the property of a private citizen (such as driveways, landscaping, etc.), even when such improvements are in the road right-of-way, the Contractor shall notify the owner of such property and the Owner, at least seven (7) days in advance of any affecting Work, so that any desired preparations can be made.

1.03 ROADS AND ACCESS

- A. All work shall be conducted to minimize damage to existing roadways, easements and parking lots, including limiting wheel loads to acceptable levels. At all times keep roadways, shoulders, and ditches free from excess materials and debris.
- B. Spillage of soil, dust, rock, mud, etc. on all roads (including State, County, City and private roads) used by the Contractor (and any working for Contractor) during construction, shall be prevented as much as possible. If spillage cannot be prevented, an hourly patrol shall be provided by the Contractor to police and sweep clean all spillage. At the conclusion of each workday, such traveled areas shall be left completely clean and free from all extraneous materials. Contractor is entirely responsible to prevent such spills and follow all related laws and regulations. If spillage of hazardous material occurs, Contractor shall immediately notify the proper authorities and remove the spill in the proper manner. Owner will not be liable for any additional costs due to spillage of any kind.
- C. All damaged gravel, concrete and/or asphaltic concrete surfaces shall be repaired as required to conditions acceptable to the governing body and Engineer. No cleated or crawl-type equipment shall be operated on paved surfaces, except to cross a road when adequate protection of the surface is provided.
- D. During construction the Contractor shall take necessary measures to avoid and abate excessive dust. Sprinkling of roadways and sites may be necessary and shall be conducted carefully to avoid over wetting while keeping dust to a minimum.
- E. Contractor is responsible for constructing, maintaining, and removing any additional access that Contractor deems necessary for the Work. Contractor must notify Owner and Engineer, and must obtain written consent from the governing body, prior to construction of additional access not shown on the drawings. All applicable regulations shall be followed in such access construction, including obtaining any required permits.

END OF SECTION

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SECTION 01050 – FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

- A. Construction stakeout – The Contractor shall be responsible for construction staking of each individual schedule/ project.
 - 1. The Engineer will provide assistance to the Contractor for general stakeout and coordinates.
- B. The Contractor shall be solely responsible for laying out the work from this stakeout control and no additional stakeout will be provided except at the expense of the Contractor.
- C. It shall be the responsibility of the Contractor to maintain and preserve the construction stakeout as provided. The Contractor will not be allowed time extensions or damages caused by the loss of control stakes. If control is lost and/or disturbed and in the judgment of the Engineer requires replacement, such replacement will be at the expense of the Contractor.
- D. It is expected that minor revisions of the stakeout along the various schedules may be required during the course of construction. These revisions and relocations shall be made only as directed by the Engineer. The Contractor shall not be entitled to any additional compensation for minor revisions or relocations.

PART 2 PRODUCTS – NOT USED

PART 3 WORKMANSHIP – NOT USED

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – All Schedules

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 01060 – REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall at all times observe and comply with all federal and state laws and lawful regulations issued and local laws, ordinances and regulations which in any manner affect the activities of the Contractor under this contract and further shall observe and comply with all orders or decrees as exist as present and those which may be enacted later by bodies or tribunals having any jurisdiction or authority over such activities of the Contractor.

- B. The contractor shall be responsible and liable for all accidents, damage or injury to any person or property resulting from any activity, duty and obligation of the Contractor under this Contract for which the Contractor may be legally liable. The contractor shall hold blameless and harmless and shall indemnify the Owner and its officers, employees and against the any and all claims, demands, loss injury, damage, actions and cost of actions whatsoever which they or any may sustain by reason of any act, omission or neglect of the Contractor or employees, agents, representatives or assignees of the Contractor in connection with the activities, duties and obligations of the Contractor under this Contract.

- C. All water system materials and construction undertaken on this project shall meet the requirements of the Oregon State Department of Human Services, Drinking Water Program, as outlined in OAR 333-061.

END OF SECTION

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SECTION 01100 – REFERENCE STANDARDS

PART 1 GENERAL

1.01 SUMMARY

Abbreviations and Acronyms. Whenever the following abbreviations are used in these specifications or in the drawings, the following definitions apply. Unless otherwise designated, all reference to the following standards, specifications and methods shall imply the latest adopted revision in effect at the time of bid opening. Such standard, except as modified herein, shall have full force and effect as though printed in the specifications.

- A. AASHTO American Association of State Highway and Transportation Officials
- B. ACI American Concrete Association
- C. AIA American Institute of Architects
- D. AISC American Institute of Steel Construction
- E. ANSI American National Standards Institute
- F. APWA American Public Works Association
- G. ASCE American Society of Civil Engineers
- H. ASME American Society of Mechanical Engineers
- I. ASTM American Society of Testing Materials
- J. AWWA American Water Works Association
- K. EPA United States Environmental Protection Agency
- L. DEQ Department of Environmental Quality (both Federal and State)
- M. DWP Oregon Dept. of Human Services, Drinking Water Program
- N. FM Factory Mutual
- O. NEC National Electric Code
- P. NEMA National Electric Manufacturers Association
- Q. NFPA National Fire Protection Association
- R. NSF National Sanitation Foundation
- S. OAR Oregon Administrative Rules
- T. ODOT Oregon Department of Transportation
- U. ORS Oregon Revised Statutes
- V. OSHA Occupational Safety and Health Act (both Federal and State)

- W. UL Underwriters' Laboratories
 - X. USDA United States Department of Agriculture
 - Y. SSPC Steel Structures Painting Council or, The Society for Protective Coatings
- 1.02 The abbreviation of "N.I.C." if shown on the plans or specifications represents work that is "Not in Contract." This work is to be completed at a later date by Owner or others and for which the Contractor will not be responsible.

END OF SECTION

SECTION 01300 - SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

This section outlines in general the items the Contractor must prepare or assemble during the progress of the work, including technical submittals, Operations and Maintenance (O&M) data, record drawings, and substitution requests. Submittals are required for each piece of equipment or material even when the item being proposed for use is the same as specified.

1.02 RELATED SECTIONS

- A. General Conditions – Article 7.04 “Or-equals” and Article 7.05, Substitutes
- B. Supplementary Conditions – SC 7.05
- C. General Conditions – Article 7.16, Shop Drawings, Samples and Other Submittals
- D. Section 01630 – Product Substitutions
- E. Section 01700 – Closeout Submittals
- F. Section 01730 – Operation and Maintenance Manuals
- G. Section 01780 – Record Drawings
- H. Various sections requiring submittals for equipment and materials

1.03 TECHNICAL PRE-BID SUBMITTAL

- A. Some of the major equipment items may require approval prior to bid, even when a specific manufacturer and model is specified and contractor plans to use the specified item. For items requiring pre-bid submittals, a complete submittal package must be received by the Engineer no later than 14 days prior to bid opening. Only items that have been approved in writing by the Engineer will be used in the project, and substitution requests for these items will not be considered. Engineer will either approve or reject such items at least 5 days prior to bid date. Items in the specifications that require pre-bid submittals are noted as such and listed below for convenience:

- 1. N/A

1.04 SUBSTITUTION REQUESTS

- A. Where the specifications state “or-equal”, “or approved equal”, or similar statement, the Engineer alone will determine if the proposed substitute item is allowed.
- B. Requests for substitution for items specified by manufacturer or manufacturer's model number as specified throughout the Contract Documents shall be in writing and be accompanied with sufficient information to allow the Engineer to identify the nature and scope of the request. Information to be provided shall include:
 - 1. Reason the substitution request is being made.

2. All submittal information required for the specified item or equipment, including all deviations from the specified requirements necessitated by the proposed substitution.
3. Reproducible contract drawings, marked up to illustrate the alterations to all structural, architectural, mechanical and electrical systems required to accommodate the proposed substitution.
4. If the substitution requires any mechanical, electrical or structural changes, the Contractor will be responsible for costs in evaluating a requested substitution. The cost for such an evaluation will be determined on a case-by-case basis, after receipt of written request. The Engineer will notify the Contractor in writing of said cost. If the Contractor wishes to proceed, he shall advise the Engineer in writing and submit additional information as may be requested. Final approval of a substitution must be made by both the Engineer and Owner.
5. No additional costs of any kind will be incurred by the Owner or Engineer by approval or rejection of any substitution request.

1.05 SUBMITTALS

A. Technical submittals

1. Technical submittals covered by these specifications include manufacturer's information, shop drawings, test procedures, test results, samples, request for substitutions and miscellaneous work related submittals. Submittals shall also include, but not be limited to, all mechanical, electrical and electronic equipment and systems, materials, reinforcing steel, fabricated items, piping and conduit details, and lead time required for delivery to job site.

2. Contractor's Responsibilities

- B. The Contractor shall furnish all drawings, specifications, descriptive data, certifications, dimensional drawings, samples, tests, methods, schedules and manufacturers installation and other instructions as required by the contract documents, or the Engineer, to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the contract documents.

1. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the specified requirements.
2. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where his submittal may affect the work as shown on the Plans.
3. The Contractor shall coordinate submittals among his subcontractors and suppliers.
4. Submittals shall coordinate 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.

5. The Contractor shall not proceed with work related to a submittal until the submittal process is complete.
6. The Contractor shall certify on each submittal document that he has reviewed the submittal, verified final conditions and complied with the contract documents. The Contractor may authorize in writing a material or equipment supplier to deal directly with the Engineer. This interaction shall be limited to contract interpretations to clarify and expedite the work.
7. Charges will be documented and the Contractor will be charged for review of multiple non-conforming submittals for any one (1) item in excess of two (2) times.

1.06 RECORD DRAWINGS

- A. During the course of construction, Contractor shall maintain a marked-up set of the project drawings. See Section 01780.

1.07 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. Contractor shall collect O&M data from all equipment and material suppliers for all items provided in the project. See Section 01730.

1.08 ENGINEER'S REVIEW

- A. Review shall not extend to means, methods techniques, sequences or procedures of construction, or to verify quantities, dimensions, weights or gages, or to fabrication processes, except when specifically indicated or required by the contract documents, or to safety precautions or programs.
- B. The Contractor shall submit five (5) copies of all submittal material to Engineer. Two (2) copies will be returned upon final approval. If the submittal is rejected four (4) copies will be returned.
- C. Unless otherwise specified, within 14 calendar days after receipt of submittal, the Engineer will return the marked-up copies. The Contractor shall take appropriate action if the submittal needs to be resubmitted. If specified submittal material is to be used for O&M data, all corrections shall be made and new clean copies shall be submitted with the O&M data.
- D. Review of contract documents, method of work or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibilities for errors therein and shall not be regarded as an assumption of risks or liability by the Engineer or Owner. The Contractor shall have no claim under the Contract on account of failure or partial failure of the method of work, material or equipment so reviewed.

END OF SECTION

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SECTION 01310 – CONSTRUCTION PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide a progress schedule indicating the times for starting and completing the various stages of work, including any Milestones.
- B. As work progresses, Contractor shall prepare and submit updated progress schedules as necessary.
- C. Schedule duration of each activity shall be based on the work being performed during the normal 40-hour work week with allowances made for legal holidays and normal weather conditions.
- D. Updates – Schedule shall be updated at least once per month as required to maintain accuracy.

1.02 SUBMITTALS

- A. Within 10 days after the date of the Agreement (Contract), submit a proposed progress schedule to the Owner and Engineer for approval.
- B. Interim Schedule
 - 1. Contractor shall submit within 10 days after award of Contract, but before any scheduled pre-construction conference, an Interim Schedule setting forth all activities for the first two (2) months of construction.
 - 2. Review comments by the Engineer concerning the Interim Schedule shall be considered in developing the Overall Schedule.
 - 3. The Contractor shall submit three (3) copies of the Interim Schedule.
- C. Overall Schedule
 - 1. For Contract Periods exceeding 60 days, the General Contractor shall prepare and submit, within 30 days after the award of Contract, an Overall Schedule composed of all construction operations in connection with the Contract.
 - 2. Overall Schedule, if it is sufficiently developed to equal or exceed the Interim Schedule requirements, may be submitted in lieu of a separately prepared Interim Schedule. In any event, the Interim Schedule shall form the basis for the Overall Schedule and will be considered an integral part of the Overall Schedule.
 - 3. Contractor shall submit three (3) copies to the Engineer for his review. Within seven (7) days after receipt of the submittal, the Engineer shall review the submitted schedule and return one copy of the marked-up original to the Contractor. If the Engineer finds that the submitted schedule does not comply with specified requirements, the corrective revisions will be noted on the submittal copy returned to the Contractor for corrections and resubmitted.
- D. Schedule Content

4. Schedules shall indicate the sequence of work and the time of starting and completion of each activity. Activities shall include, but not be limited to, the following items as they pertain to the Contract:
 - a. Each subcontractor's items of work
 - b. Temporary provisions for continued service
 - c. Installation of specific major items
 - d. Submittals from Contractor to Engineer for review and return to the Contractor. Material and equipment order, manufacture and delivery
 - e. Dates for performance of all testing procedures
 - f. Dates for tie-ins to existing systems
 - g. Final cleanup and Start-Up
 - h. Allowance for inclement weather

1.03 PROGRESS OF WORK

- A. The Contractor shall execute work with such progress as necessary to prevent delay to the overall completion of the project and with such forces, materials and equipment to assure completion in the time established by the Contract.
- B. The Contractor may find it necessary to work overtime, double shifts, weekends and/or holidays if such a schedule is required to complete the project within the time allowed.

END OF SECTION

SECTION 01400 – QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. Work shall conform to these specifications and the standards of quality contained herein.
1. Only new items of recent manufacturer and quality specified, free from defects, will be permitted on the Work, unless items are specifically noted as existing to be reutilized. Remove rejected items immediately from the Work and replace with items of quality specified. Failure to remove rejected materials and equipment shall not relieve the Contractor from responsibility for quality and character of items used, nor from any other obligation imposed by the Contract.
 2. No work defective in construction or quality, or deficient in any requirement of the drawings and specifications will be acceptable in consequence of the Owner's or the Engineer's failure to discover or to point out defects or deficiencies during construction; nor will the presence of Resident Project Representatives on the work relieve the Contractor from responsibility for securing the quality and progress of work as required by the Contract. Defective work revealed within the time required by guarantees shall be replaced by the Contractor by work conforming to the intent of the Contract. No payment, whether partial or final, shall be construed as an acceptance of defective work or improper materials.

END OF SECTION

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SECTION 01500 – TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes mobilization, temporary utilities, temporary construction, safety requirements, temporary environmental controls, and other temporary controls.
- B. Submittals
 - 1. Traffic control plan (see Section 01570).
 - 2. Staging area plan and notification of any obstructions encountered during mobilization.
 - 3. Plans for disposal of waste materials and excavated material not required for fill, including permits as required.
- C. Permits:
 - 1. Contractor shall secure and pay for all permits and fees required pertaining to temporary facilities and all other work.
 - 2. Construction permits as required by the City, Lane County Planning and Development, Building Division and/ or other agencies shall be the responsibility of the Contractor to secure.
- D. Mobilization shall include de-mobilization and consist of preparatory work and operations, including but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site; for the establishment of offices, buildings and other facilities necessary for work on the project; for premiums on bond and insurance for the project, and for other work and operations which the Contractor must perform or costs he must incur before beginning work on the project and after completion of the project.
- E. Access of Government Officials. Authorized representatives of the Federal, State and Local Governments shall at all times have safe access to the Work, whenever in preparation or in progress, and Contractor shall provide proper facilities for such access and inspections.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Contractor shall provide all materials necessary for all work this Section.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. During all construction operations, the Contractor shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to their place of business or residence, unless the Contractor has made special arrangements with the affected persons and has notified

Engineer and Owner. All temporary facilities shall be removed by the Contractor upon completion of the Work.

1. Temporary Utilities
 - a. Electric Power and Telephone
 - b. Electrical power. Power requirements should be confirmed by the Contractor for any special power needs. Arrangements for power shall be the responsibility of the Contractor.
 - c. Phone service shall be the responsibility of the Contractor
 - d. Sanitary Facilities
2. The Contractor shall provide chemical toilets of suitable types and maintain them in a sanitary condition at all times, conforming to code requirements and acceptable to the health authorities. They shall be of watertight construction so that no contamination of the area can result from their use. Arrangements shall be made for frequent emptying of the toilets. Upon completion of the work, toilets shall be removed and the area restored to its original condition.
 - a. Portable toilet facilities shall be located only at locations approved by the Owner.
3. Water
 - a. Water is available for normal filling, flushing and testing operations through Owner approved connections to the existing system.
4. Safety Requirements
 - a. Proper traffic control shall be provided in accordance with Section 01570.
 - b. Access for Police, Fire, and School Bus Service
 - c. Notify the fire department, police department and, when applicable, the School District before closing any street or portion thereof, and no closing shall be made without the Engineer's approval. Notify said departments when the streets are again passable for emergency vehicles. Do not block off emergency vehicle access to any area, such as consecutive arterial crossings or dead-end streets, in excess of 300 linear feet, unless the Contractor obtains special written permission from the chief of the fire department. Conduct operations so as to cause the least interference with any fire station access and at no time prevent such access.
 - d. The Contractor shall furnish a list of emergency telephone numbers to both the Engineer and the Owner so that contact may be made easily at all times in cases of emergencies.
 - e. Fire Prevention. Contractor shall perform all work in a fire-safe manner. Contractor shall supply and maintain on site all fire-fighting equipment, supplies, and capable personnel for extinguishing incipient fires as required by all Federal, State and local laws and regulations. Each piece of internal combustion engine-driven equipment shall be equipped with a

fire extinguisher in accordance with the appropriate recommendation of the National Fire Protection Association (NFPA). All engines shall be equipped with functional spark arrestors and sound suppression devices.

5. Temporary Environmental Controls

- a. The Contractor shall maintain affected areas from his construction free from environmental pollution that would be in violation of federal, state or local regulations.

6. Air Pollution Control

- a. Minimize air pollution likely to occur from construction operations by wetting down bare soils to control dust and requiring proper combustion emission control devices on construction vehicles.
- b. Give unpaved streets, roads, and detours or haul roads in the construction area a dust preventative treatment or periodically water to prevent dust. Strictly adhere to applicable environmental regulations for dust prevention.

7. Water Pollution Control and Erosion Control

- a. Discharge from dewatering, or flushing operations shall not directly impact existing water courses.
- b. Turbidity shall not exceed 10 percent above natural stream turbidities as a result of the project. The turbidity standard may be exceeded for a limited duration, provided all practicable erosion control measures have been implemented, including, but not limited to:
- c. Use of filter bags, sediment fences, silt curtains, leave strips or berms, placing mulch and hay bale silt fences, or other measures sufficient to prevent offsite movement of soil.
- d. Use of an impervious material to cover stockpiles when unattended or during a rain event.
- e. Graveled construction accesses to prevent movement of material offsite via construction vehicles.
- f. Sediment traps or catch basins to settle out solids prior to water entering ditches or waterways.
- g. Spreading mulch on exposed embankments greater than 3 feet in height.
- h. Place hay bale silt fence at any locations where soil erosion potential is evident and as directed by the Engineer.
- i. Constructing sediment basins where surface runoff is causing soil erosion or as directed by the Engineer.
- j. Erosion control measures shall be maintained as necessary to ensure their continued effectiveness.

- k. Petroleum products, chemicals, or other deleterious materials shall not be allowed to enter the water.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Mobilization, Bonding, and Insurance - Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.
- B. Construction Facilities and Temporary Controls - Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 01610 – STORAGE AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

- A. Protect products scheduled for use in the Work by means as described in this Section and as recommended by the manufacturer.

1.02 MANUFACTURER'S RECOMMENDATIONS

- A. Except as otherwise approved by the Owner, determine and comply with manufacturers' instructions on product handling, storage and protection.

1.03 PACKAGING

- A. Deliver products to the job site in their manufacturer's original container, with the labels intact and legible.
- B. Maintain packaged materials with seals unbroken and labels intact until time of use.
- C. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements at no additional cost to the Owner.
- D. The Owner may reject as non-complying such material and products that do not bear identification satisfactory to the Owner as to the manufacturer, grade, quality and other pertinent information.

1.04 STORAGE

- A. Store materials on-site in coordination with the Owner to provide suitable site access and clearance.
- B. Do not store unnecessary materials that will not be incorporated into the work.

1.05 PROTECTION

- A. Protect stored materials from moisture and temperature, and unauthorized handling.
- B. Provide protection for finished surfaces.
- C. Maintain finished surfaces clean, unmarred and suitably protected until accepted by the Owner.
- D. Provide proper protection for all workers.

1.06 REPAIRS AND REPLACEMENTS

- A. In event of damage, promptly make replacements and repairs to the approval of the Owner and at no additional cost to the Owner.
- B. Additional time required to secure replacements and to make repairs will not be considered by the Owner to justify an extension of the Contract Time of Completion.

- C. Repair all scratches and damage to painted surfaces promptly with proper color and material.
- D. Backfill or other soil materials to be incorporated into the Work which have become too wet due to improper storage and protection shall be properly dried or replaced prior to incorporation into the Work.

END OF SECTION

SECTION 01630 – PRODUCT SUBSTITUTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section describes procedures for securing approval of proposed product substitutions.

1.02 PRODUCT OPTIONS

- A. The Contract is based on standards of quality established in the Contract Documents.
- B. See Section 01300 Submittals, and the General Conditions (Sections 7.04, 7.05 and 7.16) for additional information on submittals and substitutions.
- C. In agreeing to the terms and conditions of the Contract, the Contractor has accepted the responsibility to verify that the specified products will be available and to place orders for all required materials in such a timely manner as is needed to meet his agreed construction schedule.
- D. The Owner has not agreed to the substitution of materials or methods called for in the Contract Documents, except as they may specifically otherwise state in writing.
- E. Where materials and methods are specified by naming one single manufacturer or model number, without stating that equal products will be considered, only the material and method named is approved for incorporation into the Work.
- F. Where materials and methods are specified by name or product number, followed by the words "or equal approved in advance", materials and methods proposed by the Contractor to be used in lieu of the named materials and methods shall in all ways be equal or exceed the qualities of the named materials and methods. For consideration as an "equal approved in advance", complete detailed submittals (5 copies) must be received by the Engineer at least fourteen (14) days prior to the bid opening date. Approved substitute items will be listed by addendum prior to bid opening.
- G. Where the phrase "or equal," or "or approved equal," occurs in the Contract Documents, do not assume that the materials, equipment or methods will be approved as equal unless the item has been specifically so approved for this Work. Prepare detailed submittal and submit to Engineer. Substitutes will not be incorporated into the work unless submittal is approved by the Owner via the Engineer.
- H. Submittals shall include all technical information and diagrams as necessary to allow Engineer to evaluate the proposed substitution. Any/all differences between the specifications or specified equipment and the proposed substitution shall be clearly noted in the submittal. Submittals shall clearly indicate the specific model numbers, part numbers, and options of the proposed substitution.

1.03 DELAYS

- A. Delays in construction arising because of the time required for approval of substitution requests will not be considered by the Owner as justifying an extension of the agreed Time of Completion.

END OF SECTION

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SECTION 01700 – CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes procedures and requirements for finalizing and closing out the Project(s).
- B. Final clean-ups and restorations shall be done prior to requesting final inspections.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.01 RESTORATION AND CLEAN-UP

- A. Upon completion of any portion of the work, promptly remove temporary facilities generated by that portion of the work, including surplus materials, equipment and machinery unless directed otherwise by the Engineer or the Owner. All construction work by the Contractor shall be clean and free of rubbish, dirt, overspray, and extraneous materials to the satisfaction of the Engineer before acceptance of the work.
- B. Street/Road Cleanup. All roadways affected during construction shall be cleaned and restored. All ditches and culverts shall be cleaned and re-graded for proper drainage. Culverts broken or damaged by construction activities shall be restored to their original condition and location. Immediately following construction, remove all dirt, mud, rock, gravel, and other foreign material at the completion of the day or as otherwise required by the Engineer.
- C. Site Restoration and Cleanup. Restore or replace any ground covering (e.g., bark chips, cinders, gravel, river rock, etc.) to the original condition or better. Replace topsoiled areas, rake and grade to conform to their original contours. Replace any damaged landscaping or plantings to prior conditions in manner acceptable to Owner. Reseed grass areas as approved. Seed and protect any disturbed slopes.

3.02 CERTIFICATIONS

- A. Contractor shall provide certifications in accordance with the Standard General Conditions Article 15 and Supplementary Conditions SC-15.01 prior to final payment.
- B. See Section 01740 for Warranty requirements.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

- A. This item shall be considered incidental and no separate measurement and payment will occur.

END OF SECTION

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SECTION 01730 - OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SUMMARY

- A. This section outlines in general the format and content of O&M Manuals required on the project.
- B. Contractor shall collect O&M data from all equipment and material suppliers for all items provided in the project. Data shall be specific to the actual equipment used with specific model numbers and options highlighted. General cut-sheets that do not clearly indicate the specific parts and options provided on this job will not be accepted.

1.02 RELATED SECTIONS

- A. Section 01300 – Submittals
- B. Section 01700 – Contract Closeout
- C. Various sections requiring operation and maintenance data

1.03 SUBMITTALS

- A. The Contractor shall submit two (2) copies of the complete manuals to Engineer by 50% construction, which will be reviewed, revised and approved prior to start-up per OAR 340-52-0040(4). The manuals will be reviewed by the Engineer. If complete and acceptable without corrections, Engineer will notify the Contractor is writing and one (1) additional set will be sent to the Engineer by the Contractor.
- B. If changes, corrections, or additional information is required, the Engineer will notify the Contractor and may either return one (1) copy, return portions marked-up, or request additional data. Contractor will then resubmit two (2) copies of the corrected manuals. Contractor shall keep copies for their records. This process will continue until Engineer has two complete approved sets.
- C. When the manuals are complete and approved by the Engineer, the Contractor will then provide one (1) additional complete set so that Engineer can retain one set and two sets can be delivered to the Owner.
- D. Final payment will not be issued until all approved O&M manuals are received.

PART 2 PRODUCTS

2.01 FORMAT

- A. Data shall be prepared in the form of an instructional manual providing clear information on operational procedures, periodic maintenance requirements, repair procedures, and troubleshooting procedures.
- B. Binders shall be commercial quality, 8-1/2 x 11 inch three-ring binders with hardback plastic covers. Maximum binder ring size is 2 inches and multiple volumes will be used as required. Covers shall have a clear outer shell to allow insertion of cover sheet.

- C. Each binder shall be identified with a cover that is typed with the title "OPERATION AND MAINTENANCE INSTRUCTIONS", the title of the project, the name of the Owner, and the date of project completion.
- D. Each binder shall include a table of contents and tabbed dividers either color coded or with printed labels. Labels shall be permanently affixed. Manual contents shall be arranged by systems and process flow under section numbers and sequence of table of contents.
- E. Text shall be manufacturer's printed data or typewritten data on 20 pound bond paper. Drawings shall be provided with reinforced punched binder tab, bound with text, and folded as necessary to the size of text pages.

2.02 CONTENT

- A. The first sheet inside the cover shall provide the title of project; names, addresses and telephone numbers of the Engineer; names, addresses and telephone numbers of the general contractor with the names of responsible parties.
- B. For each product or system, provide the names, addresses, and telephone numbers of subcontractors and suppliers, including local sources of supplies and replacement parts.
- C. Product Data: Section sheet shall clearly identify specific products, component parts, and data applicable to the installation.
- D. Drawings shall supplement product data to illustrate relations of component parts of equipment and systems to show control and flow diagrams.

2.03 MATERIALS AND FINISHES

- A. Building products, applied materials, and finishes shall include product data with catalog number, size, composition, and color and texture designations.
- B. Instruction for care and maintenance shall include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and schedule for cleaning and maintenance.

2.04 Equipment and Systems

- A. For each item of equipment and each system, a description of the unit or system component parts, identification of function, normal operating characteristics, and limiting conditions; and performance curves, engineering data and tests, and complete nomenclature and commercial number for replaceable parts.
- B. Electrical service characteristics, controls, and communications for panelboard circuits. Color coded wiring diagrams as installed.
- C. Operating procedures. Start-up, break-in, and routine normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and any special operating instructions.
- D. Maintenance Requirements. Routine procedures and guide for troubleshooting, disassembly, repair, and reassembly instructions; and alignment, adjusting, and checking instructions.
 - 1. Servicing and lubrication schedules and list of lubricants required.

2. Manufacturer's printed O&M instructions
3. Sequence of operation by controls manufacturer
4. Parts lists, illustrations, assembly drawings and diagrams
5. Control diagrams
6. Charts of valve tag numbers
7. List of manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage
8. Additional data requirements as specified in individual product sections.

PART 3 EXECUTION- NOT USED

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

- A. Payment for O&M Manuals will be considered an incidental cost. No separate measurement and payment will occur.

END OF SECTION

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SECTION 01740 – WARRANTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Installed Materials Warranties. Prior to 75% completion and payment for work under this Contract, the Contractor shall furnish the Owner through the Engineer, all warranty and/or guarantee forms normally furnished by the manufacturer of equipment. Warranty form shall include the specific equipment installed, the duration of the warranty, details of the warranty, and the installer's name, address and phone number. Installation date will be filled in by the Owner and will coincide with date of substantial completion of the work under this contract. All such warranties shall name the Owner as the warranted party.
- B. Attention is directed to various other sections of the Contract Documents where specific material or installation warranties may be required for items specified.

1.02 CONTRACTORS WARRANTY OF WORK

- A. Contractor shall guarantee the Work for a period of one (1) year from the date of Final Acceptance. All materials and workmanship that prove defective within the one-year guarantee period shall be promptly replaced or corrected with no additional cost to the Owner. Written certification that Contractor will replace all materials and workmanship that prove defective within one-year after the date of Final Acceptance is required for project close-out and shall accompany application for Final Payment.
- B. Contractor shall correct any work not in compliance with specifications and is responsible for all repairs of damage to other improvements, natural or artificial structures, systems, equipment and vegetation cause by, or resulting in whole or in part from occurrences beginning during the warranty period and are the result of defects in construction or materials installed under this Contract. Contractor shall be responsible for all costs associated with site cleanup and remediation caused by, or resulting in whole or in part from, defects in its work or materials.
- C. Within 10 calendar days of the Owner's written notice of defects, Contractor shall begin repair of the defects and all related damage. If Contractor or Contractor's Surety fails to correct and repair the defects in a timely manner, the Owner may have the correction and repair performed by others. Contractor or Contractor's Surety shall promptly reimburse the Owner for all expenses incurred to correct and repair the defects.
- D. In case of an emergency where delay could result in serious loss or damage, the Owner may make emergency corrections and repairs without written notice to Contractor. Contractor or Contractor's Surety shall promptly reimburse the Owner for all expenses incurred to correct and repair the defects.
- E. On Contractor's letterhead; provide written letter stating that Work has been completed in accordance with the Contract Documents and that a one year warranty of the work will be provided from the date of Final Acceptance. Written certification that Contractor will replace all materials and workmanship that prove defective within one-year after the date of Final Acceptance is required for project close-out and shall accompany application for Final Payment.
- F. One-Year Warranty Inspection. On the 11th month following final project completion and acceptance, Contractor shall be available to be present during the on-site warranty

inspection by Owner. Any defects identified in materials or workmanship shall be corrected within 30 days by the Contractor at his own expense

PART 2 *PRODUCTS- NOT USED*

PART 3 *EXECUTION- NOT USED*

PART 4 *SPECIAL PROVISIONS*

4.01 MEASUREMENT AND PAYMENT

- A. This item shall be considered incidental and no separate measurement and payment will occur

END OF SECTION

SECTION 01780 - PROJECT RECORD DRAWINGS

PART 1 GENERAL

1.01 SUMMARY

- A. This section outlines in general the Contractor requirements for preparing and maintaining and record drawings of the project.
- B. Contractor shall provide access to the Record Drawings to the Engineer and Owner throughout construction and shall finalize and submit complete record drawings upon completion of the work.
- C. Accurate Record Drawings or "As-Builts" are considered extremely important and it shall be entirely the Contractor's responsibility to maintain a complete and accurate record of all details of the project as he constructs and installs equipment and materials.
- D. Engineer or Owner may stop work if it is determined that Contractor is not properly recording details in record drawings and require correction and accurate documentation of all previous work before additional work proceeds.
- E. Engineer must accept and approve the drawings prior to recommending final payment.

1.02 RELATED SECTIONS

- A. General Conditions – Article 7 , Section 7.11, Record Documents

1.03 SUBMITTALS

- A. Submit two complete sets of initial marked-up Record Drawings immediately upon completion of construction work. Engineer will review for completeness and either approve or return one set with comments and corrections.
- B. If initial submittal required corrections, submit one complete set of corrected marked-up Record Drawings to Engineer with or before request for final payment.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

- A. Maintain one set of black-line prints of the Contract Drawings. Mark-up drawings using erasable red-colored pencil. Use additional colors as necessary to clearly document changes from original drawings for different categories of work at the same location.
- B. Use clear original or copy of project drawings for mark-up. Use shop drawings for markup when they are more capable of showing actual physical conditions completely and accurately.
- C. All deviations or differences from the original drawings, including dimensional, location, layout, material, and other details shall be noted clearly. Any additional information discovered during construction shall also be noted including location and depth of buried utilities and structures not shown in the original drawings.

2.02 FORMAT

- A. Organize Record Drawings into manageable sets using plans and shop drawings as applicable. Keep sets bound and protected.
- B. Keep on-site during construction and clearly identify as "Record Drawing" on cover.

PART 3 EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Record data as soon as possible after obtaining it. Do not wait until the end of the job or a portion of the job to record data.
- B. Give particular attention to information concealed that would be difficult to identify or measure and record later. Record and check the markup before enclosing concealed installations.
- C. Require the individual who installed or constructed the portion of the work, or otherwise obtained the record data, to prepare that portion of the marked-up record print.
- D. Incorporate changes and additional information previously marked on Record Drawings, erase, redraw, and add details and notations where applicable.
- E. Refer instances of uncertainty to Engineer for resolution.

END OF SECTION

DIVISION 2 – SITE WORK **TABLE OF CONTENTS**

<u>SECTION NO.</u>	<u>TITLE</u>
SECTION 02240	CONTROL OF WATER
SECTION 02250	DEMOLITION AND SITE PREPARATION
SECTION 02315	TRENCH EXCAVATION, BEDDING & BACKFILL
SECTION 02321	COMPACTION TESTING
SECTION 02630	STORM DRAIN PIPE AND FITTINGS
SECTION 02720	AGG BASE
SECTION 02740	ASHPALT CONCRETE PAVEMENT
SECTION 02775	SIDEWALKS

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SECTION 02240 - CONTROL OF WATER

PART 1 GENERAL

1.01 SUMMARY

- A. This section covers the control of surface water runoff, dewatering of pipeline trenches and structural excavations, and other elements required for control of water as dictated by the site conditions during construction.
- B. The design, installation, and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor assumes all liability for operation of the dewatering system and shall man the system during its operation. The dewatering system and discharge shall meet the requirements of all codes and regulatory agencies having jurisdiction of the system operation.
- C. Contractor shall inspect the construction site and consult with the City and applicable regulatory agencies to determine the best applicable method of dewatering, discharge filtration, and available options for receiving bodies. Contractor shall be responsible for all applicable permits.
- D. Submittals
 - 1. Prior to performing any excavation, the Contractor shall submit a dewatering plan to the Engineer for review. The submittal shall include method of installation, method and location of discharge, method of discharge filtration, and general details of the proposed dewatering system.

1.02 MATERIALS

- E. Materials and equipment required for control of water shall be furnished and maintained as required to perform the construction.
- F. Piping/Hose
 - 1. Contractor shall provide discharge piping constructed of rigid pipe with positive restrained joints.
 - 2. Provide water tight pipe system.

1.03 WORKMANSHIP

- G. The necessary machinery, appliances and equipment shall be furnished, installed, operated and maintained to keep excavations free from water during construction, and to dispose of the water so as not to cause injury to public or private property or to cause a nuisance, inconvenience or a menace to the public. Sufficient pumping equipment and machinery in good working condition shall be provided for all emergencies including power outage, and sufficient workmen shall be available at all times for the operation of the pumping equipment. The dewatering systems shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from the Engineer.
- H. The control of surface runoff and groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils" during excavation, shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils. Natural or compacted soils softened by saturation with

groundwater or standing surface water shall be removed and replaced as instructed by the Engineer at no additional expense to the Owner.

- I. During construction of structures, installation of pipelines, placing of structure and trench backfill and the placing and setting of concrete, excavations shall be kept free of water. Surface runoff shall be controlled so as to prevent entry or collection of water in excavations. The static water level shall be drawn a minimum of one (1) foot below the bottom of the excavation, so as to maintain the undisturbed state of the foundation soils and allow the placement of fill or backfill to the required density. The dewatering system shall be installed and operated so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.
- J. Open and cased sumps shall not be used as primary dewatering for excavations deeper than three (3) feet below the static water table. Location of open or cased sumps shall be outside of trench excavation or limits of structural excavation.
- K. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures and pipelines.
- L. Provisions shall be made to take care of surplus water, mud, silt or other runoff pumped from excavations and trenches or resulting from slicking or other operations. Siltation of completed or partially completed structures and pipelines by surface water or by disposal of water from dewatering operations shall be cleaned up at the Contractor's expense.
- M. The Contractor shall be responsible for any damages to existing on- and off-site facilities and work in-place resulting from mechanical or electrical failure of the dewatering system.
- N. The Contractor shall comply with all applicable local, State, and Federal laws and regulations pertaining to erosion control and discharge of water off-site.
- O. Necessary filtering media, bags, or other methods shall be used to ensure that turbidity limits in the receiving bodies are not exceeded during dewatering activities.

PART 2 PRODUCTS- NOT USED

PART 3 EXECUTION- NOT USED

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 02250 – DEMOLITION AND SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

- A. The work in this section includes the furnishing of all labor, equipment, materials, incidentals, and performing all work required for the removal and disposal of concrete, miscellaneous structures, sewer piping as designated for removal, debris and other items or improvements of manmade origin, in accordance with the Plans and these Specifications.
- B. The removal work described herein does not include the removal or disposal of items or improvements designated to remain.
- C. The area in which removal work, under these Specifications, is to be performed shall be confined to the minimum dimensions, within the public right-of-way or easements, which will permit proper construction of the proposed improvements, or as otherwise indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete shall be as specified in Section 03300.
- B. Select Fill and Backfill shall comply with Section 02315.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Pavements, Curbs, Walks and Driveways
 - 1. Where construction operations require the removal of pavements and other concrete flatwork or structures, bituminous pavements or portions thereof, the area to be removed shall be neatly sawcut. Just prior to placement of hot ac pavement final sawcuts shall be made 6-inches outside the limits of the trench on each side to a depth of 1½-inches, or deeper as required, to permit the removal of material without damage to adjoining portions of structures to be left in place. All cuts shall be clean, vertical cuts made true to lines designated or approved by the Engineer. See Detail drawings for further clarification.
 - 2. The Contractor shall remove and dispose of all pavement and structures, or portions thereof, which lie within the limits of excavation.
 - 3. Pavements and/or structures designated to remain but damaged as a result of the Contractor's operations shall be sawcut and removed as described above, and replaced or restored at the sole expense of the Contractor.
- B. Salvaged Materials

1. Gratings, disinfection system components, valves and other reusable materials removed shall remain the property of the City and shall be salvaged as directed by the City Engineer and delivered to the City's storage yard by Contractor.
 2. Other salvageable materials shall become the property of the Contractor and shall be disposed of by the Contractor away from the site.
 - a. Salvaged materials of any kind shall not be reused in new work without the written approval of the Engineer.
- C. All items and materials designated to remain shall be protected against damage as required. Damage to items or materials not intended for removal shall be repaired promptly by the Contractor to the satisfaction of the affected property owner. If the Engineer determines it necessary, repairs shall consist of complete replacement of the affected items or materials. All such repairs and replacements shall be made by the Contractor without compensation.
- D. Disposal of Materials
1. All materials, except those determined by the Engineer or Owner to be reusable, shall become property of the Contractor at the place of origin and shall be disposed of by the Contractor in conformance with all laws, regulations and rules legally imposed on such activities.
 - a. Contractor shall make every effort to salvage or recycle construction demolition items and debris as is feasible.
 2. Materials shall not be disposed of on City owned or City controlled lands except by written permission of the City, and if so permitted, the materials shall be placed only at such locations and in such manner as the City may direct. Materials may be disposed of on private properties only with written permission of the property owner(s) involved, and with copies of the agreement furnished to the City and Engineer.
- E. Excavations resulting from the removal of structures and/or obstructions shall be backfilled and compacted in accordance with the requirements of Section 02320. Backfill materials shall consist of the type and class designated on the Plans and specified in Section 02320.
- F. All existing ditches damaged by the Contractor by his operations and incidental ditching shall be re-constructed as required as to maintain existing drainages and ditches. The Contractor shall maintain channel width and side slopes of existing conditions.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 02315 – TRENCH EXCAVATION, BEDDING, & BACKFILL

PART 1 GENERAL

1.01 SUMMARY

- A. This work consists of furnishing all labor, materials, incidentals and equipment, as well as performing all work required for excavation, foundation stabilization, pipe bedding, pipe zone material, trench backfill, compaction, final grading, hauling and disposal of material resulting from the construction of utility piping, and all related appurtenances. Included also is the locating and protecting of existing utilities and other improvements (see Division 1), shoring, and bracing, excepting only such work as is covered and included under other sections of this Division, or other Divisions of these Contract Documents.
- B. Excavation must be in accordance with ORS 757.541 to 757.571 and all other applicable laws and regulations.

1.02 REFERENCES

- A. Oregon Standard Specifications (OSS) – The 2008 Oregon Department of Transportation/APWA Oregon Chapter Standard Specifications for Construction.

1.03 DEFINITIONS

- A. Trench Excavation – Trench excavation consists of the removal of all material encountered in the trench to the limits shown on the Plans or as directed. Trench excavation shall be classified as either common excavation or rock excavation.
 - 1. Common excavation is defined as the removal of all material as required to complete the planned improvements, regardless of type, nature or condition of materials encountered, except that which is designated as rock excavation.
 - 2. Rock excavation is defined as the removal of boulders composed of igneous, sedimentary or metamorphic stone material which have a least dimension of 36-inches or more, or a displacement of one cubic yard or more; or the removal of solid ledge rock which, in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, barring or breaking with power operated tools.
 - a. No soft or disintegrated rock; hard-pan or cemented gravel that can be removed with a hand pick or power operated excavator or shovel; no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere; and no rock outside of the minimum limits of measurement allowed, which may fall into the excavation, will be measured or allowed.
 - b. When solid rock layers have an overburden of non-rock material (common material) which cannot practically be stripped and handled separately, and/or when solid rock is interspersed with non-rock material, the entire mass will be classified as solid rock if the actual solid rock fraction exceeds 85% of the entire volume.
- B. Trench Foundation – Trench foundation is defined as the bottom of the trench on which the pipe bedding is to lay and which provides support for the pipe.

- C. Foundation Stabilization – Foundation stabilization is defined as the furnishing, placing and compacting of specified materials for any unsuitable material removed from the bottom of an excavation, as directed by the Engineer, to provide a firm trench foundation.
- D. Rip-Rap Slope Protection – Rip-rap slope protection is defined as the furnishing and placement of the specified material as an embankment or channel slope protection on exposed slopes or channels for slope protection and erosion control applications.
- E. Pipe Bedding – Pipe bedding is defined as the furnishing, placing and compacting of specified materials on the trench foundation so as to uniformly support the barrel of the pipe. The total bedding depth shall be as shown on the Contract Drawings.
- F. Pipe Zone – Pipe zone is defined as the furnishing, placing and compacting of specified materials for the full width of the trench and extending from the top of the bedding to a level above the top outside surface of the barrel of the pipe as shown on the Contract Drawings.
- G. Trench Backfill – Trench backfill is defined as the furnishing, placing and compacting of material in the trench extending from the top of the pipe zone to the bottom of pavement base, ground surface or surface material. Plans generally show locations for each type of backfill class.
- H. Drain Rock – Drain rock is defined as the furnishing, placing and compacting of specified free draining material for the full width of the drain trench (perforated pipe drains) and extending to a level as specified above the top outside surface of the pipe barrel.

1.04 SUBMITTALS

- A. Certifications, test results, source, and samples for all imported material proposed to be used in the work. Samples of materials to be used shall be submitted 2 weeks in advance of use. Samples shall consist of 0.5 cubic feet of each type of material. Samples of Class E material are not required.
- B. Drawings, tabular product data, and method of installation and removal of all sheeting, sheet piling, shoring, and bracing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Trench Foundation – The trench foundation shall be undisturbed native material when suitable. Where ground water or other unstable conditions exist and the native material cannot properly support the pipe, additional excavation may be required. The trench shall be stabilized with foundation stabilization material when such conditions are present in the opinion of the Engineer.
- B. Foundation Stabilization – Foundation Stabilization: 1½”-0 or 2”-0 aggregate base rock meeting OSS Sections 00641 and 02630. Required when native trench foundation material contains groundwater, or is unsuitable to provide a firm foundation in the opinion of the Engineer.
- C. Rip Rap Slope Protection – Material for Rip Rap Slope Protection shall be 6”-0 stone embankment material meeting the requirements of OSS 00330.16 and shall be an unweathered, hard, angular, durable free draining material, visibly well graded from course to fine.

- D. Pipe Bedding – Material for pipe bedding shall be clean, hard, sound, durable, well-graded, ¾"-0 crushed rock, free from organic matter. Engineer must approve material prior to use.
- E. Pipe Zone – Material for pipe zone shall be the same material used for bedding.
- F. Trench Backfill
 - 1. Class "A" Backfill: Native or common excavated material, free from organic or other deleterious material, free from rock larger than 3-inches, and which meets the characteristics required for the specific surface loading or other criteria of the backfill zone in the opinion of the Engineer. If stockpiled material becomes saturated or unsuitable, Class B, C or D Backfill shall be substituted. Engineer must approve material prior to use.
 - 2. Class "B" Backfill: ¾"-0 dense-graded aggregate, uniformly graded from coarse to fine and meeting OSS Section 02630.10.
 - 3. Class "C" Backfill: Clean sand with no particles larger than ¼-inch.
 - 4. Class "D" Backfill: Pit run or bar run material, well graded from coarse to fine, with maximum aggregate size of 3 inches.
 - 5. Class "E" Backfill (CLSM or CDF): Controlled Low-Strength Material (cement slurry) conforming to OSS Section 00442.
 - a. Slurry shall consist of a highly flowable lean concrete mix; mixture of Portland cement, fly ash, fine aggregates, water and admixtures as required for a mixture that results in a hardened, dense, non-settling, hand excavatable fill.

PART 3 EXECUTION

3.01 GENERAL

- A. Remove, haul, and dispose of all formations and materials, natural or man-made, irrespective of nature or conditions encountered, within lines and grades shown on the Plans or defined herein, and as necessary for completion of the proposed improvements. The method of excavation shall be as determined by the Contractor, and as required for special protection of existing improvements. Special care shall be taken to avoid over excavation below subgrades. Store and protect materials suitable for use as backfill where applicable. Clearing & Grubbing and Removal of Structures and Obstructions to be completed prior to excavation.
- B. Coordinate and provide all utility locates prior to any excavation as required by local state and federal laws and regulations. When the precise location of subsurface structures and/or utilities is unknown, locate such items by hand excavation prior to utilizing mechanical excavation equipment. Use hand excavation when mechanical equipment might damage existing improvements which are to remain undisturbed. See Division 1 for other requirements.
- C. Incidental to excavation shall be the furnishing, installing and removal of all shoring, sheeting, bracing as required to support adjacent earth banks and structures, keep excavations free from water, and to provide for the safety of the public and all personnel working in excavations.

3.02 EXCAVATION

- A. Excavate to the lines and grades shown on the project Plans, allowing for forms, shoring, working space and gravel base. Provide a minimum clearance around pipe barrel in all directions or greater in accordance with the standard trench detail drawing.
- B. Shoring and Bracing
 - 1. Sheet and brace excavation as necessary to prevent caving and to protect adjacent structures, property, workers and the public.
 - 2. The design, planning, installation and removal of all sheeting, shoring, sheet piling, lagging and bracing shall be accomplished in such a manner as to maintain the required excavation or trench section and to maintain the undisturbed state of the soil below and adjacent to the excavation.
 - 3. Horizontal strutting below the barrel of a pipe and the use of pipe as support are not acceptable.
 - 4. All sheeting, shoring and bracing shall conform to safety requirements of OSHA and other Federal, State and local agencies.
- C. Dewatering
 - 1. Furnish, install and operate all necessary machinery, appliances and equipment to keep excavations free from water during digging and initial backfilling. Dispose of water in such a manner as to prevent damage to public or private property, or nuisance or menace to the public.
 - 2. At all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outage. Have available, at all times, competent workers for operation of the equipment.
 - 3. Control surface runoff to prevent entry or collection of water within excavations. All excavations shall be kept free of water during placement of backfill and/or concrete placement.
 - 4. Comply with all laws regarding stormwater runoff, protection of natural resources, and other applicable laws and regulations.

3.03 FOUNDATION STABILIZATION

- 3.04 The contractor shall overexcavate the trench to firm undisturbed soils or rock when, in the opinion of the Engineer, the trench foundation materials are not suitable for the support of the pipe. Foundation Stabilization materials, as specified, shall be placed and compacted in lifts not exceeding 6-inches in compacted thickness to the required grade. Each lift shall be compacted to at least 95% of the maximum dry density in accordance with ASTM D698.

3.05 RIP RAP SLOPE PROTECTION

- A. Remove any brush, trees, stumps and other organic material from slopes and channels to be protected by rip rap and dress to a smooth surface. Remove all unsuitable material to the depth as shown or as directed and replace with approved material.

3.06 DISPOSAL OF EXCESS MATERIALS

- A. Excavated materials not suitable or required for backfill shall be hauled away and disposed of on approved sites arranged by the Contractor. No site shall be used for disposal of materials without written approval of the property owner. All costs associated with the hauling and disposal of materials shall be borne by the Contractor. The Contractor shall be entitled to any proceeds received from the sale of excess materials.

3.07 TEMPORARY STOCKPILING

- A. Place excavated materials suitable for use as backfill (and not excess material) only within construction easements, right-of-way, or approved work area. Stockpiles shall be placed in such manner as to provide the minimum inconvenience to the public.
- B. The Contractor shall obtain written permission from any property owners prior to placement of stockpiles on private property. Provide copies to the Owner and Engineer. Remove stockpiles as soon as possible and restore sites to affected property owners' satisfaction.
- C. Access to all fire hydrants, water valves and meters shall be maintained. Stockpiles shall not be permitted to block any stormwater drainage ditches, gutters, drain inlets, culverts or natural water courses.
- D. Protect stockpiled material which is to be later incorporated into the work so that excessive wetting or drying of the material does not occur. Material shall be brought to near optimum moisture content prior to placement and compaction. Depending on the moisture content of stockpiled materials, necessary processing may include aeration, mixing and/or wetting. No additional payment will be allowed for protecting or preparing native backfill materials.
- E. If approved native materials become unsuitable (too wet or mixed with unsuitable materials) due to negligence by the Contractor, then imported granular materials may be required for backfilling at the subject location at no additional cost to the Owner.
- F. Comply with all requirements of the 1200-C Construction Stormwater Permit. Provide necessary protection for stockpiled materials so that silt-laden runoff does not occur during rain events and to prevent wind-blown dust from stockpiles.

3.08 PIPE ZONE AND TRENCH BACKFILL

- A. Place and compact pipe bedding material before placing pipe in the trench. Dig depression for pipe bells to provide uniform bearing along the entire pipe length. Thoroughly compact bedding material to at least 95% of the maximum dry density in accordance with ASTM D698.
- B. Place materials in the pipe zone in layers not greater than 6 inches thick and in a manner that equalizes the pressure on the pipe and minimizes stress. As required under the haunches of pipe and areas not accessible to mechanical tampers or to testing, compact with hand methods to ensure thorough contact between the material and the pipe. Before placing the pipe zone material, condition, aerate, or wet the material so that the moisture content of each layer is within minus 4% to plus 2% of optimum moisture content.
- C. Contractor shall backfill the trench above the pipe zone in successive lifts not exceeding 12-inches in loose thickness. Do not allow the backfill to free-fall into the trench until at least 3 feet of cover is provided over the top of the pipe. Each lift shall be compacted, using suitable mechanical or pneumatic equipment, to a minimum of 95% of the maximum dry density as determined by ASTM D698. If the specified compaction is not

obtained, the Contractor may be required to use a modified compaction procedure and/or reduce the thickness of lifts. If approved materials meeting the specifications cannot be compacted to the required density regardless of compactive effort or method, the Engineer may reduce the required density or direct that alternate materials be used. In no case shall excavation and pipe laying operations proceed until the Contractor is able to compact the backfill to the satisfaction of the Engineer.

- D. CLSM. When CLSM Backfill is required, backfill above pipe zone with CLSM material. If the CLSM is to be used as a temporary surfacing, backfill to top of the trench and strike off to provide a smooth surface. If CLSM is not to be used as a temporary surface, backfill to bottom of the proposed resurfacing. Use steel plates to protect the CLSM from traffic a minimum of 24 hours.
- E. When backfilling is complete, the Contractor shall finish the surface area as specified. In paved or graveled areas the Contractor shall maintain the surface of the trench backfill level with existing adjacent grades with $\frac{3}{4}$ "-0 crushed rock until pavement replacement is completed and accepted by Owner.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 02321 – COMPACTION TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall retain and pay for the service of an approved, recognized independent testing laboratory to conduct laboratory tests on materials and field testing to determine the relative compaction of trench backfill, subgrades, embankments, gravel surfacing, aggregate base and asphalt concrete pavement, as indicated. The approved Testing Agency shall recommend methods of compaction to Contractor and issue final report to the Owner, through the Engineer, regarding compaction testing results and material compliance with the specifications.
- B. These specifications call for field compaction efforts to achieve a specified relative compaction for each of the indicated classes of backfill. Determination of in-place density shall be made by means of non-destructive nuclear probe method testing in accordance with ASTM D2922-01 and ASTM D3017-01 test methods.

1.02 DEFINITIONS

- A. Relative Compaction -- The ratio, expressed as a percentage, of the in-place density of the backfill material to the maximum density of the same material as determined by the ASTM D698 Standard Test Method.

PART 2 PRODUCTS

2.01 APPROVED TESTING AGENCIES

- A. Foundation Engineering; 820 N.W. Cornell Ave.; Corvallis, OR 97330; (541) 757-7645
- B. Professional Service Industries (PSI); 1040-A Shelly Street, Springfield, Oregon 97477; (541)746-9649.
- C. Carlson Testing, Inc.; 4060 Hudson Ave. NE; Salem, Oregon 97301 (503) 589-1252
- D. Other certified private testing laboratory(s) as approved by Engineer.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Field Testing
 - 1. Testing to determine the relative compaction of materials placed and compacted by the Contractor shall be performed a short distance behind construction. Tests shall be taken on each lift of the material prior to placement of the succeeding lift to ensure proper compaction is obtained. The Testing Agency shall perform testing at such locations and elevations as to be representative of the entire material and area being compacted. The Engineer shall have authority to require testing at times and locations he deems necessary.
 - 2. A sufficient number of density tests shall be taken on the first section of subgrade and trench backfill placed by the Contractor to establish the effectiveness of the Contractor's compactive efforts. If tests indicate that the specified relative

compaction for a given material is not being achieved, the Contractor shall modify compaction methods in order to obtain the specified results.

3. A minimum of 2 tests will be required to be taken at each site visit. It is estimated that the following number of site visits will be required:
 - a. A minimum of two (2) site visits shall be required along pipeline routes.
 4. Additional site visits or tests may be required to prove Contractor is meeting compaction requirements or as requested by the Owner, Engineer, and other affected utilities.
- B. Failing Tests – For areas failing to meet the specified compaction, the Contractor shall be responsible to perform all additional work necessary to achieve specified compaction at no additional cost to the Owner. Additional work may include further compactive effort, moisture treatment, other compaction methods, removal and replacement of failing materials, or other processes required to obtain the specified results.
- C. Any subsequent settlement of backfilled areas during the one-year warranty period shall be considered to be the result of insufficient compaction, and shall be promptly repaired by the Contractor at no additional cost to the Owner.
- D. The Contractor shall not be allowed any additional compensation for down time incurred as a result of compaction testing or waiting for test results.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Compaction Tests - Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.
1. Only Compaction Tests with results meeting the requirements of these Specifications will be accepted. All costs associated with or arising from additional work required due to failing compaction test results, including removal and replacement of material, shall be borne by the Contractor.
 2. Contractor must submit invoice from Testing Agency clearly identifying Project, location and date of testing, material tested, test method, test results, specified compaction, maximum dry density of material tested, and number of tests taken. Only tests directed by the Engineer and which obtain passing results will be paid for.

END OF SECTION

SECTION 02630 – STORM DRAIN PIPE & FITTINGS

PART 1 GENERAL

1.01 SUMMARY

- A. This item shall include furnishing and installing the storm drain pipe required for the storm drain improvements identified on the Plans.
- B. The Contractor shall provide manufacturer's certifications, including test results for all piping, fittings and appurtenances supplied. All submittals shall be in conformance with the requirements of Section 01300.
- C. All work shall conform to the latest version of the Oregon Standard Specifications (OSS) Part 00400, except as specified herein and shown on the Plans.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All pipe, fittings and appurtenances shall be new and unused.
- B. HDPE Storm Drain Pipe (12" through 48" diameter)
 - 1. Storm drain pipe shall have smooth interior and annular exterior corrugations. Pipe and fittings shall meet AASHTO M294, Type S. Pipe and fittings shall be from the same manufacturer.
 - 2. Pipe end connections and fittings shall be rubber or neoprene gasketed.
 - 3. HDPE pipe and fittings shall be Sure Lock WT Pipe as manufactured by Hancor, Inc. or N-12 IBST pipe as manufactured by Advanced Drainage Systems, Inc. or approved equal.
- C. PVC Storm Drain Pipe (12" diameter and less)
 - 1. Pipe shall be typical sanitary sewer piping meeting the requirements of ASTM D3034.
- D. Concrete shall conform to Oregon Standard Specifications Section 00440, Commercial Grade Concrete. Compressive field strength shall not be less than 3,000 psi at 28 days. Maximum aggregate size shall be 1½-inches. Slump shall be between 2 and 4 inches.
- E. Non-Shrink Grout. Grout shall be Sika 212, Euco N-S, Five Star, or approved equal nonmetallic cementitious commercial grout exhibiting zero shrinkage per ASTM C827. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing. Nonshrink grout shall be placed and packed only with the use of an approved commercial bonding agent. Unused grout shall be discarded after 20 minutes.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

- A. All pipe and fittings shall be installed in accordance with the manufacturer's recommendations and APWA standards.
- B. Remove from job site material, which in the judgment of the Engineer is damaged, not as specified, or otherwise rejected. Payment will not be made for damaged or rejected materials, their removal, or for repairs to such materials.
- C. Preparation of Trench – Excavate and prepare trench for pipe laying to the lines and grades as specified and shown on the Plans. Place any required foundation stabilization and compact pipe bedding prior to laying pipe. Stabilize trench as required and comply with OSHA safety provisions.
- D. Place and compact pipe bedding material before placing pipe in the trench. When applicable, dig depression for pipe bells to provide uniform bearing along the entire pipe length. Thoroughly compact bedding material to prevent future bellies.
- E. Install to lines and grades shown on the Plans. Maximum deviation shall not exceed 0.05 feet vertically.
- F. Prior to lowering pipe into the trench, the Engineer or City representative will check for damage to the pipe. The Contractor shall repair or replace, as directed, all damaged or flawed pipe prior to installation.
- G. Thoroughly clean inside the pipe before laying. Prevent foreign material from entering the pipe while it is being placed in the trench. Remove all foreign material from the inside of the pipe and joint before the next pipe is placed. Keep debris, tools, rags or other materials out of the pipes at all times.
- H. Lay pipe with bell ends facing the direction of laying. For lines on an appreciable slope, face bells up-grade unless otherwise directed by the Engineer. Thoroughly clean the ends of the pipe to remove all foreign matter from the pipe joint. Lubricate the bell and spigot ends with approved pipe lubricant, as recommended by the manufacturer.
- I. Care must be taken to ensure the pipe is not moved and the side support fill is not disturbed when moving sheeting or trench boxes.
- J. Place materials in the pipe zone in layers not greater than 6 inches thick and in a manner that equalizes the pressure on the pipe and minimizes stress. As required under the haunches of pipe and areas not accessible to mechanical tampers or to testing, compact with hand methods to ensure thorough contact between the material and the pipe. Before placing the pipe zone material, condition, aerate, or wet the material so that the moisture content of each layer is within minus 4% to plus 2% of optimum moisture content
- K. Provide proper Backfill Class material as required. Backfill the trench above the pipe zone in successive lifts. Do not allow the backfill to free-fall into the trench until at least 3 feet of cover is provided over the top of the pipe. Modify the compaction as necessary to protect the pipe. Compact each lift to not less than 95% of the maximum dry density.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 02720 – AGGREGATE BASE/ GRAVEL SHOULDER

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes all work necessary for furnishing, placing, compacting and grading aggregate base/ Gravel Shoulder on the prepared surface to the lines, grades, thicknesses and cross sections shown on the Plans or where indicated.

1.02 REFERENCES

- A. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- B. OSS – Oregon Standard Specifications for Construction, 2008 Edition.

1.03 SUBMITTALS

- A. Contractor shall furnish sample of proposed material for visual inspection by Engineer prior to importing to site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate leveling course and shoulder rock shall be 1" – 0 or ¾" – 0 (19.0mm – 0) angular crushed rock conforming to OSS Section 00640.
- B. Aggregate sub-base shall be 1½" – 0 (37.5mm – 0) angular crushed rock. Use clean, hard, durable aggregates, reasonably well-graded from the maximum size to dust.
- C. Aggregate leveling course and sub-base shall conform to OSS Section 00640 or shall be obtained from a source pre-approved by the Owner.
- D. Geo-Fabrics
 - 1. Separation liner shall be provided beneath aggregate base and native bearing soil and shall have a mean average roll value (MARV) strength properties meeting the requirements of AASHTO M 288-2000 Class 2 geotextile (geotextile for separation) with a permittivity greater than 0.05 sec. ⁻¹ and an apparent opening size less than 0.6 mm.
 - 2. Specification sheet to be provided on selected geotextiles for approval prior to order and delivery to site.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Sequencing and Scheduling – Notify Owner and Engineer 48-hours prior to placement of aggregate base to permit inspection.
- B. Excavate to proper sub-grade elevations as shown on the Plans or as necessary to provide required thickness of aggregate base.

- C. Preparation of sub-grade – Provide a firm sub-grade surface on which aggregate base is to be placed. Scarify sub-grade surface to provide bonding for aggregate base.
 - 1. Sub-grade Overexcavation & Replacement – Remove and dispose of any unstable or unsuitable materials as directed by the Engineer. Replace any excavated materials with successive lifts of aggregate sub-base or other materials as directed by the Engineer. Grade and compact, as required, to provide a smooth surface that conforms to the surrounding grades.
 - 2. Place geo-fabric separation liner over areas where over excavation is required to provide a bridge over soft native bearing soils. Liner shall be placed smooth and without wrinkles or folds in the direction of filling with a minimum 2 foot overlap between adjacent rolls.
 - 3. Sub-grade Compaction – compact exposed sub-grade.
- D. Mixing – Mix to provide a homogeneous mixture of unsegregated and uniformly dispersed materials. Add water or aerate, as necessary, during mixing to achieve optimum moisture content $\pm 2\%$ during placement.
- E. Placement
 - 1. When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be achieved, operations shall be suspended. Owner shall not be liable for damages or claims of any kind or description due to the suspension of operations by the Engineer.
 - 2. Aggregate base materials shall be deposited on the sub-grade at a uniform quantity per linear foot so that the Contractor will not resort to spotting, picking up, or otherwise shifting material. Segregation of aggregates shall be avoided and material so spread shall be free of pockets of coarse or fine materials.
 - 3. Place aggregate base materials such that when compacted and finish graded it will conform to the grades and sections shown on the Plans. Aggregate base materials shall be placed in maximum lifts of 6-inches, or as approved by the Engineer. Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.
 - 4. Place shoulder rock materials such that when compacted and finish graded it will match final pavement grade. Shoulder rock materials should be 1 foot wide and depth as needed or as approved by the Engineer.
- F. Compacting and Shaping
 - 1. Aggregate base materials shall be compacted by self propelled, smooth drum, static or vibratory rollers capable of achieving the specified compaction.
 - 2. Shape and maintain the surface of each layer of aggregate base during compaction operations such the surface of each layer is parallel to the established grade and cross section for the finished surface within 0.05 foot.
 - 3. Aggregate base materials shall be compacted to 95% maximum dry density as determined by the ASTM D698 test method.
- G. Comply with Section 02321, Compaction Testing.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 02740 – HOT MIX ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes furnishing all materials, labor and equipment necessary to construct asphalt concrete pavement to the lines, grades and cross sections shown or established, including one or more courses and overlays. Work shall be performed in conformance with any applicable State, County or City Standards.

PART 2 PRODUCTS

2.01 DEFINITIONS

- A. Hot Mixed Asphalt Concrete (HMAC) – Asphalt concrete is a hot mix of asphaltic cement; well graded, high quality aggregate; mineral filler and additives, as required; plant mixed into a uniformly coated mass, hot laid in on a prepared foundation, and compacted to a specified density.
- B. Oregon Standard Specifications (OSS) – The 2008 Oregon Department of Transportation/APWA Oregon Chapter Standard Specifications for Construction.

2.02 MATERIALS

- A. Unless otherwise specified herein, types, grades, quality and proportions of materials shall conform to specified and/or applicable sections of the current Oregon Standard Specifications.
- B. HMAC shall be Level 3 HMAC, ½-inch Dense Graded Mix in accordance with OSS Section 00745.
- C. Asphalt Tack Coat shall consist of CSS-1 or CSS-1h emulsified asphalt (EA) tack coat conforming to OSS 00730.
- D. Base Aggregate shall be as specified in Section 02720 of these specifications.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Unless otherwise specified herein, HMAC shall be mixed, processed, hauled, laid, compacted and finished in accordance with OSS Section 00745.
- B. Notify the Engineer at least 48-hours prior to placement of base aggregate and asphalt concrete pavement to permit inspection.
- C. When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be achieved asphalt concrete paving operations shall be suspended. Owner shall not be liable for damages or claims of any kind or description due to the suspension of operations by the Engineer. HMAC shall not be placed when the ambient temperature is below 35° F.
- D. Adhere to all applicable State and/or OSHA regulations pertaining to road closure, traffic control, and other related safety precautions.

- E. To provide for the convenience and safety of the traveling public, pavement replacement shall be performed immediately following the completion of backfilling operations. In the event that pavement replacement cannot be performed as such, the Contractor shall maintain the trench backfill on a daily basis, as directed, until pavement replacement has been completed.
- F. Subgrade and aggregate base shall be prepared, compacted and finished in accordance with Section 02720.
- G. Pavement Sawcutting
 - 1. Utility trenches in existing pavement areas shall be sawcut immediately prior to repaving. Sawcuts shall be made a minimum of 6-inches outside the limits of the trench, or to the outer extents of pavement damaged as a result of the Contractor's operations, whichever is greater.

H. Tack Coat Asphalt

- 1. Contact surfaces of manholes, catch basins, gutters and existing pavements shall be treated with a layer of tack coat asphalt. Do not place on wet surfaces.
- 2. Joints between existing and new AC pavement shall be filled with tack coat asphalt.
- 3. Apply tack coat asphalt with a pressure distributor capable of uniformly applying the emulsified asphalt at even heat on variable surface widths up to 16-feet, at readily determined and controlled rates from 0.05 to 0.20 gallons per square yard, and with uniform pressure. Pressure distributor shall include a tachometer, pressure gages, accurate volume measuring devices and a thermometer for measuring temperature of tank contents. Pressure distributor shall be equipped with a positive power asphalt pump and full circulation spray bars adjustable both laterally and vertically. Set bar height for triple lap coverage.
- 4. Minimum surface temperature at the time of placement of tack coat asphalt shall not be less than 50° F.
- 5. Tack coat shall only be applied to clean dry surfaces. All loose material should be removed by sweeping, flushing with water or other approved methods.
- 6. Apply tack coat asphalt at the following rates for the indicated surfaces.

Surface	Application Rate (gallons / yd ²)	
	Undiluted	Diluted 1:1 with Water
New HMAC	0.05 – 0.07	0.10 – 0.13
Oxidized HMAC	0.07 – 0.10	0.13 – 0.20
Milled HMAC	0.10 – 0.13	0.20+

- 7. Tack coat asphalt shall be at a temperature between 140° F and 185° F as recommended by the manufacturer at the time of application.
- 8. Do not place HMAC on the tack coat until the asphalt separates from the water, but before it loses its tackiness.

I. Asphalt Concrete Pavement

- 1. HMAC shall be a minimum of 250° F at the time of placement.

2. Storage of HMAC in silos shall not be permitted.
3. Control of line and grade shall be manual.
4. HMAC shall be covered during hauling if rain or cold air temperatures are encountered any time between loading and placement. HMAC will be rejected if any of the following is observed: mix falls below minimum specified temperature; slumping or separating; solidifying or crusting; absorbing moisture. Rejected loads shall be disposed of at the Contractor's expense.
5. Deposit HMAC from the hauling vehicles so segregation is prevented. HMAC shall not be windrowed.

J. Placement

1. HMAC should be placed using a self-contained, self-propelled paver supported on tracks or wheels that do not contact the mix being placed.
2. When leveling irregular surfaces and raising low areas, do not exceed 2-inches actual compacted thickness on any one lift.
3. Place the mix in the number of lifts and courses, and to the compacted thickness for each lift and course as shown on the Plans. Limit the minimum lift thickness to twice the maximum aggregate size in the mix.
4. The compacted depth of new asphalt concrete pavement on public streets shall be 2-inches, minimum. Asphalt concrete paving for utility trench patches shall be 2-inches, minimum, or shall match the existing paving, whichever is greater. Asphalt concrete overlays on public streets shall have a minimum thickness of 2-inches. On non-public roads or driveways, match existing thickness, with a minimum thickness of 2-inches. Asphalt concrete pavement in excess of 2-inches thick shall be constructed in multiple lifts of approximately equal thickness. The maximum compacted thickness of any individual lift shall not exceed 2-inches.
5. Pavement shall be placed, shaped, compacted and finished to the grades and cross sections shown on the Plans or established. Taper new overlays at limits to match existing asphalt pavement.
6. HMAC shall be compacted using self-propelled steel wheeled static rollers, vibratory rollers, or pneumatic tired rollers capable of achieving the minimum compaction specified. If vibratory rollers are used, they should be specifically designed for compaction of HMAC, have adjustable amplitude and frequency, and be capable of at least 2000 vibrations per minute. Finish rolling should be performed by a static roller or a vibratory roller in the static mode.
7. Asphalt concrete pavement shall be compacted to a minimum of 92% relative compaction with the theoretical maximum density determined by AASHTO T-209. Testing shall be performed at random locations using a nuclear gauge operated in the back-scatter mode. At least one density test shall be performed every 1000 lineal feet on each spread or a minimum of one test each day of production.
8. No traffic shall come in contact with any newly paved surface until surface has cooled and set sufficiently to prevent marking. The Contractor is responsible for traffic control.

K. Warranty

1. Contractor shall maintain all asphalt concrete paved areas and shall furnish all required materials and workmanship at no additional cost to the Owner for a period of one year following the Owner's acceptance of the complete project.
2. If any newly paved asphalt concrete surfaces settles, cracks, breaks, or becomes otherwise defective within the warranty period as described herein, then the deficiencies or damages in surfacing shall be immediately repaired by the Contractor upon request and in a manner approved by the Engineer.
3. All costs incurred in the repair of deficiencies or damages shall be borne by the Contractor, with no additional compensation allowed.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 02775 – SIDEWALKS

PART 1 GENERAL

1.01 SUMMARY

- A. The work in this section includes the furnishing of all labor, materials, equipment and performing all work for the placement of new sidewalks and approaches using Portland cement concrete.

1.02 RELATED SECTIONS

- A. Section 03300 Cast in Place Concrete

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete shall be as specified in Section 03300.
- B. Expansion and joint filler shall be ½-inch thick preformed asphalt fiberboard conforming to ASTM D994.
- C. Poured joint sealer for expansion joints shall be polyurethane-base, non-sag elastomeric sealant, and gray in color. Sika Corporation "Sikaflex-1A" or approved equal.
- D. If required or indicated on the plans, reinforcing steel shall be as specified in Section 03200.
- E. Aggregate base shall be as specified in Section 02720. If no specific size or grade is noted, furnish either 1"-0 or ¾"-0 as directed by the Engineer.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Properly prepare bedding and foundations using appropriate materials and workmanship, depths, widths, and cross sections shown on the plans and details or as directed.
- B. Bring areas on which structures are to be constructed to established line, and make firm, dry and free of all unsuitable or deleterious materials before placing concrete. Existing concrete surfaces shall be clean and moist at the time of placing new concrete.
- C. Forms shall have sufficient strength to resist the pressure of the concrete and to prevent leakage. Forms shall extend for the full depth of concrete and shall be adequately braced. Forms shall be cleaned and coated with an appropriate release agent before concrete is placed against them. Face forms shall be removed as soon as possible to permit finishing of face. Front and back forms shall be removed, after concrete has set, without damage to the concrete.
- D. Concrete shall be deposited into the forms without segregation and then tamped and spaded for complete consolidation. Mechanical vibration may also be used.

- E. Joints shall be placed at appropriate intervals for the section replaced. Joints shall be the preformed filler type and shall be not less than ½ inch wide and placed flush or no more than 1/8 inch below the concrete surface.
- F. Construct suitable connections between new and existing concrete where existing driveways, walks, and other structures are cut back to permit the new construction or where the new construction abuts existing concrete. Unless shown or directed, otherwise, furnish and place minimum ½ inch thick preformed expansion joint filler between new and existing concrete.
 - 1. Between driveways, walks, monolithic curbs and sidewalks, and surfacing, provide expansion joints:
 - 2. Between driveways and concrete pavement.
 - 3. Transversely in walks opposite expansion joints in adjoining curbs and elsewhere so the distance between joints does not exceed 45 feet.
 - 4. Transversely in walks at a distance of 16 feet to 8 feet from the ends of walks which abut curbs.
 - 5. Around poles, posts, boxes, and other fixtures which protrude through or against the structures.
- G. Stairs
 - 1. Provide expansion joints for stairs at the top and bottom landings as shown on the details.
- H. Surface Finishing
 - 1. Remove forms, if any, from structures after the concrete has taken its initial set and while the concrete is still green.
 - 2. Repair minor defects with mortar containing one part Portland cement and two parts sand. Do not plaster exposed surfaces.
 - 3. The top and face of the sidewalk shall be true and straight, free from humps, sags, or other irregularities. The surface shall not vary more than ¼ inch from the edge of a 12 foot long straightedge laid on the top or face of the structure, except in curves. Contractor shall furnish the straightedge and operate it for testing, if needed.
 - 4. Finish concrete surfaces to smooth and uniform texture by troweling, floating, and cross brooming. Lightly groove or mark surfaces into squares or other shapes to match markings on similar or existing surfaces in the vicinity, as directed.
 - 5. On all sidewalk ramps and accessible route islands, install truncated domes as shown. Place according to the manufacturer's recommendations.

3.02 Curing

- 1. Cure and protect concrete after placing and finishing.

2. Keep the concrete free from contact, strain, and public traffic for at least seven calendar days, or longer, as directed.
3. Do not apply curing compounds to the designated truncated dome areas of sidewalk ramps and accessible routes.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Mobilization, Bonding, and Insurance - Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 03110 – CONCRETE FORMWORK AND ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Concrete formwork required for all project structural concrete.
- B. Formwork design, placement, proper securing and support, and removal.
- C. Coordination for various wall and slab penetration locations and sizes including sleeve positioning for casting in place.
- D. Positioning of anchor bolts, grating and vault lid frames, and other imbedded items.

1.02 RELATED SECTIONS

- A. Section 03300 – Cast-In-Place Concrete
- B. Section 03200 – Concrete Reinforcement
- C. Hangers and Inserts for Mechanical and Electrical Work: Divisions 15 and 16

1.03 REFERENCES

- A. American Concrete Institute (ACI) 318-11, Chapter 6 – Formwork, Embedded Pipes, and Construction Joints.
- B. ACI 347R-04 – Guide to Formwork for Concrete
- C. ACI Special Publication, SP-4(7th) – Formwork for Concrete

1.04 QUALITY ASSURANCE

- A. The formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in "Recommended Practice for Concrete Formwork", ACI 347 and for design considerations, wind loads, allowable stresses and other applicable requirements of the local building code. The design and construction of the formwork shall be the responsibility of the CONTRACTOR. Form design shall be certified by a Registered Structural Engineer.
- B. Forms shall be constructed by laborers experienced in concrete formwork erection. Formwork shall be constructed such that the hardened surfaces shall conform to the tolerance limits of ACI 347.
- C. Formwork shall be true in every respect to produce hardened concrete to the required shape, size, grade, and alignment as indicated on the Construction Drawings, and of sufficient strength, bracing, and rigidity to maintain their position and shape under the loads and operations incidental to placing and curing the concrete, as well as other forces resulting from the movement of the forms. The forms shall be mortar-tight at the time concrete is placed in them and shall be so constructed that the surfaces of the finished concrete will be reasonably free from ridges, fins, offsets, or similar defects. Adequate and suitable means for removing the forms without injury to the surfaces or edges of the finished concrete shall be provided.

- D. Resulting work which is not in conformance with applicable contract specifications shall be promptly removed and replaced.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect form materials from damage that may affect finish appearance or form stability.
- B. Keep forms clean and free from deleterious materials. Protect form coating to prevent contamination.
- C. Protect form ties from rusting.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Plywood Forms will be grade marked B-B Plyform, Exterior Class 1 and 2 and HDO Medium Density Overlaid Plywood Concrete Form, B-Matte Formquard or equal, conforming to the requirements of U.S. Products Standard PS-1.
- B. Metal Forms will use smooth metal plate free from surface irregularities.

2.02 ACCESSORIES

- A. Form Ties
 - 1. Shall be factory fabricated form ties, snap-off type of adequate design to prevent form deflection and concrete spalling upon removal. The permanently embedded portion shall terminate not less than 3/4-inch from the face of finished concrete. The permanently embedded portion shall have a waterseal washer located at the approximate center of walls.
 - 2. Breakback Distance: Ties will be placed so that the set back in the concrete is such that the portion of the tie remaining after snap-off and removal of exterior portions is at least 1 inches back from the concrete surface.
 - 3. Do not use wire ties and wood spacers
- D. Form Release Agents
 - 1. Form coating will be non-grain-raising and non-staining resin or polymer type that will not leave residual matter on the surface of the concrete or adversely affect bonding to concrete of paint, plaster, mortar, protective coatings, waterproofing or other applied materials. Coatings containing mineral oils, paraffin, and other non-drying ingredients are not permitted. For concrete surfaces contacting potable stored water, the coatings and form release agents shall be completely non-toxic and approved by the EPA for the intended use.
- E. Form Joint Caulking
 - 1. Manufacturer and Brand: Sonneborn Sonolac, Dap Acrylic Latex, or approved
- E. Chamfer Strips – clear white pine or similar with planed surface against concrete.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ensure that reinforcing steel is properly placed according the spacing and tolerances required, and that proper inspection has been conducted.
- B. Ensure waterstops are installed as required when placed prior to formwork.
- C. Review plans for wall and slab penetrations and imbedded items.
- D. Remove debris and foreign matter from formwork. Clean form contact surfaces. Replace with new material when necessary or when directed.
- E. Remove loose rust and foreign matter from reusable hardware prior to installation into Formwork.
- F. Re-use Forms only when contact surfaces equal original use and forms have been adequately cleaned.

3.02 INSTALLATION

- A. Comply with ACI 318 and ACI 347. Fabricate with facing materials that produce the specified tolerance requirements of ACI SP-4, produce true surfaces and lines, sharp corners, and surfaces free of offsets, bulges, ridges, etc.
- B. Carefully conform to the shapes, lines and dimensions of the drawings. Ensure that edges are chamfered where shown. Form any Surface Indentations shown on the Drawings.
- C. Arrange to provide concrete cold joints as indicated on the drawings. Unless otherwise directed, make contraction, expansion, and construction joints only where shown. Continue reinforcing steel across construction joints which are not indicated to be free moving.
- D. At forms for exposed concrete, fill form panel joints with Form Joint Caulking Compound, and strike compound flush with panel on face adjacent to exposed Concrete, or cover joints with thin, smooth, plastic, pressure-sensitive tape.
- E. At forms for exposed concrete, seal Form Ties against leakage with Form Joint Caulking Compound.
- F. Make form joints tight to prevent leakage. Minimize the number of form joints used.
- G. Ensure that formwork is properly supported, tied, and braced to prevent deflection and maintain shape (see allowable tolerances for formwork).
 - 1. Provide bracing as required to meet load requirements.
 - 2. Protect against undermining or settlement when placed on ground.
 - 3. Anchor as required to prevent upward or lateral Formwork movement during Concrete placement.
 - 4. Locate ties equidistant and symmetrical. Align vertically and horizontally.
- H. Provide Access Openings as required for cleaning and inspection of Forms and Embedded Items prior to placing Concrete. Locate where not exposed to view.

- I. Provide Openings and Chasings of Slabs and Walls for Mechanical and Electrical Work. Sizes and locations are directed by Mechanical and Electrical Trades and Drawings.
- J. Anchor Bolts: Set with templates to assure accurate bolt positioning
- K. During Concrete placement, in areas where Formwork develops weakness, settlement, or distortion, stop concrete placement, remove placed concrete, and remove or strengthen Formwork.
- L. Reposition to true alignment prior to, during, and after Concrete placement, if necessary.

3.03 ALLOWABLE TOLERANCES FOR FORMWORK

- A. Variation from Plumb: 1/4 inch in 10 feet maximum
- B. Variation of Building Lines: 1/4 inch in any Bay or 20 feet maximum
- C. Variation in Cross-Sectional Dimensions: Minus 1/8 inch; plus 1/4 inch
- D. Variation in Surface Tolerance: 1/8 inch in any 10 feet measured with 10-foot straightedge.
- E. Maximum Deflection of Form facing between Supports: $0.00025 \times \text{Span}$
- F. Wall Locations: Accurately size and locate within 1/8 inch.

3.04 FORM TREATMENT

- A. All forms shall be adequately treated with form release agent to prevent concrete damage during form removal.
- B. Prior to each use: Apply form coating to contact surfaces in accordance with Manufacturer's instructions. Conduct surface preparation in accordance with manufacturer's instructions prior to coating forms.
- C. When treating previously set forms, carefully prevent coatings from covering reinforcing steel, waterstops, imbedded items, or existing concrete.
- D. Prevent coatings from collecting in puddles.

3.05 FORM REMOVAL

- A. Leave forms and shoring in place until concrete has attained sufficient strength to safely support own weight and imposed loads.
- B. Remove forms at time and in manner to insure safety of structure, and without concrete surface damage.
- C. At exposed concrete, form removal time shall be uniform to avoid color differences.
- D. Remove top forms from any sloping concrete surfaces as soon as concrete is self-supporting. Repair and finish, if necessary, and cure immediately.

3.06 CLEANING AND REPAIRING

- A. Including Work of other Trades, clean, repair, and touch-up, or replace when directed, products which have been soiled, discolored, or damaged by Work of this Section.
- B. Remove debris from Project Site upon Work completion, or sooner if directed.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 03200 – CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes reinforcement for concrete including deformed steel bars, welded-wire-fabric, and fiber reinforcement.
- B. Supply, detail shop drawings, and place reinforcement.
- C. Provide reinforcing to the sizes and dimensions shown on the drawings and according to approved shop drawings for rebar placement.

1.02 RELATED SECTIONS

- A. Section 03110 – Structural Cast-In-Place Concrete Forms
- B. Section 03300 – Cast-In-Place Concrete

1.03 REFERENCES

- A. American Standards for Testing and Materials (ASTM), latest edition
 - 1. ASTM A 615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 2. ASTM A 185 – Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 3. ASTM A 82 – Specification for Steel Wire, Plain, for Concrete Reinforcement
- B. American Concrete Institute (ACI), latest edition
 - 1. ACI 315-99 – Details and Detailing of Concrete Reinforcement
 - 2. ACI 318 – Building Code Requirements for Reinforced Concrete
 - 3. ACI 408R – Bond and Development of Straight Reinforcing Bars in Tension
 - 4. ACI 439.3R-07 – Types of Mechanical Splices for Reinforcing Bars
- C. Oregon Structural Specialty Code (OSSC) – Adopted Oregon code, 2010 edition or latest revision.
- D. Concrete Reinforcing Steel Institute (CRSI)
 - 1. CRSI Manual of Standard Practice, 1997
 - 2. CRSI Reinforcing Bar Detailing, 1999
 - 3. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
 - 4. CRSI 65 – Recommended Practice for Placing Bar Supports

1.04 SUBMITTALS

- A. Certified Mill Test Reports for steel.
- B. Detail and placement drawings. Submit in accordance with Section 01300 at least 14 days prior to reinforcement fabrication.
 - 1. Reinforcing steel shall be detailed in accordance with the “ACI Detailing Manual” SP-66 (04), ACI Committee 315; CRSI; and in conformance with the project drawings.

2. Shop drawings shall include sufficient plan, section, and elevation drawings of all beams, walls, slabs, footings, columns, and other shapes to clearly show all reinforcement details, spacing, and sizes.
 3. Bends, splices, hooks, ties and all other details shall be shown. Drawings shall indicate any fieldwork required.
 4. Shop drawings shall show steel specifications and conformances.
- C. Samples of all proposed bar supports with a written description of where each support is proposed to be used.

1.05 QUALITY ASSURANCE

- A. Coordinate with other Trades affecting or affected by Work of this Section.
- B. Bends, hooks, laps, splices, cover, and other details shall conform to OSSC Section 1907; and ACI 318, except where more stringent requirements are shown in the drawings or specified herein.
- C. Perform reinforcement work in accordance with CRSI Documents 63 and 65.
- D. Conduct field measurements as necessary prior to fabrication. Conform to the approved detail and placement drawings.
- E. All materials shall be new, unused, specifically manufactured for the intended purpose.
- F. Any welding shall be conducted by persons with Welder Certification in accordance with AWS D1.4.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered properly bundled and labeled to show grade, size and location. Deformed bars shall be marked with the letter "S" per ASTM A615. Deliver with suitable hauling and handling equipment.
- B. Properly store to protect from moisture. Cover steel with waterproof covering and store so that materials are not against unprotected earth.
- C. Handle material carefully to protect from cuts, nicks, kinks, deformation, and other damage. Ensure worker safety.

PART 2 PRODUCTS

2.01 REINFORCEMENT MATERIALS

- A. Reinforcing Bars for Concrete
 1. All structural reinforcement shall be deformed bars.
 2. Deformed billet steel; ASTM A 615, Grade 60

2.02 ACCESSORIES

- A. Provide all Accessories necessary for proper Reinforcement placement, spacing, support, and fastening. Bricks, broken CMU, spalls, rocks or similar materials shall not be used for support of reinforcing steel.

- B. Tie Wire: 16-gauge minimum, black annealed steel; acceptable patented system.
- C. Bar Supports, Bolsters, Chairs and Spacers
 - 1. Sized and shaped for strength and support of reinforcement during installation and placement of concrete. Use only approved materials.
 - 2. High density concrete dobies. Compressive strength equal or greater than concrete to be placed. No plastic or low cement content dobies accepted.
 - 3. Chairs: Stainless steel. With plastic tips when used at surfaces that will be exposed to view.
 - 4. Spacers: Plastic wheel type. Preco Barspan Wheels, or approved equal.
 - 5. Plastic Shims may be used to support plastic spacers.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that surfaces to receive Reinforcement are accurately sized and located, square, plumb, rigid, secure, and otherwise accurately prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Reinforcement shall be free from mud, oil or other nonmetallic coatings that decrease bond.
- D. Remove surface rust and mill scale with wire brush. Heavily rusted bars shall not be used.
- E. Do not start Work until conditions are satisfactory.

3.02 PLACEMENT

- A. Perform reinforcement work in accordance with CRSI Documents 63 and 65, and fabricate in compliance with ACI 315.
- B. Conform to approved placement and detail drawings and specified tolerances herein.
- C. Reinforcement shall be accurately placed and adequately supported before concrete is placed, and shall be secured against displacement within the tolerances of this section.
- D. All reinforcement shall be bent cold unless otherwise permitted by the Engineer.
- E. Reinforcement partially embedded in concrete shall not be field bent unless approved by the Engineer.
- F. Do not weld splices, crossing bars, or other locations.
- G. Splices: Provide bars in full lengths to preclude the need for splices as much as possible. Locate any allowed splices not indicated on the drawings at points of minimum stress. Development length and splices shall conform to ACI 318. At wire mesh, lap one full mesh plus 2-inches. Splices of adjacent bars shall be staggered. Use greater splice lengths where shown in the drawings.
- H. Spacing: Comply with OSSC Section 1907.6, contract drawings, and approved shop drawings.

- I. Protective Concrete Cover: Comply with OSSC Section 1907.7 minimums. Provide greater cover where shown in the drawings.
- J. Bars in slabs shall be supported on well-cured concrete blocks or approved chairs.
- K. Tolerances:
 - 1. Concrete Cover: Plus or minus ¼ inch.
 - 2. Spacing Between Bars: ¼ inch.
- L. Bar relocation to avoid interference with other reinforcement, conduits or embedded items: 1 bar diameter, unless otherwise approved by Engineer.
- M. Reinforcement around openings: Unless otherwise shown on the drawings, place at least double the area of steel removed by the opening around the opening and extend on each side sufficiently to develop bond in each bar. At square or rectangular openings, place at least one diagonal bar at each corner.

3.03 PROTECTION

- A. Protect other Work against damage and discoloration caused by Work of this Section.
- B. Protect placed reinforcement from subsequent movement and inclement weather until concrete is placed.

3.04 FIELD QUALITY CONTROL

- A. The Engineer shall be notified when reinforcing steel is ready for inspection. Inspection must occur before any concrete is placed.
- B. Notify Engineer at least 48 hours in advance and allow sufficient time for inspection.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

03300 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes work required to supply, place, finish and cure cast-in-place concrete, including mix design, certifications, submittals and testing.
- B. Installation of inserts, sleeves, anchor bolts, grounding cable and other items embedded in concrete, but furnished under other sections.
- C. Rinsing out of transit mix trucks, washing or wetting of concrete, site cleanup, or other activity related to water at the site shall be in conformance with all EPA requirements for the prevention of water runoff to storm water sewers or creeks.

1.02 RELATED SECTIONS

- A. Section 03110 – Structural CIP Concrete Forms
- B. Section 03200 – Concrete Reinforcement
- C. Section 03600 – Grout

1.03 REFERENCES

- A. American Standards for Testing and Materials (ASTM), latest editions
 - 1. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field
 - 2. ASTM C33 – Specification for Concrete Aggregate
 - 3. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 4. ASTM C94 – Standard Specification for Ready-Mixed Concrete
 - 5. ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete
 - 6. ASTM C150 – Standard Specification for Portland Cement
 - 7. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - 8. ASTM C260 – Standard Specification for Air Entrained Admixtures for Concrete
 - 9. ASTM C309 – Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete
 - 10. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
 - 11. ASTM C618 – Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- B. American Concrete Institute (ACI), latest editions
 - 1. ACI 301 – Standard Specification for Structural Concrete in Buildings
 - 2. ACI 304R – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
 - 3. ACI 305R – Recommended Practice for Hot Weather Concreting
 - 4. ACI 306R – Recommended Practice for Cold Weather Concreting
 - 5. ACI 309R – Guide for Consolidation of Concrete
 - 6. ACI 318 – Building Code Requirements for Reinforced Concrete
 - 7. ACI SP-15 – Field Reference Manual (*have copy on-site*)
- C. Oregon Structural Specialty Code (OSSC) – 2010 Edition or latest revision.

1.04 SUBMITTALS

- A. Mix design submittals and certificates of compliance shall be furnished at least 30 days prior to any anticipated concrete placement. All submittals must be approved by the Engineer prior to placement of any concrete.
- B. Contractor is responsible to obtain design of the concrete mix that shall conform to ASTM C94 and the requirements of this section. Mix design shall be prepared by a professional testing laboratory or concrete mix design professional.
- C. Submit properties of each mix design for each class of concrete including:
 - 1. Average compressive strength of proposed mixture
 - 2. Documentation of strength test results of similar concrete mixtures in accordance with ACI 318
 - 3. Slump
 - 4. Air Content
 - 5. Density
 - 6. Water/Cement ratio
 - 7. Maximum aggregate size
 - 8. Cementitious materials and type
 - 9. Admixtures
- D. Certificates of compliance for aggregate, cement, and admixtures signed by the concrete supplier certifying that materials meet or exceed these specifications.
- E. Concrete placement schedule showing construction joint locations and type, and placement sequence.
- F. Product data for proposed curing compounds, admixtures, hardeners, sealers, etc. to be used.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Conform to ACI 305R in hot weather.
- C. Conform to ACI 306R in cold weather.
- D. Installer Qualifications: Concrete work shall be finished by persons with at least 5 years experience with work of similar scope and quality.
- E. No chloride containing admixtures shall be used.
- F. On-Site water addition to concrete will not be permitted.
- G. Conduct field-testing as specified.
- H. Admixtures shall be added in strict conformance with the manufacturer's instructions.
- I. Manufacturer Qualifications: Concrete supplied from concrete plants with current certification under the NRMCA Certification of Ready Mixed Concrete Production Facilities. Individual with responsibility for concrete mixtures certified as an NRMCA Concrete Technologist Level 2.

1.06 DELIVERY

- A. Concrete shall be scheduled and delivered in a timely manner in accordance with ASTM C94 and ACI 304R. Ensure that forms and reinforcement are complete and ready to accept concrete prior to scheduling delivery.
- B. When installing a continuous pour section, ensure that trucks arrive and concrete is placed with no greater than 45 minutes elapsing between lifts.

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

- A. Hydraulic Cement per ASTM C150
- B. Fly Ash: ASTM C618, up to 15% by volume of cement content

2.02 WATER

- A. Water used for mixing shall be clean and potable.

2.03 AGGREGATE

- A. Aggregates shall be natural materials conforming to ASTM C33 as modified herein.
- B. Aggregates shall be nonreactive as defined in ASTM C33 and tested per ASTM C289.
- C. Aggregate shall contain no soil, friable particles, organic matter, or other deleterious materials. Aggregate shall be washed prior to use in the concrete mix.
- D. Aggregates shall contain no chert, limestone, or shale.
- E. Coarse Aggregate:
 - 1. Use coarse aggregate from only one source for exposed concrete in a single structure.
 - 2. Coarse aggregate shall be smooth, rounded and uniform. No more than 15% shall be elongated (max. dimension 5 times min. dimension).
 - 3. Coarse aggregate shall be durable, sound and hard.
 - 4. Maximum Size: 3/4-inch, but not more than one-fifth of narrow dimension between sides of Formwork, one-fourth depth of slab, nor three fourths of narrowest distance between Reinforcing Steel.
- F. Fine Aggregate:
 - 1. Use fine aggregate from only one source for exposed concrete in a single structure.
 - 2. Fine aggregate shall not exceed 40% by weight of combined aggregate total, except when coarse aggregate maximum size is 1/2-inch or less.
 - 3. Fine aggregate shall be durable, sound, clean and hard.
 - 4. Sand Equivalent of 75 minimum per ASTM D2419.

G. Combined (Coarse and Fine) Gradation per ASTM C136:

<u>US Standard Sieve</u>	<u>% Passing by Weight</u>
1 1/2-inch	100
1-inch	90-100
3/8-inch	45-75
No. 4	33-50
No. 8	28-44
No. 16	23-38
No. 30	10-22
No. 200	0-2

2.04 CHEMICAL ADMIXTURES

- A. General:

1. When two or more admixtures are used, they shall be certified by the manufacturer(s) to be compatible.
 2. Chlorides are not permitted in any form.
 3. Air Entraining and Water Reducer admixtures are required.
 4. All admixtures shall be added at the batch plant, unless otherwise specified.
- B. Midrange Water Reducer:
1. Shall conform to ASTM C494, Type A and F.
 2. Master Builders, Inc. "PolyHeed" Series; or approved equal.
- C. High-Range Water Reducer (Superplasticizer):
1. Shall conform to ASTM C494, Type F or G; and ASTM C1017, Type I or II.
 2. Master Builders, Inc. "Rheobuild"; or approved equal.
- D. Air-Entraining Admixture:
1. Shall conform to ASTM C260.
 2. Master Builders, Inc. "MicroAir", "MB-AE 90"; or approved equal.
- 2.05 FIBERS
- A. Fibrous Concrete Reinforcement: ASTM C1116. Shall be "Fibermesh MD" added at a minimum of 1.5 pounds per cubic yard. Use where specified or shown on the drawings.
- 2.06 BONDING AGENT
- A. Required where new concrete is poured against existing concrete, and on embedded items with less than 1½-inches of cover.
- B. 100% solids, two component epoxy bonding compound meeting ASTM C881, Type II, Grade 2, Class B or C materials except as modified herein.
- C. Properties:
1. Bond Strength @ 14 days (ASTM C882) – 1800 psi minimum
 2. Tensile Strength @ 7 days (ASTM D638) – 4400 psi minimum
 3. Tensile Elongation @ 7 days (ASTM D638) – 1.49% maximum
- D. Master Builders, Inc. "Concresive Liquid PL"; or approved equal.
- 2.07 CURING COMPOUNDS AND SEALERS
- A. Evaporation Reducer: Spray applied monomolecular film that reduces the rate of surface moisture evaporation, minimizes plastic shrinkage, and does not effect the cement hydration process. Master Builders, Inc. "Confilm"; WR Meadows "Sealtight Evapre"; or approved equal.
- B. Exterior Use Liquid Membrane-Forming Curing Compound: Shall conform to ASTM C309, Type I, Class B and ASTM C1315, Type 1, Class A. WR Meadows "CS-309-25"; or approved equal.
- C. Interior Use Liquid Membrane-Forming Curing Compound: Water-base acrylic curing and sealing compound conforming to ASTM C309, Type I, Class B and ASTM C1315, Type 1, Class A. WR Meadows "Vocomp-25-1315"; or approved equal.
- D. Concrete Sealer: Non-yellowing, acrylic co-polymer solution meeting ASTM C309, Type 1, Class B and ASTM C1315, Type 1, Class A. WR Meadows "TIAH 1315"; or approved equal.

2.08 CONCRETE HARDENERS

- A. Liquid concrete densifier and hardener, chemical resistant, colorless, with 100% active chemicals. WR Meadows "Liqui-Hard"; or approved equal.

2.09 VAPOR BARRIER

- A. ASTM D2103 – Polyethylene Film and Sheeting, 6 mils thickness.

2.10 HIGH-PERFORMANCE CONCRETE MIX

- A. Use: All water-holding structures and adjoining structures, equipment pads, footings, support walls, retaining walls, and others not designated for standard concrete. May be used in place of standard concrete except for interior slabs where a smooth trowel finish is required.
- B. Mix Design Requirements:
 1. Cement: Portland Cement, Type II, ASTM C150.
 2. Water / Cementitious Materials Ratio: 0.35-0.40 by weight
 3. Strength: 4500 psi minimum, ASTM C39
 4. Slump before plasticizer: 1.5 to 3-inches, ASTM C143
 5. Air Content: 5.5-7% by volume, ASTM C231
 6. Water Reducer: High-Range
 7. Maximum slump at time of placement: 8-inches (with rheoplastic admixture)

2.11 STANDARD CONCRETE MIX

- A. Use: Sidewalks and walkways, curbs and gutters, reinforced concrete parking areas and other miscellaneous structures
- B. Mix Design Requirements:
 1. Cement: Portland Cement, Type I or II, ASTM C150
 2. Water / Cementitious Materials Ratio: 0.45-0.50 by weight
 3. Strength: 3500 psi minimum, ASTM C39
 4. Air Content: 2.5-5% by volume, ASTM C231
 5. Water Reducer: Mid or High-Range
 6. Maximum slump at time of placement: 5-inches or less

PART 3 EXECUTION

2.01 PREPARATION

- A. Examine all reinforcement, formwork, waterstops, premolded joint fillers, and other embedded items to ensure they are accurately placed, properly secured and cleaned.
- B. Ensure that inspection of reinforcement is complete and installation approved.
- C. Ensure concrete mix design and test certifications have been submitted and approved.
- D. Ensure that all required materials and equipment are on-site and operable.
- E. Ensure that subgrade and base rock are properly placed and compacted. Place vapor barrier and leveling sand at slab-on-grade locations. Sprinkle subgrades and other porous surfaces with water to reduce adsorption.

- F. Apply form release agent to formwork.
- G. Apply bonding agent where required.
- H. Notify General Contractor of work requiring correction. Do not start work until conditions are satisfactory.
- I. Review for various locations to receive different types of concrete mixes.
- J. Notify Engineer at least 48 hours in advance of concrete placement.

2.02 CONCRETE PLACEMENT

- A. Comply with ACI 304, ASTM C94, ACI 305R and 306R, and OSSC Section 1905 as required.
- B. Convey and place by methods with will prevent material separation, segregation, and loss. Mix for at least 10 minutes and at least 3 minutes immediately prior to discharging at the job site.
- C. Concrete shall be delivered to site and placed within formwork within 1½ hours after the introduction of water to the mixture.
- D. Deposit concrete continuously or in layers so that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or other planes of weakness. Where seams are unavoidable, provide construction joints as directed.
- E. Do not convey pneumatically placed concrete through aluminum pipe.
- F. Do not retemper concrete, or add water on-site for other reasons.
- G. Use trunks or tremies when pouring walls to ensure concrete does not drop or fall more than 4 feet. Place in layers not exceeding 2 feet in depth.
- H. Screed all slabs to true levels or slopes, true within ¼ inch per 10 feet. Evenly slope to any drain at 3/16 inch per foot, unless otherwise shown on Drawings.
- I. When mean temperature exceeds, or is expected to exceed 80°F during placement and finishing operations, steps shall be taken in accordance with ACI 305R to reduce concrete temperature and water evaporation. Slabs will be fog sprayed from the completion of screeding until curing is begun (except during troweling). Submit detailed hot weather concreting procedure to Engineer for approval at least 2 days prior to planned placement.
- J. When mean temperature falls below, or is expected to fall below 40°F, comply with ACI 306R. Concrete shall be protected from freezing by means acceptable to the Engineer. Submit detailed cold weather concreting procedure to Engineer for approval at least 2 days prior to planned placement.

2.03 CONSOLIDATION

- A. Employ mechanical, high frequency vibrators to consolidate concrete around reinforcement, into corners and angles of formwork, and to exclude rock pockets, air bubbles and honeycomb.

- B. Have sufficient number of vibrators and tampers on-site. Minimum of 1 device per each 20 c.y. placed per hour.
- C. Vibration shall be in accordance with ACI 309. Vibrator frequency shall be between 8000 and 12000 rpm.
- D. Hold Vibrator in one spot no longer than 15 seconds; keep in constant motion, insert and withdraw at points approximately 18 inches o.c.
- E. Maintain vibrator in vertical position when penetrating concrete walls. At slabs, hold vibrator perpendicular to the surface at all times.
- F. Vibrate each successive lift. Extend vibrator into previous lift to avoid seams.
- G. Transporting concrete with vibrator is not permitted.
- H. Maintain spare vibrators at jobsite during concrete placement.
- I. Supplement vibration by forking and spading along surfaces of forms and between reinforcing whenever flow is restricted.

2.04 CONTROL JOINTS

- A. Form to true, straight lines, with adjacent slab sections flush at Joints. Make panels as close to square as possible.
- B. Conform to ACI 302 and the Project Drawings. If not shown, submit control joint layout plan to Engineer for approval.
- C. Joints shall be formed by tooling into fresh concrete. The joint shall be perpendicular to the concrete surface and $\frac{1}{4}$ of the thickness of the slab. Zip strips not allowed.
- D. Fill joint as directed with proper joint sealants.
- E. Extend Reinforcement through Joints, unless otherwise shown on Drawings.
- F. If necessary, and approved by Engineer, joint may be saw cut as soon as concrete has sufficiently hardened to prevent dislodging of aggregates. Saw continuous slots perpendicular to surface and $\frac{1}{4}$ of slab thickness. Must be complete within 12 hours of concrete placement.

2.05 CONCRETE FIELD TESTING

- A. Samples for concrete tests shall be taken in accordance with ASTM C172.
- B. If total quantity of a class of concrete for the project is less than 50 cubic yards, strength tests are not required when evidence of satisfactory strength is submitted to and approved by Engineer.
- C. Samples for compressive strength tests of each class of concrete shall be taken not less than once per day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 feet squared of surface area of walls or slabs. If the total volume of concrete for each class is such that less than 5 tests are required, then samples shall be made from at least 5 random batches or each batch if less than 5 batches is required.

- D. Acceptance of concrete shall be based on strength test results of standard cured cylinders in accordance with ASTM C 31 and tested at 28 days in accordance with ASTM C 39. Strength test results are the average of two specimens.
- E. When strength cylinders are made, tests of slump per ASTM C143, air content per ASTM C94, temperature per ASTM C1064 and density per ASTM C138 shall be made and recorded with the strength test results.
- F. Strength of each concrete class shall be deemed satisfactory when both of the following criteria are met:
 - 1. The average of three consecutive compressive-strength tests equals or exceeds specified compressive strength
 - 2. Any individual compressive-strength test result does not fall below specified compressive strength by more than 500 psi.
- G. When compressive strength tests indicate low strength, follow procedure in ACI 318 chapter 5.6.4 Investigation of low-strength test results.

2.06 FINISHES

- A. Rough Form Finish
 - 1. Finish resulting after form removal with fins or projections exceeding ¼-inch removed, and with tie holes and defective areas repaired and patched.
 - 2. Location: Formed concrete surfaces not exposed to view in the finished structure.
- B. Standard Smooth Finish
 - 1. As-cast surface with all fins and projections completely removed and smoothed, and with all tie holes and defective areas repaired and patched for a uniform, smooth appearance.
 - 2. At unformed surfaces, such as tops of walls, strike-off smooth and finish with a texture matching adjacent surfaces.
 - 3. Location: Formed surfaces exposed to view in the finished structure.
- C. Float Finish
 - 1. After placing slabs, do not work the surface until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or by hand-floating if area is small or inaccessible to power units.
 - 2. Check the level of the surface plane to a tolerance not exceeding ¼-inch in 10 feet when tested with a 10-foot straightedge placed on the surface in not less than two different angles from a reference point. Cut down high spots and fill low spots. Uniformly slope surfaces to drain where shown on the drawings.
 - 3. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture. Do not overfinish.
 - 4. Location: Monolithic slab surfaces that are to receive a trowel finish and other finishes.
- D. Trowel Finish
 - 1. After floating, begin the first trowel finish operation using a power driven trowel. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge.

2. Do not absorb wet spots with neat cement or cement-sand mixture, and do not use chemical dryers.
 3. Location: Monolithic slab surfaces exposed to view, or to be covered with resilient floor covering, or to receive liquid hardener treatment.
- E. Nonslip Broom Finish
1. After concrete has received floating finish specified above, provide light brushing with fiber-bristle broom perpendicular to traffic flow.
 2. Location: Exterior walks and other horizontal walking surfaces.

2.07 CONCRETE SURFACE REPAIRS

- A. After removal of forms, repair and patch defective areas with specified repair mortar.
- B. In honeycomb and rock pocket areas, saw cut area and remove material down to solid concrete. Saw cut edges perpendicular to the concrete surface. Thoroughly clean out loose material, saturate area with water to a saturated surface dry condition and brush-coat the area to be patched with a slurry coat of structural repair mortar. Place additional mortar to patch the area before the slurry coat has dried. Smooth and blend to surrounding surface. Do not feather edges.

2.08 CONCRETE CURING AND PROTECTION

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete from rapid moisture loss before and during finishing operations with a fog spray or evaporation reducer. Apply evaporation reducer in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Curing shall begin as soon as the finishing operation has been completed and the surface will not be damaged by the curing method. Curing shall be maintained for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing compound, by moist curing, by moisture-retaining cover curing, or combinations thereof, as specified herein.
1. Moist Curing. Use one of the following methods
 - a) Keep concrete surface continuously wet by covering with water
 - b) Use continuous water-fog spray
 - c) Cover concrete with absorptive cover (burlap cloth, 9 oz./s.y.), thoroughly saturate with water, and keep continuously wet. Completely cover all concrete and lap edges 4-inches. Place moisture retaining cover (polyethylene film) over absorptive cover.
 2. Moisture-Retaining Cover. Cover all surfaces completely with polyethylene sheets, lap edges at least 3-inches, and seal with waterproof tape. Immediately repair any holes or tears with sheet material and tape.
 3. Curing Compound. Use specified compound and apply in accordance with manufacturer's instructions. Apply within 1 hour of final finishing operations or form removal. Maintain continuity of coating and protect from damage during curing period. If finish materials are to be applied later, follow manufacturer's instructions for compound removal.

- D. Exterior Structural Concrete: Cure for 7 days with moist cure or moisture-retaining cover. After 7 day period, apply specified or approved sealing compound to surfaces that will be exposed in the finished structure.
- E. Interior Slabs to be Covered (with resilient flooring): Cure for 7 days with moist cure or moisture-retaining cover. Or; cure for 7 days using specified or approved interior curing/sealing compound. Ensure compound compatibility with adhesives.
- F. Interior Slabs Exposed and Other Exposed Interior Concrete: At interior slab locations that will remain uncovered, interior curbs, equipment pads, etc., cure for 7 days with moist cure or moisture-retaining cover. After 7 days, or as recommended by the manufacturer, apply liquid chemical hardener. Follow manufacturer's instruction for hardener application. Apply at least two coatings unless otherwise recommended by the manufacturer and approved. Protect adjoining work from overspray and remove all excess hardener from surface of floor slab.
- G. Protect all surfaces from damage until curing is complete and sealers and hardeners have dried.

2.09 CORRECTION AND REMOVAL OF DEFECTIVE WORK

- A. Remove and replace any concrete which shows excessive cracks or severe damage. Remove and replace slabs which do not drain properly, or are improperly finished, and other defective concrete as directed.
- B. Remove and replace work with improper cover over steel, concrete containing wood, cloth or other foreign matter.
- C. Fill and repair all voids, rock pockets, and other defects as directed. Voids larger than 3/4-inch shall be considered excessive and such work shall be removed and replaced.
- D. Remove and replace any concrete that has been improperly cured or finished.
- E. Should concrete fail to meet the minimum specified 28 day strength as determined by tests on both the regular and spare cylinders, the concrete will be deemed defective and shall be removed and replaced. Contractor shall bear the entire cost of such testing, removal, redesign, and replacing of defective concrete.
- F. Concrete which has improper water/cement ratios, and/or improper air contents shall be removed and replaced as directed.
- G. Contractor shall bear all costs for removal and replacement of defective work.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 03600 GROUT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes various types of grout as may be required for the project as shown on the Drawings and as required.
- B. Work includes supply, preparation, mixing, application, finishing and curing of grout.

1.02 RELATED SECTIONS

- A. Section 03200 – Concrete Reinforcement
- B. Section 03300 – Cast-In-Place Concrete
- C. Miscellaneous Sections of Divisions 5, 11 and 15 for anchor bolts, base plates and other materials to be grouted or bonded in place.

1.03 REFERENCES

- A. ASTM C1107 - Standards Specification for Packaged Hydraulic-Cement Grout (Nonshrink)
- B. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars – Modified
- C. ASTM C1090 - Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic Cement Grout
- D. ASTM C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- E. ASTM C827 – Test Method for Early Volume Change of Cementitious Mixtures
- F. ASTM C882 – Test Method for Bond-Strength of Epoxy-Resin Systems Used with Concrete.
- G. ACI 351 - Grouting for Support of Equipment and Machinery

1.04 SUBMITTALS

- A. Submit list of each type of grout proposed for each location to be grouted. Include manufacturer's specifications, use recommendations, surface preparation and application instructions, and protection of adjacent surfaces.
- B. Submit three copies of submittal package. Grout shall be approved prior to use.

1.05 QUALITY ASSURANCE

- A. Grout Manufacturer shall be consulted when questions arise during selection of a particular grout for application. Grout used shall be as recommended by the manufacturer for each type of application.
- B. Grout shall be mixed, placed and cured in strict conformance to the manufacturer's instructions. Surfaces to be grouted shall be carefully prepared according to the manufacturer's instructions. Improper surface preparation and curing are the most common causes of grout failure and problems.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's sealed containers with contents clearly labeled.
- B. Store materials in a dry area at a temperature between 40 and 100°F.

PART 2 PRODUCTS

2.01 STANDARD NON-SHRINK GROUT

- A. Non-metallic, non-bleeding, cement based non-shrink grout meeting ASTM C1107, Grades B or C. Pumpable and pourable with positive expansion per ASTM C827.
- B. Compressive Strength at Flowable Consistency per ASTM C109: 2500 psi at 1 day, 5000 psi at 3 days, and 8000 psi at 28 days (minimums).
- C. Use: Grouting around pipe and conduit penetrations in concrete slabs, and other locations where non-shrink grout is called for and other specified grouts are not required.
- D. Manufacturers: Dayton Superior Corp. "1107 Advantage Grout"; ThoRoc "621 Construction Grout"; EUCO "NS Grout"; or approved equal.

2.02 PRECISION NON-SHRINK GROUT

- A. High performance, non-metallic, non-bleeding, non-gaseous, chloride-free, cement based non-shrink grout meeting ASTM C1107, Grade C. Pumpable and pourable, vibration resistant, and heat and thermal shock resistant. Positive expansion per ASTM C827 and ASTM C1090.
- B. Expansion: 0.01-0.07% at 1 day and 0.02-0.07% at 28 days when tested per ASTM C1107 in Fluid State.
- C. Compressive Strength at Fluid Consistency per ASTM C1107: 4000 psi at 1 day, 6000 psi at 3 days, and 9000 psi at 28 days (minimums).
- D. Use: Under base plates of equipment and other items where grout base is shown in the drawings or required.
- E. Manufacturers: Dayton Superior Corp. "Sure-Grip High Performance Grout", "1107 Advantage Grout"; EUCO "Hi-Flow Grout"; or approved equal.

2.03 DRY PACK GROUT

- A. Cement based, non-shrink, noncorrosive, non-metallic, high density, high strength grout for dry pack applications. Meets COE CRD-C-621.
- B. Compressive Strength per ASTM C109: 3000 psi at 1 day, 6500 psi at 7 days, and 8000 psi at 28 days (minimums) at damp pack consistency.
- C. Use: Pipe penetration patches in precast concrete, overhead applications and other areas where poured or pumped grout use is not practical.
- D. Manufacturers: Dayton Superior Corp. "Sure-Grip Grout Dri-Pak"; W.R. Meadows "Pac-It"; EUCO "Dry Pack Grout"; or approved equal.

2.04 EPOXY GROUT

- A. Multi-component, pre-proportioned epoxy grout. High impact and vibration resistance.
- B. Compressive Strength per ASTM D695 at 50°F: 9200 psi at 1 day and 12000 psi at 14 days
- C. Tensile Strength per ASTM D638 at 10 days: 2600 psi minimum
- D. Flexural Strength per ASTM D790 at 14 days: 5000 psi minimum
- E. Bond Strength per ASTM C882 at 14 days: 2200 psi minimum (to concrete)
- F. Water Absorption per ASTM D570: 0.3%
- G. Use: Deep pour applications (more than 4-inch thick), grouted rods and anchor bolts.
- H. Manufacturers: Dayton Superior Corp. "Sure-Grip Epoxy Grout"; or approved equal.

2.05 ACCESSORIES

- A. Aggregate: Washed pea gravel, maximum 3/8-inch size.
- B. Water: Clean potable water.
- C. Curing Compound: Water based, acrylic as recommended by grout manufacturer.

PART 3 EXECUTION

3.01 MIXING

- A. Mix materials in accordance with the manufacturer's instructions.
- B. Where grout depth will exceed 2-inches, add aggregate at a maximum rate of 25 pounds per 55 pound bag.
- C. Do not retemper mix.

3.02 PREPARATION

- A. Carefully prepare all surfaces to be grouted in accordance with the manufacturer's recommendations and as specified. Concrete must be cured for 28 days before placing grout.
- B. Clean surfaces to remove loose and foreign material by waterblasting, mechanical abrasion, or sandblasting. Surface shall be free of dirt, oil, curing compounds and laitance.
- C. Remove unsound concrete by chipping or grinding. Grind or sandblast steel surfaces to remove all rust, mill scale and paint.
- D. Install forms to contain liquid grout. Seal joints and corners.

3.03 INSTALLATION – CEMENTITIOUS GROUTS

- A. Follow manufacturer's instructions.
- B. Just prior to grouting, thoroughly saturate concrete surfaces for 24 hours; remove excess water.
- C. Place grout continuously by most practical means. Work from one side to avoid entrapped air.
- D. Grout may be rodded or tamped, but do not vibrate.
- E. Apply curing compounds to exposed grout in accordance with manufacturer's instructions or cure with wet burlap for 3 days. Curing shall commence immediately after placement.

3.04 INSTALLATION – EPOXY GROUTS

- A. Follow manufacturer's instructions.
- B. Allow surfaces to dry completely before grouting.
- C. Place grout continuously by most practical means. Work from one side to avoid entrapped air.
- D. For grout depths exceeding 3 inches, place grout in maximum 3-inch lifts; allow each lift to cure before placing next lift.
- E. Consolidate material to eliminate voids and air pockets.
- F. Lightly mist exposed grout with solvent, then steel trowel to smooth surface. Do not apply curing compounds.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

DIVISION 5 – METALS **TABLE OF CONTENTS**

<u>SECTION NO.</u>	<u>TITLE</u>
SECTION 05080	HOT-DIP ZINC COATING
SECTION 05090	ANCHOR BOLTS AND FASTENERS
SECTION 05530	GRATES

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SECTION 05080 – HOT-DIP ZINC COATING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Specifications for applying protective coating to structural metals, anchor bolts, fasteners, and other metal hardware.

1.02 DESIGN REQUIREMENTS

- A. As specified herein.

1.03 REFERENCES

- A. ASTM A123-89 Zinc (hot-dip galvanized) Coatings on Iron and Steel Products
- B. ASTM A143-74 Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
- C. ASTM A153-82 Zinc Coating (hot-dip) on Iron and Steel Hardware
- D. ASTM A384-76 Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
- E. ASTM A385-80 Providing High-Quality Zinc Coatings (hot-dip)
- F. ASTM A780-80 Repair of Damaged Hot-Dip Galvanized Coatings
- G. MILSPEC DOD-P-21035-78 Paint, High Zinc Dust Content, Galvanizing Repair

1.04 SUBMITTALS

- A. Manufacturer's product data showing conformance to specified product.
- B. Manufacturer's recommendation for application of zinc dust-zinc oxide coating.
- C. Coating applicator's Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements.

1.05 QUALITY ASSURANCE

- A. Coating systems to protect components from corrosion and other environmental degradation. System shall result in a consistent product in quality and appearance.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Manufactured materials shall be delivered in original, unbroken packages bearing the label of the manufacturer.
- B. All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 PRODUCTS

2.01 Zinc Oxide Coating Systems

- A. Zinc coating material shall be as specified in ASTM A153.
- B. Zinc dust-zinc oxide coating shall conform to MILSPEC DOD-P-21035. Coating shall be as manufactured by Z. R. C. Chemical Products, Galvicon Company or approved equal.
- C. Coating weights shall conform to ASTM A123 or Table 1 of ASTM A153, as appropriate.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Steel members, fabrications and assemblies shall be galvanized after fabrication in accordance with ASTM A123.
- B. Anchor bolts and nuts shall be stainless steel unless noted otherwise.
- C. Where zinc coating has been damaged after installation, substrate surface shall be first cleaned and then repaired with zinc dust-zinc oxide coating in accordance with ASTM A780. Coating shall consist of multiple coats to dry film thickness of eight (8) mils.
- D. 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.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 05090 – ANCHOR BOLTS AND FASTENERS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section shall include furnishing and installing anchor bolts, screws, and other fasteners, complete with washers and nuts as shown on the Plans or specified or as required for proper anchorage of equipment and materials.

1.02 DESIGN REQUIREMENTS

- A. Fasteners and bolts shall have sufficient strength for the intended location and use. Equipment anchorage fasteners shall be included in a code approved published report (ie. ICBO Evaluation Report, or ICC ER) showing tested strength values and compliance with current IBC.

1.03 REFERENCES

- A. ASTM A58.1-82 Minimum Design Loads for Buildings and Other Structures
- B. ASTM A36/A36M-89 Structural Steel
- C. ASTM A307-90 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- D. ASTM A320-A320M-88 Alloy-Steel Bolting Materials for Low Temperature Service
- E. IBC International Building Code, Latest Edition
- F. ICBO International Conference of Building Officials
- G. ICC-ES ICC Evaluation Service, Inc.

1.04 SUBMITTALS

- A. Manufacturer's product data showing conformance to specified product requirements.
- B. Data indicating load capacities, chemical resistance, and temperature limitations.
- C. Installation instructions
- D. Evaluation report from ICC-ES for the particular brand of anchors to be used showing load capacities and compliance with the 2006 IBC.

PART 2 PRODUCTS

2.01 General

- A. All anchor bolts and fasteners shall be stainless steel unless noted otherwise.
- B. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 15 percent, up to a limiting maximum oversizing of 1/8-inch. Unless otherwise specified, or shown in the drawings, minimum anchor bolt diameter shall be ½ inch.

- C. Tapered washers shall be provided where mating surface is not square with the nut. Flat washers required all other places. Nuts and washers shall be same material as bolts.

2.02 Bolts, Nuts, Washers

- A. Bolts. ASTM A320, Type 304 or 316, Stainless Steel, B8 or B8M Class 1 or 2
- B. Nuts and Washers. ASTM A194, Grade 8, 304 or 316 stainless steel.

2.03 Wedge-Type Mechanical Anchor Bolts (Into Solid Concrete)

- A. Wedge anchors shall have a stainless steel split expansion ring and a threaded stud bolt body and integral cone expander, nut and washer. Anchor bodies, nuts, and washers shall be type 304 or 316 stainless steel.
- B. The exposed end of the anchor shall be stamped to identify anchor length. Stampings should be preserved during installation for any subsequent embedment verification.
- C. Anchors shall be tested to ASTM E488 criteria and listed by ICC (formerly ICBO).
- D. Approved products include: ITW Red Head Trubolt; Hilti Kwik Bolt tz; or approved equal.

2.04 Sleeve-Type Mechanical Anchor Bolts (Into Hollow Concrete Block)

- A. Sleeve type anchors with split expansion sleeve over a threaded stud bolt body and integral expander, nut and washer. Anchor bodies, nuts, and washers shall be type 304, 316, or 18-8 stainless steel.
- B. The exposed end of the anchor shall be stamped to identify anchor length. Stampings should be preserved during installation for any subsequent embedment verification.
- C. Anchors shall be tested to ASTM E488 criteria and listed by ICC (formerly ICBO).
- D. Approved products include: ITW Red Head Dynabolt; Hilti HLC Sleeve Anchor; or approved equal.

2.05 Adhesive Anchor Bolts

- A. Threaded Rod. ASTM F-593 CW stainless steel threaded rod, type 304 or 316. Nuts shall be stainless steel conforming to ASTM F-594. Washers shall be stainless steel conforming to ASTM A-240, AISA 304, and ANSI B18.22.1. Rod to have a minimum yield strength (f_y) of 65,000 psi in 3/8" to 5/8" diameter and 45,000 psi in 3/4" to 1-1/4" diameter.
- B. Where exposed to potable water (tank interiors, etc.), adhesive shall be listed as compliant with NSF/ANSI Standard 61.
- C. Epoxy Adhesive. Two component, 100% solid (no solvents), non-sag paste, insensitive to moisture. Meets ASTM C881-90, Type IV, Grade 3, Class A, B, and C with the exception of gel time. Shrinkage during cure per ASTM D2566: .00051 in./in. maximum. Compressive strength, ASTM D695: 10,300 psi minimum. Water solubility: None. Heat deflection temperature, ASTM D648: 140°F minimum.
- D. Approved products include: Threaded Rod – Hilti HAS Stainless Steel or approved equal; Adhesives – ITW Red Head C6; Hilti HIT RE 500; or approved equal.

2.06 Lag Bolts/Screws

- A. Hex head 18-8 or 304 stainless steel with washers.

2.07 Toggle Bolts

- A. Use only where lag screws cannot be secured to wood wall studs.

2.08 Nails

- A. All nails used shall be hot-dip galvanized.

2.09 U-bolts

- A. All U-bolts to be ½" galvanized steel.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Expansion, wedge or adhesive anchors set in holes drilled in the concrete after the concrete is placed will not be permitted in substitution for cast-in-place anchor bolts except where otherwise specified. Upset threads shall not be acceptable.
- B. Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or phenolic washers.
- C. Use carbide tipped hammer drill bits made in accordance to ANSI B212.15-1994 to install anchors.
- D. Cast In-Place Anchor Bolts
 1. Anchor bolts to be embedded in concrete 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 and the metalwork shall be grouted in place.
 2. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.
- E. Adhesive Anchor Bolts
 1. Use of adhesive or capsule anchors shall be subject to the following conditions:
 - a. Use shall be limited to locations where exposure, on an intermittent or continuous basis, to acid concentrations higher than 10 percent, or to machine or diesel oils, is extremely unlikely.
 - b. Use shall be limited to applications where exposure to fire or exposure to concrete or rod temperature above 120 degrees F. is extremely unlikely. Overhead applications (such as pipe supports) because of the above concerns, shall be disallowed.
 - c. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.

- d. 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.
- e. Embedment depth shall be as specified. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two (2) capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.
- f. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.
- g. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.
- h. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.
- i. Anchor shall be left undisturbed and unloaded for full adhesive curing period.
- j. Concrete temperature (not air temperature) shall be compatible with curing requirements of adhesives per adhesive manufacturer.

F. Expansion Anchors

- 1. Use of expansion or wedge type anchors shall be subject to same conditions in as epoxy (adhesive) anchors as applicable.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 05530 – GRATING

PART 1 GENERAL

1.01 SUMMARY

- A. This section shall include furnishing and installing galvanized steel bar grating and associated bearing bars, complete with anchors as shown on the Plans.

1.02 RELATED SECTIONS

- A. Section 05080 Hot-Dip Zinc Coating

1.03 REFERENCES

- A. ASTM A36/A36M Structural Steel
- B. ASTM A1011/ A1011M Steel, Sheet and Strip, Carbon, Hot Rolled, Commercial Quality
- C. ASTM A153-82 Zinc Coating (hot-dip) on Iron and Steel Hardware

1.04 QUALITY ASSURANCE

- A. Grating shall be as specified. Both bearing bars and cross bars shall be continuous.
- B. Openings shall be banded with bars having the same dimensions as the bearing bars.
- C. Perimeter edges shall be banded with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and shall be peened or ground to a smooth surface.
- D. No single piece of grating shall weigh more than 80 pounds unless specifically detailed otherwise
- E. Cut-outs for obstructions shall be made with a minimum of 2" clearance to obstruction. Cut-outs shall be made to the next continuous bearing bar beyond the 2" clearance.
- F. Any field cut of the grate will require that the area cut be re-galvanized per section 05080.

PART 2 PRODUCTS

2.01 General.

- A. Steel used in bearing bars, cross bars and connection bars of rectangular section shall conform to ASTM A 1011/A 1011M Commercial Steel (Type B) for hot rolled carbon steel sheet and strip. Cross bars made of wire rod shall conform to ASTM A 510 (A 510M) for carbon steel wire rods and coarse round wire, except that permissible tolerance on diameter of coarse round wire shall be ± 0.005 in. Combinations of these steels are permitted to be welded together.
- B. Rivets shall be of steel, $\frac{1}{4}$ in. minimum diameter, flat head type.
- C. All steel shall be galvanized unless otherwise noted.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Steel members, fabrications and assemblies shall be galvanized after fabrication in accordance with ASTM A123.
- B. Anchor bolts and nuts shall be stainless steel unless noted otherwise.
- C. Where zinc coating has been damaged after installation, substrate surface shall be first cleaned and then repaired with zinc dust-zinc oxide coating in accordance with ASTM A780. Coating shall consist of multiple coats to dry film thickness of eight (8) mils.
- D. 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.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

- A. Payment for this item shall be included within the lump sum basis for the amount stated on the Bid Form for the Project. No separate measurement or payment will be made for these quantities and items.

END OF SECTION

DIVISION 9 –FINISHES
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<u>SECTION NO.</u>	<u>TITLE</u>
SECTION 09900	PAINTS AND COATINGS
SECTION 09960	HIGH PERFORMANCE COATINGS

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SECTION 09900 – PAINTS AND COATINGS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Work in this section includes furnishing and field application of all paints and coating systems required for interior and exterior coating of drywall, wood, steel, iron, plastic, concrete, masonry, and other materials to be painted.
 - 1. Unless otherwise specified or shown, paint all surfaces and items that are exposed to view.
- B. Section also necessary surface preparation, protection, curing and touch-up.
- C. Summary of items to be painted on this project under this section include:
 - 1. Interior walls and ceilings
 - 2. Exterior CMU block walls
 - 3. Any new materials provided not prefinished or painted under Section 09960.

1.02 RELATED SECTIONS

- A. Section 08110 – Steel Doors and Frames
- B. Section 09960 – High Performance Coatings
- C. Division 15 – Mechanical: Fabricated and/or shop primed items
- D. Division 16 – Electrical: Fabricated and/or shop primed items

1.03 SURFACES NOT TO BE PAINTED

- A. Prefinished items including finished metal surfaces.
- B. Walls or ceilings of concealed or inaccessible areas.
- C. Fire or smoke rating labels on doors or frames.
- D. Equipment name plates.
- E. Piping identification labels.
- F. Moving parts of mechanical or electrical equipment.
- G. Cast in place concrete surfaces.

1.04 SUBMITTALS

- A. Product Data
 - 1. Materials List: Complete list of proposed manufacturers and products.
 - 2. Manufacturer's Specifications: Manufacturer's technical information for each product, including paint analysis and application instructions.
 - 3. Material safety data sheets for each product.
- B. Samples: Preliminary Samples: 8-1/2" x 11" samples of each color, texture and sheen on glossy card stock. Owner will select colors to be used from manufacturer's standard.
- D. Certificates: Provide certificate from each manufacturer stating material is premium quality and suitable for intended use on this Project.
- E. Closeout Submittals:

1. Two copies of manufacturer's color and sheen formula, and 4" x 6" color chips, for each final color used in the Project.
2. Product Usage Records: Three copies of product usage records for each paint, coating and solvent product used in the project. Include product name, amount used, surface preparation records, and period of time over which the product was used.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years successful experience in work of similar scope.
- B. Regulatory Requirements: Products containing chromates, cadmium, lead, or mercury or are not permitted.
- C. Manufacturer's Instructions: Perform painting work in accordance with manufacturer's written instructions and recommendations.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the Project in original, new, unbroken packages and containers bearing manufacturer's name and label, with:
 1. Name of material, color and sheen.
 2. Manufacturer's name, product number and date of manufacture.
 3. Contents by volume of major pigments and vehicle constituents.
 4. Thinning and application instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Sherwin-Williams; ICI Paint Stores, or Benjamin Moore.
 1. Unless otherwise indicated, Sherwin-Williams products are specified in Paint Schedule Articles 3.03 to establish standards and type of materials required. Equal products of manufacturers specified above are acceptable.

2.02 MATERIALS

- A. Material Quality
 1. Provide premium quality materials. Materials not bearing manufacturer's identification as a premium-grade product are not acceptable.
 2. Should manufacturer's specifications or product numbers change, provide its current equal or better product.
 3. Primer and undercoats are to be of same manufacturer as final coat.
 4. Materials left from previous jobs are not acceptable.
 5. Use only thinners approved by paint manufacturer, and use only within recommended limits.
 6. Etching Solutions: As recommended by paint manufacturer for the use intended.
 7. Solvents: Non-petroleum based, as recommended by paint manufacturer for the use intended.
- B. Finish Coat Coordination: Provide finish coats which are compatible with prime paints used.

2.03 COLORS

- A. General
 - 1. Use of proprietary names in color selections does not imply exclusion of equivalent products of other manufacturers.
 - 2. The proposal and acceptance of any paint manufacturer shall not restrict the owner to selection of standard colors of that manufacturer.
- B. Finish coat colors shall be factory mixed.

2.04 HIGH PERFORMANCE COATINGS

- A. Piping, fittings, pumps, unfinished metallic hardware, and other pertinent equipment shall be coated with high performance coatings per Section 09960.

PART 3 EXECUTION

3.01 PREPARATION

- A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.
- B. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting. Reinstall removed items after painting.
- C. Clean surfaces before applying paint. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.
- D. Moisture Content: Do not paint over surfaces where moisture content exceeds manufacturer's instructions.
- E. Ferrous Metals:
 - 1. Bare Surfaces: Clean of oil, dirt, loose mill scale, and other foreign substances with solvent or by mechanical cleaning.
 - 2. Shop Applied Primer: Touch up where damaged or bare using same type of primer as adjacent surfaces.
 - 3. Galvanized Surfaces: Clean free of oil and surface contaminants using solvent.
- F. Plywood/Gypsum Board: Remove dust, and repair surface imperfections. Spot-prime defects after repair.
- G. Mix painting materials in accordance with manufacturer's instructions.
- H. Store materials in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
- I. Stir materials before application to produce mixture of uniform density, and stir as required during application. Do not stir surface film into material, strain material before using if necessary.

3.02 APPLICATION

- A. Apply paint in accordance with manufacturer's instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.
 - 2. Ensure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
 - 3. Sand lightly between each succeeding enamel or varnish coat.
 - 4. Finish exterior doors on tops, bottoms and side edges same as exterior faces.

- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or otherwise prepared for paint as soon as practicable after preparation.
 - 1. Do not apply materials in areas where dust is being generated, or will be generated, before coatings are thoroughly dry.
 - 2. Allow time between successive coats to permit proper drying.
 - 3. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.

- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to achieve a total dry film thickness (DFT) as recommended by coating manufacturer and as specified.

- D. Prime Coats: Apply to items not previously primed. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.

- E. Finish Coats: Provide even texture. Leave no laps, irregularity in texture, skid marks, or other surface imperfections.
 - 1. Opaque Finishes: Provide opaque, uniform finish, color and coverage. Cloudiness, spotting, holidays, brush marks, runs, sags, ropiness or other surface imperfections are not acceptable.
 - 2. Transparent Finishes: Provide glass smooth surface film of even luster. Cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections are not acceptable.

- F. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not accepted.

3.03 PAINT SCHEDULE

EXTERIOR COATINGS				
Location	Preparation	Primer / Intermediate	Finish Coats	Total DFT
Unprimed Metals	Commercial Blast (SSPC-SP6)	Series 66 or N69 Hi-Build Epoxoline Two coats DFT 3.0-5.0 mils, each coat	Series 73, or 1075 Endura-Shield Polyurethane DFT 2.0-5.0 mils	9.0 – 13.0 mils
Shop-Primed Metals	Hand Tool or Power Tool (SSPC-SP2 or SP3)	Factory Primed Intermediate coat of Series 27 Typoxy DFT 2.0-3.0 mils	Series 73, or 1075 Endura-Shield Polyurethane DFT 2.0-3.0 mils	4.0 – 6.0 mils
Wood	Clean and Dry	Series 36 Undercoater DFT 2.0-3.5 mils	Series 23 Enduratone DFT 2.0-3.0 mils	4.0 – 6.5 mils
CMU (previously unpainted)	ASTM D4259	130 Envirofill or 54-562 Masonry Filler 60-80 ft ² /gal Intermediate Coat: Series 156 Enviro-Crete DFT 4.0-8.0 mils	Series 156 Enviro-Crete DFT 4.0-8.0 mils	8.0 – 16.0 mils plus filler
Fiber Cement Siding (Shop-Primed)	Clean and Dry	N/A	Series 180 Tneme-Crete	4.0 – 10.0 mils
INTERIOR COATINGS				
Location	Preparation	Primer / Intermediate	Finish Coats	Total DFT
Unprimed Metals	Commercial Blast (SSPC-SP6)	Series 66 or N69 Hi-Build Epoxoline Two coats DFT 3.0-5.0 mils, each coat	Series 73, or 1075 Endura-Shield Polyurethane DFT 2.0-5.0 mils	9.0 – 13.0 mils
Shop-Primed Metals	Hand Tool or Power Tool (SSPC-SP2 or SP3)	Factory Primed. Intermediate coat of Series 27 Typoxy DFT 2.0-3.0 mils	Series 73, or 1075 Endura-Shield Polyurethane DFT 2.0-3.0 mils	4.0 – 6.0 mils
Wood	Clean and Dry	Series 36 Undercoater DFT 2.0-3.5 mils	Series 23 Enduratone DFT 2.0-3.0 mils	4.0 – 6.5 mils
CMU (unpainted)	ASTM D4259	Series 130 Envirofill Intermediate Coat: Series 113 H.B. Tneme-Tufcoat DFT 4.0-6.0 mils	Series 113 H.B. Tneme-Tufcoat DFT 4.0-6.0 mils	8.0 – 12.0 mils plus filler
CMU (previously painted)	Clean and Dry	None	Series 113 H.B. Tneme-Tufcoat DFT 4.0-6.0 mils	4.0 - 6.0 mils plus previous paint
Gypsum Board	Clean and Dry	Series 51-792 PVA Sealer or 151-1051 Elasto-Grip FC DFT 1.0-2.0 mils	Series 113 H.B. Tneme-Tufcoat DFT 4.0-6.0 mils	5.0 – 8.0 mils

3.04 APPROVED EQUALS

- A. The painting materials listed above are provided as references. Approved equal materials will be allowed upon submittal.

3.05 COLOR SCHEDULE

- A. Contractor to coordinate with Owner and Engineer for color selections.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 09960 – HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Section specifies field painting. All exposed metal piping and appurtenances, including equipment (pumps, etc.) shall be painted in accordance with these specifications.
- B. Section specifies prime coats that may be applied in shop under other sections.
- C. Painting includes surface preparation and coating of exposed interior and exterior piping, equipment, building surfaces, doors, trim, floors, and other surfaces.
- D. Paint systems for all items exposed to product water shall be ANSI/NSF Standard 61 certified for potable water contact. Make necessary equivalent substitutions per manufacturer.

1.02 RELATED WORK

- A. Shop prime painting of steel and ferrous metals: Divisions 11, 13, and 16 sections.
- B. Painting of wood, gypsum board, CMU, and non pipe related items: Section 09900

1.03 SUBMITTALS

- A. Submit in accordance with Section 01300.
- B. Manufacturer's Literature and Data:
 - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature, indicating brand names, product type color, gloss level, coating composition, Federal Specification Number or manufacturers name or product number where applicable, and certificates as specified.

1.04 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer
 - 2. Product type
 - 3. Batch number
 - 4. Instructions for use
 - 5. Safety precautions
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. If paint or other coating, state coat types; prime, body or finish.

- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 65 and 85 °F.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Primer
 - 1. Tnemec Series 66 or 69 Hi-Build Epoxoline.
 - 2. Series 20 or 140 Pota-Pox for items exposed to product water.
- B. Intermediate Coat
 - 1. When required, shall be same material as primer.
 - 2. When manufacturer's factory primer is not Tnemec Series 66 or 69, use Tnemec Series 27 F.C. Typoxy.
 - 3. Series 20 or 140 Pota-Pox for items exposed to product water.
- C. Finish Coat
 - 1. Interior Exposed
 - a. Tnemec Series 66 or 69 Hi-Build Epoxoline.
 - 2. Immersion in Product Water
 - a. Series 20 or 140 Pota-Pox for items exposed to product water.
 - 2. Exterior Exposed
 - a. Tnemec Series 73, 1074 or 1075 Endura-Shield.

2.02 REGULATORY REQUIREMENTS

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed local, state or district requirements.
 - 2. Lead-Base Paint: Shall not be used.
 - 3. Asbestos: Materials shall not contain asbestos.

PART 3 EXECUTION

3.01 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials. Comply with SSPC-PA Guide 3, Safety in Paint Application.
 - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
 - 1. Do no exterior or interior painting in foggy, damp or rainy weather. The relative humidity must be below 85% and the substrate temperature at least 5 °F above the dew point.
 - 2. Paint exterior and interior surfaces when ambient temperature is between 50 and 90 degrees F, except when otherwise designated in manufacturer's printed instructions. Maintain interior temperatures until paint dries hard.
 - 3. Apply coatings only when substrate temperatures are within the range recommended in writing by the coating manufacturer.
 - 4. Do no exterior painting when it is windy and dusty.
 - 5. Do no painting in direct sunlight or on surfaces that will soon be warmed by the sun
 - 6. Apply only on clean, dry and frost free surfaces.

3.02 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 - 1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
 - 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
 - 3. See Section 3.05 of this specification for specific surface preparation requirements.
 - 4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used.

C. Steel:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter by use of solvents, emulsions, cleaning compounds, or by steam cleaning.
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning. Remove weld splatter with power tools.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with metal filler compound. Finish flush with adjacent surfaces.
 - a. This includes flat head countersunk screws used for permanent anchors
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat that expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas that expose bare metal of factory finished items with paint as recommended by manufacturer of item.
6. Surface preparation shall be as shown in the table in Section 3.5.

D. Zinc-Coated (Galvanized) Metal Surfaces:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion, with toluene, xylene or similar solvents in accordance with SSPC-SP 1. Scarify by whatever means feasible to achieve a minimum 1.5 mil anchor pattern.
2. Spot coat abraded and damaged areas of zinc coating which expose base metal, using zinc rich paint MIL Spec MIL -P-21035, on hot-dip zinc-coated items and spot prime with zinc dust primer, Fed Spec. TT-P-641.
3. Follow paint system manufacturer's recommendations.

E. Ductile and Cast iron:

1. Follow paint system manufacturer's recommendations.

F. Concrete:

1. Shot blast or mechanically abrade per ASTM D4259. Comply with SSPC-SP13.

3.03 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two-part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise. Do not break down prepackaged kits.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.04 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between applications of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.
- H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.05 PAINT SYSTEMS

- A. Primer shall be epoxy applied to a Dry Film Thickness as shown. More than one coat may be required.
- B. Intermediate (body) coat required on exterior exposed surfaces of ductile or cast iron. DFT of 4.0 to 6.0 Mils. All factory-primed steel not using specified primer shall have an intermediate coating of the specified material (Series 27 F.C. Typoxy) with a DFT of 2.0 to 3.0 Mils.
- C. Finish coating shall be epoxy on interior and immersion surfaces and shall be polyurethane for exterior surfaces. More than one application may be required to achieve specified DFT.
- D. The following table details painting system requirements and is based on the specified Tnemec products
- E. All surfaces to be coated that will be in contact with product water shall be coated with an NSF listed coating system as specified.

Exposure	Surface Prep.	Primer	Intermediate DFT	Finish	Total DFT
STEEL					
Exterior Exposed	SSPC-SP6	3.0 to 5.0 Mils Series 66 or 69	~	3.0 to 5.0 Mils Series 73, 1074, 1075	6.0 to 10.0 Mils
Interior Exposed	SSPC-SP6	3.0 to 5.0 Mils Series 66 or 69	~	4.0 to 6.0 Mils Series 66 or 69	7.0 to 11.0 Mils
Immersion	SSPC-SP10	3.0 to 5.0 Mils Series 20 or 140	~	4.0 to 6.0 Mils Series 20 or 140	7.0 to 11.0 Mils
FACTORY PRIMED STEEL					
Exterior Exposed	Clean and Dry	Factory	2.0 to 3.0 Mils Series 27 F.C.	3.0 to 4.0 Mils Series 73, 1074, 1075	5.0 to 7.0 Mils
Interior Exposed	Clean and Dry	Factory	2.0 to 3.0 Mils Series 27 F.C.	4.0 to 6.0 Mils Series 66 or 69	6.0 to 9.0 Mils
GALVANIZED METAL AND NON-FERROUS METAL					
Exterior Exposed	as recommended	2.0 to 3.0 Mils Series 66 or 69	~	2.0 to 3.0 Mils Series 73, 1074, 1075	4.0 to 6.0 Mils
Interior Exposed	as recommended	2.0 to 3.0 Mils Series 66 or 69	~	2.0 to 3.0 Mils Series 66 or 69	4.0 to 6.0 Mils
Immersion	SSPC-SP1 w/ brush off blast	3.0 to 5.0 Mils Series 20 or 140	~	4.0 to 6.0 Mils Series 20 or 140	7.0 to 11.0 Mils
DUCTILE OR CAST IRON					
Exterior Exposed	as recommended	3.0 to 5.0 Mils Series 66 or 69	4.0 to 6.0 Mils Series 66 or 69	2.0 to 3.0 Mils Series 73, 1074, 1075	9.0 to 14.0 Mils
Interior Exposed	as recommended	3.0 to 5.0 Mils Series 66 or 69	~	4.0 to 6.0 Mils Series 66 or 69	7.0 to 11.0 Mils
Immersion	as recommended	3.0 to 5.0 Mils Series 20 or 140	~	4.0 to 6.0 Mils Series 20 or 140	7.0 to 11.0 Mils
PVC					
Exterior Exposed	Scarify	2.0 to 3.0 Mils Series 66 or 69	~	2.0 to 3.0 Mils Series 73, 1074, 1075	4.0 to 6.0 Mils
Interior Exposed	Scarify	2.0 to 3.0 Mils Series 66 or 69	~	2.0 to 3.0 Mils Series 66 or 69	4.0 to 6.0 Mils

3.06 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.

- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non-compatible coatings from having contact. Test patches should be performed per ASTM D5064.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Sand or dull glossy surfaces prior to painting.
- H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.07 PAINT COLOR

- A. Color of priming coat: Lighter than body coat. Color of body coat: Lighter than finish coat. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- B. Colors: *(per Recommended Standards for Water Works)*

Item	Generic Color	Color, Tnemec
Raw Water Piping	Olive Green	EN07, Clover
Finished Water Piping	Dark Blue	SC06, Safety Blue
Drain and Waste Piping	Light Brown	YB31, Twine
Air Scour Piping	Dark Green	EN09, Balsam
Pumps and Motors	Dark Blue	SC06, Safety Blue
Pipe Supports, Hangers	Light Grey	IN01, ANSI No. 70

- C. Submit colors samples for Owner approval. Owner may elect to have different colors provided.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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DIVISION 13- SPECIAL CONSTRUCTION
TABLE OF CONTENTS

<u>SECTION NO.</u>	<u>TITLE</u>
SECTION 13422	DISSOLVED OXYGEN SENSOR
SECTION 13423	FLOW SENSING EQUIPMENT

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SECTION 13422 – DISSOLVED OXYGEN SENSING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Luminescent Dissolved Oxygen sensor for continuous measurement of dissolved oxygen (DO) in aqueous solutions, with predictive diagnostics capability monitor instrument.
- B. A modular single or dual channel controller that works with analog sensor modules and/or digital sensors.

1.02 RELATED SECTIONS

- A. Division 16 – Electrical
- B. Division 17- Operational Strategies

1.03 SUBMITTALS

- A. Submittals shall meet the requirements of Section 01300.

1.04 WARRANTY

- A. Sensor and controller shall have a min 2 year warranty from the date of shipment.

PART 2 PRODUCTS

2.01 Controller and Sensor will be provided by the same manufacturer to ensure compatibility and proper interaction.

2.02 CONTROLLER

- A. Manufacturer
 - 1. The controller will be a Hach model sc200 as manufactured by Hach Lange GmbH, Berlin, Germany or an approved equal.
- B. Measurement Procedures
 - 1. Microprocessor-based sensor controller.
 - 2. Change digital sensors connected to the controller by unplugging and plugging in sensors as necessary.
 - 3. Change analog sensor modules connected to the controller by unplugging and plugging analog sensor modules as necessary.
 - 4. The controller accepts 4 different analog sensor modules in any combination to measure the following:
 - a. pH/ORP module
 - 1) Combination pH/ORP
 - b. Conductivity module
 - 1) Contacting conductivity
 - 2) Inductive conductivity
 - 3) Cationic conductivity (Calculated pH)
 - c. Dissolved Oxygen/Oxygen Scavengers module
 - 1) Amperometric dissolved oxygen
 - 2) Amperometric oxygen scavengers

2.03 CONTROLLER SYSTEM DESCRIPTION

- A. Performance Requirements

1. pH/ORP sensor module
 - a. Measurement range:
 - 1) pH: -2.0 to +14.0 or -2.00 to 14.00 pH
 - 2) mV: -2100 to +2100 mV
 - b. Repeatability: 0.1% of range or better
 - c. Response time (t90%): 0.5 s
 - d. Temperature range:
 - 1) PT100/PT1000: -20 to 200 °C
 2. DO sensor module
 - a. Measurement range:
 - 1) 0 to 2000 ppb
 - b. Repeatability: ± 0.5 ppb or $\pm 5\%$ whichever is greater
 - c. Response time (t90%) for step change between 1-40 ppb: <30s
 - d. Temperature range: 0-45°C (32-113°F)
 3. Oxygen Scavengers sensor module
 - a. Measurement range:
 - b. 0 to 500 ppb of dissolved N₂H₄
 - c. 0 to 100 ppb of carbohydrazide
 - d. Repeatability: <2% of the measured value or < 1ppb, whichever is greater
 - e. Response time (t90%): < 60 seconds
 - f. Temperature range: 5-45°C (41-113°F)
 4. Contacting conductivity sensor module
 - a. Measurement range:
 - 1) Conductivity: 0-20,000 μ S/cm
 - 2) Resistivity: 0-50 Ω ·cm
 - 3) TDS: 0-9999 ppm or 0-9999 ppb
 - b. Repeatability:
 - 1) $\pm 1\%$ of reading or 0.002 μ S/cm below 0.2 μ S/cm, whichever is higher
 - c. Response time (t90%): 0.5 s
 - d. Temperature range: -20 to 200 °C
 5. Inductive conductivity sensor module
 - a. Measurement range:
 - 1) Conductivity: 0.5-10,000 mS/cm
 - 2) % concentration: 0-99.99 or 0-200.0%
 - 3) TDS: 0-9999 ppm
 - b. Repeatability: a. 0.5-10,000 mS/cm: $\pm 2\%$
 - c. Response time (t90%): 1 s
 - d. Temperature range: -2 to 200 °C
- B. Power requirements:
1. AC powered: 100 to 240 Vac $\pm 10\%$, 50/60 Hz; 15 W with 7 W sensor/network card load, 37 W with 25 W sensor/network card load.
 2. 24 VDC powered: 24 VDC, -15%, +20%; 16 W with 7 W sensor/network card load, 34 W with 25 W sensor/network card load (optional Modbus RS232/RS485 and Profibus DPV1 network connection).
- C. The controller uses a menu-driven operation system.
- D. The controller display is graphic dot matrix LCD with LED backlighting.
- E. The controller is equipped with a real-time clock.
- F. The controller is equipped with two security levels.
- G. The controller is equipped with a data logger with RS-232 capability.
- H. IFour electromechanical, UL rated, SPDT relays (Form C) are provided for user-configurable contacts rated 100 to 230 Vac, 5 Amp at 30 VDC resistive maximum.
1. The following can be programmed:
 - a. Alarm
 - b. Warning

- c. Timer/scheduled cleaning
 - d. Feeder control
 - e. Event control
 - f. Pulse width modulation
 - g. Frequency modulation
2. The following can be assigned:
- a. Primary value measurement I
 - b. Secondary value measurement I
 - c. Tertiary value measurement I
 - d. Quaternary value measurement I
 - e. Primary value Measurement II
 - f. Secondary value measurement II
 - g. Tertiary value measurement II
 - h. Quaternary value measurement II
 - i. Real time clock
 - j. Calculated values
- I. Two analog 0/4-20 mA outputs are provided with a maximum impedance of 500 ohms.
- 1. The controller can be equipped with three additional 4-20 mA outputs with a maximum impedance of 500 ohms.
 - 2. The following can be programmed:
 - 3. Alarms:
 - a. Low alarm point
 - b. Low alarm point deadband
 - c. High alarm point
 - d. High alarm point deadband
 - e. Off delay
 - f. On delay
 - 4. Controls:
 - a. Linear
 - b. Bi-linear
 - c. Logarithmic
 - d. PID
 - 5. The following can be assigned:
 - a. Primary value measurement I
 - b. Secondary value measurement I
 - c. Tertiary value measurement I
 - d. Quaternary value measurement I
 - e. Primary value measurement II
 - f. Secondary value measurement II
 - g. Tertiary value measurement II
 - h. Quaternary value measurement II
 - i. Calculated values
- J. The controller can be equipped with the following forms of communication:
- 1. MODBUS RS-232
 - 2. MODBUS RS-485
 - 3. Profibus DP
- K. All user settings of the controller are retained for 10 years in flash memory.
- L. The controller is equipped with a system check for:
- 1. Power up test (monitoring and shutdown)
 - 2. Total power draw
 - 3. Memory devices

- 4. Temperature mother board
- 2.04 CONTROLLER HOUSING AND MATERIAL
 - A. polycarbonate, aluminum (powder coated), and stainless steel
 - B. Rating: NEMA 4X enclosure, rated IP66
 - C. Controller shall include a weather protection shield
 - D. Controller shall include a RS-232/RS-485 MODBUS output card
- 2.05 SENSOR
 - A. Manufacturer
 - 1. The sensor will be a Hach model LDO Dissolved Oxygen Sensor as manufactured by Hach Company, Loveland, Colorado or an approved equal.
- 2.06 SENSOR MEASUREMENT PROCEDURES
 - A. The method of measuring dissolved oxygen will be a probe using luminescent sensor technology.
 - B. Blue LED light excites platinum based luminescent material in the probe. Red light is emitted by luminescent material with characteristics that are directly proportional to the amount of dissolved oxygen present. The red light is measured with a photo detector.
 - 1. Red LED light is used to zero the instrument between measuring cycles.
- 2.07 SENSOR SYSTEM DESCRIPTION
 - A. Performance Requirements
 - 1. Measurement range: 0.01 to 20.00 mg/L
 - 2. Resolution: 0.01 mg/L
 - 3. Accuracy
 - a. Less than 5 ppm: ± 0.1 ppm
 - b. Greater than 5 ppm: ± 0.2 ppm
 - 4. Repeatability: ± 0.1 ppm
 - 5. Response Time:
 - a. Less than 40 seconds to 90% at 20 °C
 - b. Less than 60 seconds to 95% at 20 °C
 - 6. Temperature sensor: PT100 integrated, external sensor
 - 7. Temperature range: 0 to 50 °C
 - 8. Temperature accuracy: ± 0.2 °C
 - 9. When connected to a multi-parameter digital control the overall status of the instrument performance is displayed as a percentage value via a measurement indicator
 - 10. When connected to a multi-parameter digital control the overall time remaining until maintenance tasks are due is displayed in days
 - B. Environmental Requirements
 - 1. Operational Criteria
 - 2. Operating temperature: 0 to 50 °C
 - 3. Relative humidity: 95%, non condensing
 - 4. Immersion depth: 15 meters (50 ft.), maximum
 - 5. Immersion pressure: 345 kPa, maximum
 - 6. Sample pH range: 0.0 to 12.0
 - 7. Distance, analyzer to sensor: 1000 meters, maximum
- 2.08 SENSOR MAINTENANCE
 - A. Scheduled maintenance:
 - 1. Sensor cleaning: 90 days or depending on conditions
 - 2. Sensor and sensor cap inspection: 90 days
 - 3. Sensor cap replacement: once every 2 years
 - 4. Calibration: per regulatory agency schedule, otherwise calibration-free
 - B. Unscheduled maintenance

1. Replace fuse
 2. Clean instrument enclosure
- 2.09 SENSOR EQUIPMENT
- A. The sensor is made of polybutyl methacrylate.
 - B. The probe is made of CPVC and 316 stainless steel – 1.4404.
 - C. The probe is made with Viton o-rings.
 - D. The probe is entirely corrosion-resistant and fully immersible.
 - E. The probe utilizes a 1" NPT external thread for mounting hardware connections.
 - F. The probe does not require sample conditioning or electrolyte solutions.
 - G. The probe interface to the controller is MODBUS®.
 - H. The operation of the probe is not affected by: H₂S, pH, K⁺, Na⁺, Mg²⁺, Ca²⁺, NH₄⁺, Al³⁺, Pb²⁺, Cd²⁺, Zn²⁺, Cr (total), Fe²⁺, Fe³⁺, Mn²⁺, Cu²⁺, Ni²⁺, Co²⁺, CN⁻, NO₃⁻, SO₄²⁻, S₂⁻, PO₄³⁻, Cl⁻, Anion Active Tensides, Crude Oils, Cl₂ < 4 ppm.
 - I. The probe is factory calibrated and needs no calibration or polarization prior to use.
 - J. Components
 1. Standard equipment:
 2. Probe
 3. Sensor cap
 4. Integral cable

PART 3 EXECUTION

3.01 INSTALLATION

- A. Contractor will install the analyzer and the sensor in strict accordance with the manufacturer's instructions and recommendation.
- B. Sensor will be mounted directly in the solution to be measured using the manufacturer's recommended mounting kit.
- C. Manufacturer's representative will include a half-day of start-up service by a factory-trained technician, if requested.
 1. Contractor will schedule a date and time for start-up.
 2. Contractor will require the following people to be present during the start-up procedure.
 - a. General contractor
 - b. Electrical contractor
 - c. Factory trained representative
 - d. Owner's personnel
 - e. Engineer

3.02 Manufacturer's Service and Start-Up

- A. Contractor will include the manufacturer's services to perform start-up on instrument to include basic operational training and certification of performance of the instrument.
- B. Contractor will include a manufacturer's Service Agreement that covers all the manufacturer's recommended preventative maintenance, regularly scheduled calibration and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 12 months of end-user operation post turnover.
- C. Items A and B are to be performed by manufacturer's factory-trained service personnel.
- D. Use of manufacturer's service parts and reagents is required. Third-party parts and reagents are not approved for use.

PART 4 PAYMENT

- A. Payment for items described in this section shall be included within the lump sum price for the project as stated on the Bid Form. No additional payment will be made for this work.

END OF SECTION

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SECTION 13422 – FLOW SENSING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. A compressed air flow meter with programmable capabilities and adjustable for various pipe diameters.

1.02 RELATED SECTIONS

- A. Division 16 – Electrical
- B. Division 17- Operational Strategies

1.03 SUBMITTALS

- A. Submittals shall meet the requirements of Section 01300.

1.04 WARRANTY

- A. Sensor and controller shall have a min 2 year warranty from the date of shipment.

PART 2 PRODUCTS

2.01 FLOW METER

- A. Manufacturer
 - 1. The flow meter will be a SD0515 as manufactured by IFM Electronic GMBH or approved equal.

2.02 PRODUCT CHARACTERISTICS

- A. Flow meter will be function programmable
- B. Flow meter will be adjustable for pipe diameter
- C. Flow meter will have 2 outputs
 - 1. Out1 = switching output
 - 2. Out2 = switching output or analogue output

2.03 MEASURING RANGE

- A. 2...589 scfm (D=1.5")
- B. 87.20...26.20*1000 scfm (D=10")

2.04 TEMPERATURE INDICATION

- A. 32-140°F

2.05 ELECTRICAL DATA

- A. Electrical design will be DC PNP
- B. Operating voltage – [V] 19 – 30 DC
- C. Current consumption – [mA] <100
- D. Protection class III
- E. Reverse polarity protection

2.06 OUTPUTS

- A. Output function is 2 x normally open / normally closed programmable or 1 x normally open / normally closed programmable + 1 x analogue (4...20 mA)
- B. Current rating – [mA] 2 x 250

- C. Voltage drop – [V] <2
 - D. Short-circuit protection is pulsed
 - E. Overload protection
 - F. Analogue output – 4...20 mA
 - G. Max. load [Ω] <500
- 2.07 MEASURING/SETTING RANGE
- A. Measuring range [scfm] 2...589 (D=1.5") / 87.20...26.20*1000 (D=10")
 - B. Display range [scfm] 0...707 (D=1.5") / 0.00...31.40*1000 (D=10")
- 2.08 ACCURACY / DEVIATIONS
- A. Repeatability [% of measured value] ± 1.5
 - B. Temperature monitoring
 - 1. Accuracy [K] ± 2
- 2.09 REACTION TIMES
- A. Power on delay time [s] 0.5
 - B. Flow monitoring
 - 1. Response time [s] < 0.1 (dAP =0)
 - 2. Damping, dAP [s] 0 - 0.2 - 0.4 - 0.6 - 0.8 - 1
- 2.010 ENVIRONMENT
- A. Pressure rating [bar] 16
 - B. Ambient temperature [$^{\circ}$ F] 32...140
 - C. Max. relative humidity [%] 90
 - D. Protection IP 65
- 2.011 MECHANICAL DATA
- A. Materials (wetted parts) stainless steel (304S15); FKM; ceramics glass passivated; PEEK GF30; polyester; aluminum
 - B. Housing materials – PBT-GF 20; NBR; PC (polycarbonate); stainless steel (304S15); PTFE; Brass coated; FKM; aluminum powder-coated
- 2.012 DISPLAY
- A. Display unit 4 x LED green (scfm, inch, $^{\circ}$ F)
 - B. Function display 1 x LED yellow
 - C. Switching status 2 x LED yellow
 - D. Measured values 4-digit alphanumeric display
 - E. Programming 4-digit alphanumeric display
- 2.013 ELECTRICAL CONNECTION
- A. M12 connector

PART 3 EXECUTION

- 3.01 INSTALLATION
- A. Contractor will install the flow meter in strict accordance with the manufacturer's instructions and recommendation.
 - B. Flow meter will be mounted directly on the pipe with the manufacturer's recommended mounting kit.
- 3.02 MAINTENANCE
- A. Scheduled maintenance as recommended by manufacturer.

PART 4 PAYMENT

1.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 15060	HANGERS AND SUPPORTS
SECTION 15105	PIPING SYSTEMS
SECTION 15113	VALVES AND PROCESS CONTROL
SECTION 15114	ELECTRIC ACTUATORS
SECTION 15115	PIPE PENETRATION SLEEVE AND SEALS

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SECTION 15010 - GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Division is bound by the General Conditions, Supplementary Conditions and Division 1 in addition to this Specification and accompanying Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Division 15 and 16 for related work.
- B. Division 9 for mechanical painting and coatings
- C. Numerous other sections for mechanical and related equipment.

1.03 WORK INCLUDED

- A. Provide all materials, labor and equipment together with all incidental items not shown or specified, which are required by code and good practices to provide complete systems.

1.04 COORDINATION

- A. Coordinate all work in Division 15 with work specified in other Divisions to provide a complete installation. Expense of changes required because of lack of supervision shall be borne by the Contractor. Such changes shall be to the satisfaction of the Architect.

1.05 CONTRACT DRAWINGS

- A. Location of equipment on Drawings is approximate. Plan exact location with respect to Architectural drawings, measurements on the job and work of other trades prior to work. If measurements differ slightly, modify work. If measurements differ substantially, notify General Contractor prior to fabrication.

1.06 SITE VISIT

- A. Examine site of proposed work and become familiar with job conditions affecting work. No additional allowance will be granted due to lack of information of existing conditions.

1.07 SUBSTITUTIONS

- A. Manufacturers and catalog numbers indicate quality of equipment or materials. Manufacturer's not listed require prior approval. Substitution requests must be made in writing to the Architect prior to bid in accordance with General Requirements. Provide sufficient information indicating compliance with these specifications.

1.08 RECORD DRAWINGS

- A. Provide record drawings in accordance with General Requirements and Division 1. Show all deviations from Contract Drawings and location of underground lines by accurate dimensions from building lines. Show depth of all stub outs and underground

lines. Dimension all concealed piping from building lines.

1.09 PERMITS, CODES AND INSPECTIONS

- A. Permits: Pay fees required by utilities connecting with this work, including water meter and hook-up charges of water board, power and telephone charges.
- B. Codes, Standards: Applicable codes and standards contained therein shall determine minimum requirements for materials, methods and labor practices not otherwise stated herein. Codes and standards applicable to this section include, but are not limited to, the following:
 - 1. State of Oregon Structural Specialty Code.
 - 2. State of Oregon Mechanical Specialty Code.
 - 3. State of Oregon Plumbing Specialty Code.
 - 4. State of Oregon Uniform Fire Code.
 - 5. NFPA and other Standards referenced in the above codes.
- C. Inspections: Contractor will provide for inspections and tests required by codes or ordinances during construction.
- D. Shop Drawings: Submit shop drawings in accordance with Supplementary General Conditions.

1.010 CUTTING AND PATCHING

- A. In accordance with General Requirements.

1.011 TEMPORARY SERVICES

- A. Provide in accordance with General Requirements as required for completion of work. If permanent system is used for heating, provide filters of same type used in permanent system. Replace with new filters at time of Substantial Completion.

1.012 OPERATING AND MAINTENANCE DATA

- A. Submit in accordance with Division 1 requirements.
- B. HVAC Equipment printed operation and maintenance information.
- C. Plumbing fixtures and accessories.

1.013 COMPLETION

- A. When installation is complete, cleaning and adjustments specified herein made, operate system to demonstrate to Architect that system is complete and operating in conformance with these specifications.
- B. Final Inspection: Work hereunder will not be inspected for final acceptance until operating and maintenance data, record drawings and directories have been approved.
- C. Final Acceptance: Entire installation turned over to the Owner in finished and

satisfactory working condition.

PART 2 PRODUCTS

2.01 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and equipment in a manner to prevent damage and deterioration. Store in original container. Indoor units, if stored outside, must be covered.

2.02 MATERIALS

- A. All materials employed in permanent construction shall be new, full weight, in first class condition and suitable for space provided. All similar materials shall be of one manufacturer.

2.03 ELECTRICAL EQUIPMENT

- A. General: All electrical equipment UL and NEMA labeled or acceptable to electrical inspection authorities having jurisdiction. All equipment which requires electrical service of 50 amperes or more shall have lugs suitable for either copper or aluminum supply conductors.
- B. Provide time switches and interlocking devices as required for automatic control. All wiring (and electrical work pertaining to mechanical system) by Mechanical Contractor unless specified in Division 16.

2.04 MOTORS

- A. Motors ½ HP or over voltage and phase as shown on drawings.
- B. Motors rated less than ½ HP wound for 120 volt 60 cycle, single phase, 1750 rpm, unless otherwise specified. Provide manual switch with overload protection when required.
- C. All motors protected by thermal overload protection.
- D. Motor starters and fused disconnects shall be provided by the Mechanical Contractor unless specified in Division 16.

2.05 VARIATIONS IN EQUIPMENT

- A. If approved mechanical equipment of other manufacturer requires modification or additions to any work as shown on the drawings, Mechanical Contractor shall arrange for and pay costs of such changes as part of this work.

PART 3 EXECUTION

3.01 CLEANING SYSTEMS

- A. General: After all equipment, fixtures, pipes and duct systems are installed, system shall be thoroughly cleaned. Remove all stickers and tags from equipment or fixtures. Clean all piping systems prior to installation of insulation or painting.
- B. Air Distribution Duct System: Remove all debris and dust from system before operation. Under no circumstances shall system be operated without filters.

Replace filters used during construction with new filters.

- C. Repair or replace any discoloration or damage to system, building finish, or furnishings resulting from Contractor's failure to properly clean system.

3.02 ACCESS TO EQUIPMENT AND ACCESSORIES

- A. Install equipment with adequate access for service. Provide access doors where shown or required for access to valves, P-traps, cleanouts, dampers, motors, etc. Type, size and location of access doors shall be coordinated with Architect prior to work.

END OF SECTION

SECTION 15060 – HANGERS AND SUPPORT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Piping shall be supported, in general, as described hereinafter and as shown by the pipe support details on the Drawings. Manufacturer's catalog figure numbers are typical of the types and quality of standard pipe supports and hangers to be employed. Special support and hanger details may be shown to cover typical locations where standard catalog supports are inapplicable.
- B. The Contractor shall select and design all piping support systems within the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of 5.
- C. No attempt has been made to show all required pipe supports in all locations, either on the drawings or in the details. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing them throughout the plant per accepted practices.
- D. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall, or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
- E. Where piping connects to equipment, it shall be supported by a pipe support and not by the equipment. A pipe support or hanger shall be installed adjacent to each pipe fitting or in-line device such as a valve or meter for all piping larger than 4-inch.

1.02 REFERENCES

- A. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- B. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
- C. ASTM A653 - Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process
- D. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (Formerly ASTM A570)
- E. MSS SP58 - Manufacturers Standardization Society: Pipe Hangers and Supports-Materials, Design, and Manufacture
- F. MSS SP69 - Manufacturers Standardization Society: Pipe Hangers and Supports-Selection and Application
- G. NFPA 13 - Standard for the Installation of Sprinkler Systems A. ASTM A167- Standard specification for Stainless and Chromium-Nickel steel plate, sheet and strip.

- H. ASTM D4385 – Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products.
- I. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- J. ASTM E84 - Test method for Surface Burning Characteristics of Building Materials.
- K. ASTM F569 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- L. AISI – American Iron and Steel Institute
- M. UL94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 SEISMIC REQUIREMENTS

- A. Provide seismic restraint in accordance with OSSC Section 1613. Design restraint systems in accordance with “Seismic Restraint Manual: Guidelines for Mechanical Systems”, Second Edition, 1998, SMACNA, or “A Practical Guide to Seismic Restraint”, ASHRAE RP-812, 1999.

1.04 QUALITY ASSURANCE

- A. Hangers and supports used in fire protection piping systems shall be listed and labeled by Underwriters Laboratories.
- B. Steel pipe hangers and supports shall have the manufacturer’s name, part number, and applicable size stamped in the part itself for identification.
- C. Hangers and supports shall be designed and manufactured in conformance with MSS SP 58.
- D. Supports for sprinkler piping, if required, shall be in conformance with NFPA 13.

1.05 SUBMITTALS

- A. Detailed shop drawings of all supports, including support anchoring devices, shall be supplied with the submittals specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver material carefully to avoid breakage and scoring finishes. Do not install damaged equipment.

PART 2 PRODUCTS

2.01 MANUFACTURER AND TYPE

- A. Acceptable manufacturers for various restraint, hangers, and supports will generally include B-Line, Carpenter and Paterson, Grinnel, Michigan, Superstrut, Tolco, Erico, Kindorf, Unistrut, or approved equals.
- B. Pipe Floor Supports. Horizontal piping pedestal supports shall be adjustable supports attaching to flanges or pipe stanchion saddles with U-bolts or clamps as shown in drawings.

- C. Pipe hangers for copper and plastic piping shall be coated with a plastic or neoprene protective cover. No metal portion of a hanger, support, or brace shall contact pipe directly. Use proper upper attachments and rods as required.
- D. Pipe Hangers for piping less than 8-inch diameter shall be B-Line B3172C with threaded rod, nuts and washers, or approved equal. Assembly shall be zinc plated. Install as shown in the drawings and or as required.
- E. Pipe hangers for 8-inch pipe shall be galvanized carbon steel with an adjustable swivel ring. Pipe hangers shall be Anvil International, or approved equal.
- F. Concrete rod attachment plate for pipe hanger rod shall be 304/316 stainless steel with hot dipped galvanization. National Pipe Hanger Corp, Fig 646, or approved equal.
- G. Wall Support/Clamp shall be used where shown in drawings. Strut channel horizontal support with wall mount bracket. Galvanized finish. B-Line B3064 or approved equal.
- H. Offset Clamps shall be used where shown in drawings. Galvanized finish. B-Line B3148 or approved equal.
- I. Piping clamps for board or panel mounted pipe, tubing or conduit shall be one-hole clamps, short straps, split-style clamps, or offset clamps as required. Provide any required furring or stand-offs necessary for clearances. Furring on PVC equipment boards, when required, shall be PVC.
- J. Strut channel systems shall be used where indicated on the plans and as required for proper support of vertical and horizontal multiple piping runs and electrical raceways. The strut systems are further described as:
 - 1. All strut channels shall be galvanized or epoxy coated. B-Line B22 or approved equal.
 - 2. Stainless steel hardware and accessories shall be used.
 - 3. Strut shall be 1 5/8" wide in varying heights and in combinations and arrangements as shown on the drawings.
 - 4. Pipe clamps shall include rubber pipe cushions or isolation pads. B-Line Vibraclamp BVT or approved equal. Galvanized finish.

2.02 SPLIT-STYLE PIPE CLAMPS (Behringer Clamps)

- A. Split-style pipe clamps shall be used where shown on the drawings and where this style provides the most suitable clamp for wall, panel, or ceiling mounting.
- B. Split-style clamps include a base plate, a bottom and top "clamp half" constructed of polypropylene, and a top plate. The separate components are connected using through bolts. The resulting assembly tightly cradles a piping section between the two clamp halves.
- C. Behringer clamps are available in standard and heavy duty. Heavy duty clamps are required when being attached to strut channel. For all other applications, standard clamps are acceptable, unless otherwise recommended by the manufacturer.
- D. Split-style heavy duty clamps shall be manufactured by Behringer, or approved equal.

Standard split-style clamps shall be manufactured by Behringer, Stauff, or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify piping is level, plumb and true. Verify proper wall blocking has been installed where wall connections are required. Location of supports shall be organized in such a manner as to not interfere with access and other work.

3.02 PROVISIONS FOR MOVEMENT

- A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
- B. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- C. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
 - 1. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
 - 2. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
 - 3. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
 - 4. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
 - 5. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.
- D. Pipe Support:
 - 1. Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by Code) and just below roof line.
 - 2. Adjust hangers and supports to bring piping to proper levels and elevations.
 - 3. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.

4. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.
5. Installation of drilled-in concrete anchors shall comply with the manufacturer's instructions for working load, depth of embedment, and spacing between anchors and from the edge of the slab. Where mounting holes are oversize for the anchor, install neoprene washer-bushings to provide a snug fit.

3.03 INSTALLATION

- A. Unless noted otherwise on the Drawings, horizontal pipe support or hanger spacing and hanger rod sizing for pipe shall not exceed as follows:

Pipe Size (inches)	Maximum Distance Between Supports (feet)	Minimum Hanger Rod Size (inch)
1" and less	4'	3/8"
2" to 1-1/4"	5.5'	3/8"
2-1/2" to 3-1/2"	6.5'	1/2"
4" to 5"	7'	5/8"
6"	8'	3/4"
8"	8.5'	3/4"
10"	9'	7/8"
12"	10'	7/8"
14"	15'	1"

- B. The load rating for universal concrete inserts shall not be less than that of the hanger rods they support.
- C. When supporting cast iron and ductile iron pipe, locate hanger rods near all joints and at each change of direction.
- D. All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supporters shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown. Pipe supports and hangers shall not be installed in equipment access areas.
- E. All supports and clamps shall be installed as necessary to provide a secure installation in a neat and workmanlike manner.
- F. Systems and equipment shall be anchored to resist displacement, including swinging, and overturning due to seismic forces. Friction shall not be considered as anchorage.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 15105 – PIPING SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Section specifies ductile iron, PVC, steel, stainless steel, copper, plastic tubing, and other piping systems to be used on the project.
- B. Where indicated, the Contractor may choose a piping material. Otherwise, the material referenced on Plans will be required.

1.02 REFERENCES

- A. 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 the listed documents, the requirements of this section shall prevail.

<u>References</u>	<u>Title</u>
ANSI B1.1-81	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI B1.20.1-83	Pipe Threads, General Purpose (Inch)
ANSI B16.1-89	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.5-88	Pipe Flanges and Flanged Fittings
ANSI B18.2.1-81	Square and Hex bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws
ANSI B18.2.2-87	Square and Hex Nuts
ASTM F37-88	Standard Test Methods for Sealability of Gasket Materials
ASTM F104-88	Standard Classification System for Nonmetallic Gasket Materials
ASTM F152-87	Standard test Methods for Tension Testing of Nonmetallic Gasket Materials
AWWA C111-85	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C207-86	Steel Pipe Flanges for Waterworks Service--Size 4 In. Through 144 In.
AWWA C213-07	Fusion Bonded Epoxy Coating for Interior and Exterior for Steel Water Pipes

1.03 RELATED SECTIONS

- A. Section 15110 – Valves

- B. Section 15060 – Hangers and Supports
- C. Section 15120 – Misc. Fittings & Specialties

1.04 SUBMITTALS

- A. Contractor shall submit 3 copies of technical data for project piping. Data shall include material data, pressure rating data, location of manufacture, and other information as necessary to show complete compliance with these specifications for each type of piping used.
- B. If welded piping is to be used, submit detailed shop drawings showing dimensions, pipe sizes, field weld locations, flange locations, etc.

1.05 QUALITY ASSURANCE

- A. All piping shall be new, unused and completely free from defects.
- B. All pipe materials made in the USA shall be given preference.

1.06 PIPING SCHEDULE

- A. Where not specifically noted on the plans or otherwise specified, pipe shall be installed in accordance with the following schedule and conform to the detailed specifications for each type of pipe.
- B. Contractor may, at his own discretion and expense, furnish superior piping in material and pressure rating than that specified.
- C. The following schedule (Table 1) is provided indicating the piping materials to be utilized on the project. This table should be coordinated with information shown on the plans. The Contractor should provide submittals indicating their choice of materials to be used in each application where a choice is provided.
- D. The drawings indicate the basis of design and/or recommended piping material. However, the Engineer has some flexibility as to which piping materials and system will be used in each application as indicated in the table.

TABLE 1 PIPING SCHEDULE

Typical Location/Use	Material Spec.	Joint/ Connections	Pressure Rating (min.)
Air Piping – Primary	Class 350 DI (unlined for use with hot blower air)	Ductile Flanges, Megaflange, Cast Iron Backer Flanges for Stainless Piping All gaskets to be appropriate for heated air conditions	150 psi
Non-Potable Water - open trench	Class 350 DI	Ductile Flanges, Megaflange,	150 psi
Non-Potable Water – direct bury	C909 PVC	Ductile Flanges, Megaflange,	150 psi

Storm Drain Piping	HDPE, ADS N-12, Hancor, or similar	Bell and Spigot	n/a
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1.07 ADDITIONAL PIPING SCHEDULE INFORMATION

A. Galvanized Steel Pipe:

1. Applications: Aboveground only and 2" and smaller.
2. Sanitary waste
3. Rain drain
4. Plumbing vent
5. Cooling condensate drain
6. Pipe: Schedule 40, standard galvanized steel pipe, ASTM A-53 or A-106.
7. Fittings: Cast iron threaded drainage pattern fittings, ANSI B16.12.

B. Black Steel Pipe:

1. Applications:
 - a. Propane gas
 - b. Heating water
 - c. Compressed Air
 - d. Fire sprinklers

C. Pipe: Systems 10" or smaller, operating below 400 psi, schedule 40, standard black steel pipe ASTM A-106 or A-53. Schedule 80 where indicated for hydraulic piping.

D. Underground Natural Gas and Compressed Air Piping: Coated with a minimum of ten mils of factory applied 100% thermosetting epoxy resin.

E. Threaded Fittings: For above ground installations only.

F. Banded class 120 cast iron fittings, ANSI B16.4 to 125 psi.

G. Banded class 150 malleable iron fittings, ANSI B16.3 to 150 psi.

H. Banded class 300 malleable iron fittings, ANSI B16.3 to 300 psi.

I. Welding Fittings: For all underground installations, beveled ends, seamless fittings of the same type and class of piping above.

J. Flanged Fittings: For above ground installations only.

K. Class 125 cast iron fittings, ANSI B16.2 including bolting to 125 psi.

L. Class 150 steel welding neck flanges, ANSI B16.9 to 150 psi.

- M. Class 250 cast iron fittings, ANSI B16.1 including bolting to 250 psi.
- N. Class 300 steel welding neck flanges, ANSI B16.9 to 300 psi.
- O. Facing and Gasketing: Selected for service pressures and temperatures. Full-faced for cast iron and raised face for steel flanges.
- P. Grooved Fittings: For above ground liquid installations only, of grooved or shouldered end designed to accept grooved mechanical couplings without field preparation. Match gaskets for service and temperature indicated.
- Q. Malleable Iron: ASTM A-47.
- R. Ductile Iron: ASTM A-536.
- S. Fabricated Steel: ASTM A-53, 3/4" to 1-1/2" Type F; 2"-20" Type E or S, Grade B.
- T. Steel: ASTM A-234, (A-106, Gr. B) (11"-24" 45 degree and 90 degree elbows).
- U. Manufacturers: Gruvlok, Victaulic, or accepted substitute.
- V. Cast Iron Pressure Pipe:
 - 1. Application: 4" and larger.
 - 2. Water
 - 3. Pipe: Ductile iron coated outside with bitumastic enamel, ANSI A21.51.
 - 4. Fittings: Gray or ductile iron bolted stuffing box mechanical joint or rubber ring joints, ANSI A21.1. Rubber gaskets, lubricants, bolts, and nuts, ANSI A21.11.
- W. Copper Pipe and Tube:
 - 1. Application:
 - 2. Domestic water
 - 3. Refrigerant
 - 4. Compressed air
 - 5. Priming lines
 - 6. Sanitary waste and vent
 - 7. Pipe: ASTM B88.
 - 8. Above Ground Domestic Water, Heating Water, Compressed Air, Pressure Sewer, and Liquid Soap: Type L hard temper copper with soldered joints.
 - 9. Underground Domestic Water, Heating Water, Diesel Oil, Pressure Sewer, and Priming Lines: Type L soft annealed with no joints or type K hard tempered copper with silver soldered joints.

10. Refrigerant Piping: ANSI/ASME B31.5 or SAE J 513-F, "Refrigeration Tube Fittings." Where conflicts occur, B31.5 shall govern.
 11. Above Ground Sanitary Waste and Vent: Copper tube and fitting DWV, ASTM B306.
 12. Fittings: Wrought copper solder-joint fittings, ANSI B16.22.
 13. Refrigerant Fittings: ANSI/ASME B31.5 or SAE J 513-F, brazed or flange joints.
 14. Preinsulated Piping: Type K solder joint copper piping with 1" thick urethane insulation protected by 20 gauge PVC outer jacket. Rovanco "Insul/80," equivalent Rikwil or approved substitute.
- X. Plastic Pipe
1. Application: Where approved by Code
 2. Domestic water
- Y. Pipe:
1. Cross-linked polyethylene (PEX) tubing for Water Service: ASTM F877; SDR 9. NSF-pw and NSF 61.
 2. Where used for floor heat, liners shall have oxygen barrier.
 3. Fittings: Provide fittings of the type indicated, matching piping manufacture. Where not otherwise indicated, provide fittings produced and recommended by the piping manufacturer for the service indicated.
- Z. Plastic Pipe – Drain, Waste, Vent (DWV): (Except where noted cast iron on drawings.)
1. Application: Where allowed by Code only.
 2. Sanitary waste
 3. Plumbing vent
 4. Rain drain
- AA. Pipe:
1. Acrylonitrile-butadiene-styrene (ABS) (ASTM D3965) plastic drain, waste and vent piping (ASTM F628) and fittings (ASTM D2661) (DWV).
 2. Poly(vinyl chloride) (ASTM D1784) (PVC) plastic drain, waste and vent pipe (ASTM D2665 and D1785) and fittings (ASTM D2665) (DWV).
 3. Fittings: Provide fittings of the type indicated, matching piping manufacture. Where not otherwise indicated, provide fittings produced and recommended for the service indicated by the piping manufacturer.
- BB. Flexible Gas Piping (CSST):
1. Application: 5 psi or less:

2. Natural gas
3. LPG (Propane gas)
4. Pipe: Corrugated 300 series stainless steel tubing with yellow polyethylene jacketing.
5. Fittings: Fittings shall be yellow brass and provide a self-flaring connection to the tubing. Systems incorporating gaskets or o-rings are not acceptable.
6. Underground installations: CSST pre-sleeved with heavy wall internally ribbed polyethylene secondary venting conduit with end seals and vent connection fittings.
7. Approvals: System shall be listed by an approved independent laboratory and approved for use by the local code officials. TracPipe, Gastite, or approved.

CC. Acid Resistant Pipe:

1. Acceptable Manufacturers: Fuseal, Orion, Nalgene, Durcon and Labline for plastic.
2. Application: Acid sanitary waste and acid plumbing vent.
3. Polypropylene plastic pipe, ASTM D4101 compliant material, F1412 compliant pipe.
4. Fitting and Joining Methods: Compatible with the piping system and with equal or better acid resistance and, unless otherwise indicated, made by the piping manufacturer and recommended for the service indicated.

1.08 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

- A. Insulating (Dielectric) Fittings: Provide standard products recommended by the manufacturer for use in the service indicated, and which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and reduce corrosion. Gruvlok "Di-Lok" or Victaulic "Clear Flow."
- B. Welding Materials: Provide welding materials as determined by the installer to comply with installation requirements. Comply with Section 2-C, ASME Boiler Code for welding materials.
- C. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
- D. Tin-Antimony Solder: ASTM B32, Grade 95TA.
- E. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
- F. Silver Solder: ASTM B32, Grade 96.5TS.
- G. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges. Pressure and temperature rating required for the service indicated.

- H. Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.
- I. Strainers: "Y-pattern," iron bronze body rated for pressures indicated with blow-off connection and 20 mesh stainless steel screen.
- J. Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm sewers, and yellow for gas. 3M "DBY" direct bury splice kit required at all splices.

PART 2 PRODUCTS

2.01 PVC/CPVC PIPING, SCHEDULE 40 & 80

- A. Schedule 40 or 80 PVC piping shall be manufactured from Type 1, Grade 1 polyvinyl chloride compound with a cell classification of 12454 per ASTM D1784.
- B. Pipe shall be manufactured in strict compliance to ASTM D1785, consistently meeting and/or exceeding the quality assurance test requirements of this standard with regard to material, workmanship, burst pressure, flattening, and extrusion quality.
- C. Fittings shall be injection molded, Schedule 40 or 80 (to match pipe schedule), manufactured in strict compliance to ASTM D2467 for socket type, and D2464 for threaded type. Use threaded fitting adapters only where specifically allowed as required to connect to valves. All threaded fittings shall have stainless steel reinforcements.
- D. Pipe and fittings shall be NSF Standard 61 approved for use in potable water systems.
- E. Cement shall conform to ASTM F493 and SCAQMD 1168. Cement shall be heavy-bodied, low VOC specifically recommended by the manufacturer for use in industrial sodium hypochlorite applications. Cement shall be IPS Weld-On 724 CPVC.
- F. Primer shall conform to ASTM F656 and SCAQMD 1168. Primer shall be IPS Weld-On P-70, Purple.
- G. Teflon tape shall conform to MIL spec P-27730A.
- H. Piping shall be NSF approved.

2.02 DUCTILE IRON PIPING

- A. Pipe shall be Ductile Iron Pipe (DIP), Grade 60-42-10 minimum, size and end configurations as shown in the drawings. Pressure Class 350 minimum thickness.
- B. DIP shall be manufactured in accordance with ANSI/AWWA C151/A21.51 under method of design outlined in ANSI/AWWA C150/A21.50. Flanged sections shall also conform to ANSI/AWWA C115/A21.15.
- C. Internal Lining. All ductile iron pipe shall be lined and seal coated with ceramic epoxy coating such as Protecto 401, factory applied. Dry film thickness shall be 40 mils nominal. Joint Compound (Protecto or equal) shall be applied by brush and in accordance with manufacturer's recommendations.
- D. External Coating. All DIP that will be buried or exposed to process water/wastewater on the pipe exterior shall be asphaltic seal coated on the exterior in accordance with

ANSI/AWWA C151/A21.51. Interior DIP, and exterior DIP exposed to view and not subject to submergence, will require painting and may be supplied factory primed and without asphaltic coating.

- E. Pipe shall be made in the USA and shall not have been refurbished or reworked by anyone other than the manufacturer.
- F. Provide proper spool lengths from factory with plain and flange ends as required. If field cutting is required, follow manufacturer's instruction and coat cut pipe end.
- G. Pipe shall be manufactured by American Cast Iron Pipe Company, Pacific States Cast Iron Pipe Co., US Pipe, Tyler Union, or equal.

2.03 DUCTILE IRON FITTINGS

- A. Fittings shall conform to ANSI/AWWA C110/A21.10 Standard (full body), or ANSI/AWWA C153/A21.53 (compact), with a 250 psi minimum working pressure.
- B. Where shown in the project drawings, provide bosses on fittings at locations shown.
- C. Fittings shall be factory coated with ceramic epoxy on the inside, Protecto 401, or equal. Exterior of fittings shall have an asphaltic coating in accordance with ANSI/AWWA C110/A21.10. Fittings to be installed in building interior and painted shall be supplied with primer instead of asphaltic coating.
- D. Mechanical joint fittings shall be produced in the USA in accordance with all applicable terms and provisions of ANSI/AWWA C153/A21.53 (or C110) and ANSI/AWWA C111/A21.11. MJ gasket material shall be SBR rubber. T-bolts shall be Cor-Ten or other approved high strength, low alloy steel in accordance with ANSI/AWWA C111/A21.11 (current revision).
- E. Flanged fittings shall be manufactured in the USA of ductile iron in accordance with all applicable terms and provisions of ANSI/AWWA C110/A21.10. Flanged surface shall be faced and drilled in accordance with ANSI Class 125 B16.1. Nominal body thickness shall not be less than as specified in ANSI/AWWA C153/A21.53. Misalignment of bolt holes of two opposing flanges shall not exceed 0.125 inches.
- F. Flange assembly bolts shall be ANSI B18.2.1 standard square or hexagon head carbon steel machine bolts with ANSI B18.2.2 standard hot pressed hexagon nuts. Threads shall be ANSI B1.1, standard coarse thread series; bolts shall be class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5. Flange assembly bolts and nuts shall be made of noncorrosive high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11.
- G. Flange gaskets shall be full-face with holes to pass bolts. For wastewater gasket material shall be neoprene rubber conforming to ASTM D2000, SAE J200, 1/8-inch thick. Styrene-butadiene rubber (SBR) will not be approved for use with wastewater. For air distribution gasket material shall be 100% EPDM (Ethylene Propylene Diene Monomer) conforming to ASTM D2000 as specified in the general notes. EPDM gaskets will have a min temperature range of -40°F to +300°F.
- H. Mechanical joints shall be positively restrained using MegaLugs, by EEBA Iron, or approved equal. Mechanical joints with retainer glands alone will not be acceptable on this project.

- I. Flange and Mechanical Joint fittings shall be by Tyler Union, Union Foundry Company, US Pipe; or equal.

2.04 FIELD FLANGE FITTING

- A. Restrained flange coupling adapters shall be used on the project in lieu of factory flanged spools only where indicated on the plans and approved.
- B. Other types of field flanges will not be allowed on the project.
- C. Restrained flanged coupling adapters shall be Mega-Flange by EEBA Iron, or equal.

2.05 STAINLESS STEEL VENT PIPING

- A. Use where shown on drawings or as specified in Contract Documents.
- B. Pipes shall be manufactured from ASTM A240 sheets and plates in accordance with ASTM A778 in 304L or 316L stainless steel.
- C. Pipe minimum wall thickness shall be schedule 10S nominal.
- D. Piping shall be provided in plain-end configuration in preparation for butt weld fittings.
- E. Finish shall be No. 1 H.R.A.P. (Hot Rolled Annealed and Pickled) or better.
- F. Fittings shall be butt weld type manufactured in accordance with ASTM-A-774 of the same grade (alloy) and in the same wall thickness as the pipe.
- G. Fittings shall match pipe wall thickness. Minimum wall thickness shall be schedule 10S nominal.
- H. Welding of pipe and fittings shall be performed using welders and procedures qualified in accordance with ASME Section IX. Piping and fittings with wall thicknesses up to and including 11 gauge (0.125") shall be TIG welded. Heavier walls shall be beveled and TIG welded in multiple passes. Filler metal shall be of equal or superior grade to parent metal. Weld cross section shall be equal to or greater than parent material thickness. Weld concavity, undercut, cracks, crevices, or pitting shall not be allowed. Butt welds shall have full penetration to the interior surface.
- I. After fabrication, exterior welds shall be manually scrubbed and/or brushed with non-metallic pads or stainless steel wire brushes to remove weld discoloration, rinsed with clean water and allowed to air dry.
- J. Extreme care shall be taken to avoid contact between ferrous materials with the stainless steel piping. All saws, drills, files, grinders, brushes, etc. shall be used for stainless steel only.
- K. Contractor shall paint all exposed steel or iron flanges, and other fittings, in accordance with Section 09900. Stainless steel pipe shall remain unpainted.
- L. All markings shall be removed from stainless steel pipe by Contractor to provide a consistently clean surface.

2.06 BRASS/BRONZE FITTINGS

- A. Red brass pipe nipples and piping shall be seamless, MIP threaded, rated for 150 psi working pressure, and conforming to ASTM B43 and ASTM B687. Bronze fittings shall meet the requirements of ASTM B62 with NPT threaded ends conforming to ANSI/ASME B16.15.

2.07 COPPER WATER PIPING

- A. Type K or M, copper tubing conforming to the requirements of ASTM B-88 unless otherwise specified.
- B. Joints shall be soldered and threaded as required.
- C. Solder to be used in copper piping shall be ASTM B32, Alloy Grade Sn95 or Silverbrite 100.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ensure that piping is properly installed and supported. Verify end connections as required on the drawings. Verify dimensions required for installations.
- B. Verify that piping has not been damaged in shipping or storage.

3.02 GENERAL INSTALLATION

- A. Install piping per manufacturer's instructions. Properly brace and support as directed.
- B. Follow appropriate pipe joining specifications for various MJ, Flange, solvent welded and threaded ends.
- C. All piping shall be cleaned and flushed prior to start of testing.
- D. All piping shall be leak tested in accordance with Section 15050.
- E. Potable water piping shall be flushed and disinfected in accordance with the requirement of the Oregon Department of Human Services, Drinking Water Program and OAR 331-061-050, and Section 15050.

3.03 FLANGED JOINT INSTALLATION

- A. Furnish the gaskets required for each flange joint being assembled. Gasket material for flanged joints shall be 1/8-inch thick commercial neoprene sheet conforming to ASTM D2000, SAE J200 and 1 BC 609. For 12-inch and smaller pipe, gasket shall be full face cut with holes to pass bolts. For 14-inch and larger pipe, gasket shall be ring type.
- B. Flanged joints shall be fitted so the contact faces bear uniformly on the gasket. Bolts shall be tightened progressively in a sequential, uniform manner to torque values recommended by the manufacturer of the flange or fitting. Flanged fittings shall be properly anchored, supported, or restrained during installation to prevent bending or torsional strains at the connection during and after the joining process.

3.04 MECHANICAL JOINT INSTALLATION

- A. Joints and gaskets for mechanical joints shall conform to ANSI/AWWA C111/A21.11 Standard. Furnish gaskets and hardware necessary for each mechanical joint.
- B. The pipe shall be inserted in the socket and supported as necessary to keep the pipe centered in the joint and to maintain uniform exposure of the gasket recess. The gasket shall be pressed firmly and evenly into the gasket recess prior to installing the bolts through the gland. Bolts shall be tightened progressively in a sequential, uniform manner to torque values recommended by the manufacturer of the fitting. The gland shall not be allowed to deform during the tightening process. Any required minor deflection of joints shall be made after the joint is assembled, but before final tightening of the bolts. The jointing procedure shall be repeated if effective sealing is not attained at the maximum torque. Bolts shall be tightened to manufacturer's specifications. Bolts shall not be overstressed to compensate for ineffective sealing or poor installation practice.

3.05 PRESSURE TESTING

- A. All pressure and leak testing shall be conducted by the Contractor in the presence of the Engineer.
- B. Testing shall not be commenced until all thrust blocking has been in place for not less than 10 days and sufficient backfill has been placed to prevent pipe movement.

3.06 TEST PROCEDURE

- A. The test section shall be filled with water and all air expelled from the pipe prior to testing. Contractor shall coordinate with the City to obtain water for testing.
- B. All valves isolating the test section shall be securely closed and the specified test pressure applied by means of a pump connected near the lowest point of the test section. All open pipe ends shall be plugged using blind flanges or restrained plugs, as applicable.
- C. The test pressure shall be 150 psi and the duration shall be at least 1-hour at the test pressure. No pressure drop is allowed during the test. No visible signs of leakage will be allowed at any exposed pipe, fitting or joint.
- D. Contractor shall repair or replace any defective piping or fittings at no additional cost to the Owner. Repeat pressure tests until entire system is found satisfactory.
- E. All visible leaks on new pipelines shall be repaired, regardless of the amount of leakage.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 15113 – VALVES AND PROCESS CONTROL

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Section specifies specialty valves used in the project. Section also includes process control fittings and valve accessories and appurtenances including valve actuators.
- B. Work includes furnishing, installing, testing, and adjusting valves for proper installation and operation.
- C. Valve type, size and material for each application shall be as shown in the Plans and specified herein.

1.02 QUALITY ASSURANCE

- A. All valves shall be new, unused and completely free from defects.
- B. All valves of similar type shall be by a single manufacturer.

1.03 VALVE END CONFIGURATIONS

- A. Valve end configurations shall be as shown in the drawings and required for the intended application.
- B. Flanged valves shall be manufactured in accordance with ANSI B16.1 Class 125/150, including facing, drilling and flange thickness.

1.04 RELATED SECTIONS

- A. Section 15110 – Pipeline Appurtenances

PART 2 PRODUCTS

2.01 BRONZE GATE AND GLOBE VALVES (½" THROUGH 3")

- A. Bronze valves shall be Class 150 globe style or non-rising stem solid wedge gate style. Angle style where shown or required. Threaded or union bonnet. Threaded ends.
- B. Body and bonnet shall be ASTM B61 or 62 bronze. Disc shall be bronze or Teflon. Handwheel shall be bronze or malleable iron. Stem shall be brass or copper-silicon bronze. Packing shall be non-asbestos Kevlar/Teflon or plastic/graphite.
- C. Valves shall be manufactured by Red White Valve, Stockham, Kennedy; or approved equal.

2.02 BRONZE GATE AND GLOBE VALVES (3" and up)

- A. Bronze valves shall be Class 150 globe style or non-rising stem solid wedge gate style. Angle style where shown or required. Threaded or union bonnet. Threaded ends.
- B. Body and bonnet shall be ASTM B61 or 62 bronze. Disc shall be bronze or Teflon. Handwheel of malleable iron. Stem of copper-silicon bronze. Packing shall be non-asbestos, kevlar fibers with Teflon.

- C. Valves shall be manufactured by Stockham, Kennedy, Red-White Valve Corp., or approved equal.

2.03 ECCENTRIC FULL-PORT PLUG VALVES

- A. Eccentric Plug Valves shall be of the tight closing, resilient faced non-lubricating variety and shall be of eccentric design such that the valve's pressure member (plug) rises off the body seat contact area immediately upon shaft readaptation during the opening movement. Valves shall be drip-tight at the rates pressure and shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90° from the full-open to full-closed position and vice-versa.
- B. The valve body shall be constructed of cast iron conforming to ASTM A 126, Class B. Body ends shall be flanged with dimensions, facing and drilling in full conformance with ANSI B 16.1, Class 125. Mechanical joint to meet the requirements of AWWA C111/ANSI A21.11.3.
- C. Port shall be minimum 80% of full pipe area.
- D. Valve plug shall be constructed of cast iron conforming to ASTM A126, Class B. The plug shall have a cylindrical seating surface that is offset from the center of the plug shafts. The plug shafts shall be integral. The portion of the plug in the valve body shall be fully encapsulated with Buna-N rubber. Rubber compound shall be approximately 70 (Shore A) durometer hardness. Rubber to metal bond must meet ASTM D-429-73 Method B.
- E. Plug shaft seals shall be adjustable. All packing shall be replaceable without removing the bonnet or actuator and while the valve is in service. Shaft seals shall be Buna-N.
- F. Manual valves shall have worm gear type actuators with handwheels or 2" square nuts, as indicated on the plans.
- G. Valve end configurations and sizes as shown on Plans.
- H. Buried valves shall be furnished with a cast iron valve box as specified herein, and shall have operators designed for direct bury service. Furnish with a stem extension such that the operating nut is within 30-inches of the ground surface. Furnish hand operators as shown on Plans.
- I. Valves to be matched with electric motorized actuators shall be provided and set up for mechanical and automated actuation.
- J. Valves shall be Val Matic, Clow, M&H, Kennedy, Pratt; or equal.

2.04 BUTTERFLY VALVES

- A. All valves shall be tight-closing, rubber seat type with rubber seats that are securely fastened to the valve body. No metal-to-metal surfaces shall be permitted. Valve shall be rated for a minimum of 150 psi dead-end service. Valve shall be factory coated.
- B. Valves shall be tapped full lug pattern capable of end-of-line service at 150 psi. Valves shall be designed for installation between ANSI 125 or 150 flanges without the need for gaskets.
- C. Butterfly valves shall be bubble-tight at rated pressures with flow in either direction and shall be satisfactory for applications involving throttling service and/or frequent operation.

- D. Disc shall be of a concentric design configured for high flow while maintaining strength consistent with the valve pressure rating. Valve disc shall employ a positive machined drive. Pins or bolts are not allowed for attaching the disc to the valve stem. Disc edge shall be configured to minimize opening valve torque. Disc shall be 316 SS, shaft shall be SS.
- E. Valve seat shall consist of a resilient EPDM elastomer liner molded to a rigid backing ring. Valve seat shall be field replaceable with hand tools. Valve seat shall be capable of service from 29.9" mercury vacuum to 175 psi pressure.
- F. The upper stem shall be guided by two self-lubricating bronze bearings to prevent galling and seizure.
- G. Manual lever handles to be supplied with all manual valves. Handles shall be 10-position locking type and shall be manufactured by the valve manufacturer.
- H. Butterfly valves shall be Demco Series NE-C, ABZ Figure 929, Bray Series 31; or approved equal.

2.05 SWING CHECK VALVES (4" – 12")

- A. Swing Check valves, 4-inch through 12-inch, shall be iron body, full opening swing type. Valve clapper shall swing completely clear of the waterway when valve is full open, with open flow area equal to nominal pipe diameter.
- B. Check valves, 4-inch through 12-inch shall be rated at 175 psi water working pressure and 350 psi hydrostatic test for structural soundness. Seat tightness at rated working pressure shall be in accordance with values shown in AWWA Standard C-500 for gate valve and fully conform to AWWA C508. Check valves shall be UL listed and FM approved.
- C. Cast iron shall conform to ASTM-A-126 Class B. Casting shall be clean and sound without inclusion or defect that will impair service. Furnish with fusion bonded epoxy meeting ANSI/AWWA C550 standard.
- D. Clappers shall be cast iron and rubber faced. Hinge pins shall be 18-8 stainless steel.
- E. Check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line. Glands shall be O-ring type.
- F. Check valves shall be equipped with external lever and adjustable weight. Provisions shall be included to allow addition of spring assist assembly in the field.
- G. Check valves shall be equipped with external limit switches to indicate a "valve open" condition or "valve closed" condition. See Division 16.
- H. Bosses and taps shall be provided on check valves for NPT taps. Bosses shall be provided at locations C and D, conforming to the Manufacturers Standardization Society Specification SP-45-1953. Provide galvanized malleable iron, square head pipe plug, rated for minimum 125 psi and conforming to ANSI/ASME B16.4 and ASTM A126 Class A; or equal.
 - 1. Valve sizes 2" through 3" shall have 3/4" NPT taps.
 - 2. Valve sizes 4" through 6" shall have 1" NPT taps.

- 3. Valve sizes 8" through 12" shall have 1 ½" NPT taps.
 - I. Check valve end configurations and sizes shall be as shown on the Plans.
 - J. Joint materials, nuts and bolts for mechanical and flange joints shall be as specified in Section 02514-2.01.A.
 - K. Check valves shall be as manufactured by Val Matic or approved equal.

2.06 VALVE BOXES

- A. Cast iron valve boxes with PVC extensions shall be furnished and installed with all buried gate valves. See standard detail drawing.
- B. Valve box shall have a single piece top section and separate cover. Box and cover shall be manufactured from ASTM A48, Class 30 cast iron and shall be rated for H20 traffic loading. Cover shall have "S" or "SEWER" formed in the casting.
- C. Box shaft shall be 18-inches long with a 7-inch I.D. and 7½-inch O.D. Top flange of box shall be 12-inches in diameter. Cover shall be 7¾-inch diameter.
- D. A PVC extension shall be placed at the valve extending to within 6-inches of the ground surface. The cast iron valve box is placed over this PVC extension. The PVC section shall be 6-inch diameter PVC, ASTM D3034, SDR35.
- E. A hole shall be drilled through the cast iron box section to bring a length of toning wire into the box in accordance with the standard detail drawing.
- F. Valve box assemblies shall be set such that the completed assembly is straight and plumb. The completed valve box assembly shall be centered over the operating nut of the valve and shall not transmit shock or stress to the valve, operating nut, or valve operator extension. Valve box assembly shall be kept free of rocks and other debris for the duration of the project. Valve box assembly shall be set flush with finish grade during final surface finishing.
- G. Cast iron valve boxes shall be Olympic Foundry, Inc. VB-910; or approved equal.

2.07 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

- A. Reduced pressure principle backflow preventer shall prevent contamination of the potable water supply due to back-siphonage or backpressure from substances that are health or non-health hazards. The bronze body shall be configured with individually accessible top access check valves including top-mounted test cocks. The relief valve shall be bottom centered with a separate cover. The replaceable seat rings shall be glass filled Noryl and the reversible seat discs shall be silicone rubber. Shall be equipped with Y-strainer and union-end ball valves on both ends of backflow preventer body.
- B. RP Backflow Preventer shall be Apollo RP40; or approved equal.

2.08 CORPORATION STOPS

- A. Corp stops shall be ball type and all brass conforming to AWWA C800 and ASTM B-62. MIP and FIP threaded ends as required. Ford FB1700 and FB500 as required for NPT threads.

2.09 WASTEWATER COMBINATION AIR VALVE

- A. Wastewater combination air valves shall be automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs. The valve shall also release accumulated air from a piping system while the system is in operation and under pressure. The valve shall perform the functions of both wastewater air release and wastewater air/vacuum valves and furnished as a single body or dual body type as indicated on the plans.
- B. Single body valves 4 inch and smaller shall have full size NPT inlets and outlets equal to the nominal valve size with a 2 inch inlet on 1 inch valves. The body inlet shall be hexagonal for a wrench connection. The valve shall have 3 additional NPT connections for the addition of backwash accessories.
- C. Single body valve shall provide an extended body with a through flow area equal to the nominal size of the valve. Floats shall be unconditionally guaranteed against failure including pressure surges.
- D. Single body valves shall have a full port orifice, a double guided plug, and an adjustable treaded orifice button. The plug shall be protected against direct water impact by an internal baffle and an extended float stem. The plug shall have a precision orifice drilled through the center stem. The float shall include a sensitivity skirt to minimize spillage.
- E. Valve body and cover shall be cast iron. Float, plug, guide shafts, and bushings shall be constructed of Type 316 stainless steel.
- F. Backwash accessories shall be furnished and shall consist of an inlet shut-off valve, a blow-off valve, a clean water inlet valve, rubber supply hose, and quick disconnect couplings. Accessory valves shall be quarter turn, full ported bronze ball valves.
- G. Valve interior and exterior shall be coated with fusion bonded epoxy.
- H. Valve shall have 2" NPT inlet and 1" NPT outlet.
- I. Valve shall be Val-Matic Series 801A, or approved equal.

2.010 STAINLESS STEEL BALL VALVES

- A. Stainless steel ball valves shall be full port, one or two piece body design, with FIP threaded ends, and blow-out proof stem design. Lever handle with plastic or rubber coating shall be included.
- B. Body shall be ASTM A276 type 316 or ASTM A351 Gr. CF8M stainless steel. Ball shall be ASTM A276 type 316 stainless steel.
- C. Handle, nut, stem washer, and other parts may be 316 or 304 stainless steel.
- D. Valve shall conform to specifications of MSS-SP-110 and FS WW-V-35, type II, Composition SS, Style 3. Red-White, Gemini, or approved equal

PART 3 EXECUTION

3.01 PREPARATION

- A. Ensure that piping is properly installed and supported. Verify valve end configurations required with the drawings. Verify dimensions required for valve installations. Verify proper manual operators, extensions, etc. are on-site for valve operation.
- B. Verify that valves have not been damaged in shipping or storage and are operating correctly.

3.02 INSTALLATION

- A. Install valves per manufacturer's instructions. Properly brace and support valves.
- B. Follow appropriate pipe joining specifications for various MJ, Flange, solvent welded and threaded ends.
- C. Flush all pipelines prior to valve operation to remove all grit.
- D. Operate all valves after installation to ensure smooth and proper operation. Adjust, clean, and lubricate as required.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

- A. Wastewater Treatment Plant Improvements
 - 1. Payment for Valves, Process Control and other work in this section shall be included as a portion of the lump sum price for the project as stated in the Bid Form for the Project. No separate measurement for these quantities will occur.

END OF SECTION

SECTION 15114 – ELECTRIC ACTUATORS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Section specifies specialty actuators used in the project. Section also includes process control fittings and valve accessories and appurtenances including valve actuators.
- B. Work includes furnishing, installing, testing, and adjusting actuators for proper installation and operation.
- C. Actuator type, size and material for each application shall be as shown in the Plans and specified herein.

1.02 QUALITY ASSURANCE

- A. All actuators shall be new, unused and completely free from defects.
- B. All actuators of similar type shall be by a single manufacturer.

1.03 RELATED SECTIONS

- A. Section 15110 – Pipeline Appurtenances

PART 2 PRODUCTS

2.01 ELECTRIC MOTORIZED VALVE ACTUATORS

- A. Where indicated on the plans, valves shall be outfitted with electric, motorized actuators for control of flow of air in the treatment process.
- B. Actuators shall be a WE-500 series as manufactured by Triac or approved equal.
- C. Actuators shall be capable of open/close.
- D. Actuators shall have a min torque output of 500 in-lbs.
- E. Actuator shall have a Class F reversible motor.
- F. Actuator shall include a drive nut or hand wheel for manual operation of valve.
- G. Actuator shall include an integral, watertight, NEMA 4X enclosure to protect the electrical systems from rain, wind, and weather.
- H. Actuator shall operate on 110/230 single phase power.
- I. Actuator shall be capable of a variety of mounting positions and angles. Adaptors can be used if required.
- J. Actuator shall have a position feedback sensor and 4-20 mA signal to be sent back to the main control panel.
- K. Actuator shall include a torque feedback sensor and signal capable of relay to the main control panel.

- L. Actuator shall be suitable for installation in an industrial environmental such as the wastewater treatment plant and not be susceptible to corrosion, rust, or damage from an aggressive environment.

2.02 ELECTRIC MOTORIZED MODULATING VALVE ACTUATORS

- A. Where indicated on the plans, valves shall be outfitted with electric, motorized actuators for control of flow of air in the treatment process.
- B. Actuators shall be a WE-1350 series as manufactured by Triac or approved equal.
- C. Actuators shall be capable of open/close and modulation.
- D. Actuators shall have a min torque output of 980 in-lbs.
- E. Actuator shall have a Class F reversible motor.
- F. Actuator shall include a hand wheel for manual operation of valve.
- G. Actuator shall include an integral, watertight, NEMA 4X enclosure to protect the electrical systems from rain, wind, and weather.
- H. Actuator shall operate on 110/230 single phase power.
- I. Actuator shall be capable of a variety of mounting positions and angles. Adaptors can be used if required.
- J. Actuator shall have a position feedback sensor and 4-20 mA signal to be sent back to the main control panel.
- K. Actuator shall include a torque feedback sensor and signal capable of relay to the main control panel.
- L. Actuator shall be suitable for installation in an industrial environmental such as the wastewater treatment plant and not be susceptible to corrosion, rust, or damage from an aggressive environment.
- M.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ensure that piping is properly installed and supported. Verify valve end configurations required with the drawings. Verify dimensions required for valve installations. Verify proper manual operators, extensions, etc. are on-site for valve operation.
- B. Verify that actuators have not been damaged in shipping or storage and are operating correctly.

3.02 INSTALLATION

- A. Install actuators per manufacturer's instructions.
- B. Operate all valves after installation to ensure smooth and proper operation of actuators. Adjust, clean, and lubricate as required.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 15115 – PIPE PENETRATION SLEEVE AND SEALS

PART 1 GENERAL

1.01 SUMMARY

- A. The work in this Section consists of furnishing all labor and materials, and performing all work necessary for the proper installation of annular space seals.

1.02 REFERENCES

- A. Section 03300 – Cast-In-Place Concrete
- B. Section 02509 – Site Piping

1.03 SUBMITTALS

- A. Submit product data in accordance with Section 01300.

1.04 PROJECT CONDITIONS

- A. Verify all relative dimensions, pipe outside diameter and required sleeve inside diameter, before ordering product. Contractor is responsible for product fitment and function.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Sequence deliveries to avoid delays and minimize on site storage.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by the Manufacturer. Protect from sunlight, weather, excessive temperatures and construction operations.

PART 2 PRODUCTS

2.01 MODULAR SEALS FOR PIPE PENETRATIONS

- A. Annular space between the pipe and wall shall be sealed by use of modular seals consisting of interlocking synthetic rubber links shaped to continuously fill the annular space.
- B. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM.
- C. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.
- D. Modular seal links shall be black EPDM rubber suitable for use in untreated wastewater.

- E. Modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties: Izod Impact – Notched = 2.05 ft-lb/in. Per ASTM D-256, Flexural Strength @ Yield = 30,700 psi per ASTM D-790, Flexural Modulus = 1,124,000 psi per ASTM D-790, Elongation break = 11.07% per ASTM D-638. Specific Gravity = 1.38 per ASTM D-792.
- F. All fasteners shall be 316 stainless steel per ASTM F593-95 with 85 ksi average tensile strength.
- G. Modular link seals shall be manufactured by PSI-Thunderline/Link-Seal, or approved equal. Modular seal links and modular seal pressure plates shall be products of the same manufacturer.
- H. Link-Seal models LS200, 275, 300 and 315 shall incorporate the most current Link-Seal Modular Seal design modification and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which shall permit increased compressive loading of the rubber sealing element.
- I. Link-Seal models 315, 325, 340, 360, 400, 410, 425, 475, 500, 575, and 600 shall incorporate an integral recess designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware.

2.02 BOOT SEALS (KOR-N-SEAL)

- A. Connections to precast manhole and vault sections shall be through an installed wall pipe and shall utilize a properly sized flexible rubber boot providing a watertight seal. Adapter shall be factory tested for watertightness up to 10.8 psi. Kor-N-Seal as manufactured by NPC, Inc. or approved equal.

2.03 END SEAL (FOR CASING PIPES)

- A. End seals for galvanized casing pipe shall be 1/8" thick, 70 durometer Buna Nitrile and vulcanized conforming to ASTM D-1056-67. End seal shall be designed to conform to eccentric carrier/casing configuration. Advance Products & Systems, Inc., Model AWN, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install per manufacturers recommendations and per contract drawings.
- B. Modular seals shall not be allowed to bear the weight of pipe, either during installation or anytime thereafter. Proper pipe supports shall be supplied where appropriate.
- C. Center the pipe in wall opening, making sure to properly support the pipe at both ends.
- D. Insert Modular Seal according to Manufacturer recommendations, do not add or remove links from the seal to reduce or increase "sag".
- E. Tighten bolts starting at the 12 O' Clock position and continue in a clockwise pattern. Do not tighten any bolt more than 4 turns at a time. Continue the clockwise pattern until all links are uniformly compressed. Do NOT use electric or pneumatic tools to tighten bolts, hand tighten only, follow manufacturers recommendations. Tighten until modular sealing elements "bulge" around the pressure plates.

- F. For questions regarding installation of Link-Seal modular seals call (800) 423-2410.
- G. For Kor-N-Seal installation instruction see section 02535
- H. End Seals - Install end seals per manufacturer instruction.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 16050 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. Contractor shall conform to the General Conditions, Supplementary General Conditions, and related work in all other divisions and all work in Division 16. Correlation of contract requirements is the responsibility of the Contractor.
- B. The Contract Documents are complimentary. What is required by any one, as affects this Division, shall be as binding as if repeated therein.
- C. Electrical Sub-Contractor is expected to review and be familiar with Mechanical Drawing Sheets and Division 11, 13 and 15 Specifications.
- D. Separation of this Division from other Contract Documents shall not be construed as complete segregation of the work nor shall it suggest a scope of work for a Contractor or subcontractor.
- E. Particular attention is called to the Bidding Information, Conditions of the Contract, and Special Specifications.
- F. All deviations from the Drawings or Specifications must be approved, in writing, by the Engineer and the Owner.

1.02 WORK INCLUDED

- A. It is the intention of this Section of the Specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown on the Plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the Plans, but which are necessary to make a complete working installation of all electrical systems shown on the Plans and described herein. Certain equipment and devices furnished and installed under other Divisions of this Contract (or by Owner) shall be connected under this Division. The drawings and specifications are complimentary and what is called for in either is as binding as if called for in both. To restate: Contractor is responsible for connecting all electrical equipment in this project, even if the connections are not described or detailed on the drawings or specifications.
- B. Provide equipment and installation not otherwise shown on the drawings but required by code or required to make a complete and functional electrical system.
- C. Contractor shall offer electrical assistance to all other contractors.

1.03 WORK NOT INCLUDED

- A. Equipment furnished and installed under another Division. However, electrical connection of equipment installed or furnished under another Division shall be the responsibility of the Division 16 contractor unless the task is specifically assigned in the Division documents to another contractor.

1.04 DIVISION 16 WORK DESCRIBED IN OTHER DIVISIONS INCLUDES:

- A. Temporary Power. See General Requirements.
- B. Mechanical control wiring and alarm wiring. See pertinent Divisions.
- C. Equipment control wiring. See Division 11 and Division 13.
- D. Electrical connection to all new equipment and interconnections with existing facilities, whether detailed on plans or not, is a responsibility of the Division 16 contractor.

1.05 EXAMINATION OF SITE

- A. The Contractor shall visit the premises to thoroughly familiarize himself with all details of the work and working conditions and verify all dimensions in the field, and shall advise the Engineer of any discrepancy before permitting the work. The Contractor shall be specifically responsible for the coordination and proper relation of the electrical work to the building structure and to the work of other trades.
- B. Owner shall not be responsible for any loss of unanticipated costs which may be suffered by the successful bidder as a result of such bidder's failure to fully inform himself in advance in regard to all conditions pertaining to the work and character of the work.
- C. Field-verify scale and dimensions shown on all contract documents and drawings, since exact locations, distances and levels shall be governed by actual field conditions.

1.06 PROTECTIVE AND ACCESS REQUIREMENTS

- A. Protection. Exposed parts that are subject to high operating temperatures or are energized electrically and moving parts of which are of such nature or so located as to be a hazard to operating personnel, shall be insulated, fully enclosed or guarded. Guarding shall be arranged in a manner that will not impair the proper functioning of these parts.
- B. Access. Where equipment is more than 8 feet above the floor, steel platforms and ladders shall be provided where required to permit easy access for inspection and maintenance.

1.07 COORDINATION

- A. The Division 16 Contractor shall coordinate his work with that of the other Contractors doing work in the buildings and shall examine all drawings, including the several Divisions of mechanical, ventilation, structural and general, for construction details and necessary coordination.
- B. Special attention shall be given for the following items and all conflicts shall be reported to the Engineer before installation for decision and correction:
 - 1. Location of radiators, grilles, pipes, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
 - 2. Within the limits indicated on the drawings, the maximum practicable space for operation, repair, removal and testing of equipment shall be provided.
- C. The Contractor will not be paid for cutting, patching and finishing required for relocation of work installed due to interference between the various Contractors' work.

- D. Composite Interference Drawings. Before any sleeves or inserts are set or any electrical equipment or foundations are installed, prepare and submit for approval, by the Engineer, in accordance with the General Provisions, composite coordination drawings for all equipment rooms, spaces and other areas in which the probability of interference exists. Drawings shall show the work of all trades covered, shall be drawn to a scale not smaller than 1/2" = 1'-0", and shall show clearly in both plan and elevation that all work can be installed without interference.
- E. Prior Installation. Any electrical work installed prior to approval of coordination drawings shall be at the Contractor's risk. Subsequent relocations required to avoid interferences shall be made without additional expense to the Owner. In case interference develops, the Engineer will decide which work shall be relocated, regardless of which was installed first.
- F. Outages. Schedule any power or communication outages which may affect existing facilities with the Owner and Engineer.

1.08 CODES AND STANDARDS

- A. If any conflict occurs between government adopted code rules and this Specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming with governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the plans or specifications which may be in excess of requirements of the hereinbefore mentioned rules and not contrary to same.
- B. All electrical equipment shall bear the label of the testing laboratories recognized by the State of Oregon as meeting the testing standards for minimum electrical safety.
- C. All electrical systems shall be designed to the following current National Standards. The Contractor is required to familiarize himself with the detailed requirements of these standards and any local codes and ordinances as they affect the installation of specific electrical systems.
 - 1. National Electrical Code (NEC)
 - 2. Uniform Building Code (UBC) as applicable.
- D. Comply with State and any local electrical codes, safety orders, ordinances, applicable building codes, and requirements of serving utilities.
- E. Materials shall, where rated, be UL listed and conform to applicable ANSI, NEMA, ISA and OSHA, or other recognized standards.
- F. Design features specified or shown which are over and above requirements of relevant codes and standards shall take precedence.

1.09 PERMITS AND FEES

- A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection. Contractor shall make all necessary arrangements for installation of electrical services indicated on plans.

- B. Contractor shall pay all communications, security and power company fees and/or costs for power installation, regardless if provided overhead, underground or rerouted.

1.010 CONTRACT DRAWINGS

- A. Conduits and ground connections are shown diagrammatically only and indicate the general character and approximate location. The layout does not necessarily show the total number of conduits for the circuits required, nor are the locations of indicated runs intended to show the actual routing of the conduits. The Contractor shall furnish, install and place in satisfactory condition, ready for operation, all conduits, cables and other materials required for a complete electrical system.
- B. The horsepower of motors and apparatus wattages indicated on the plans and in the panel schedules are estimated requirements of equipment furnished under other Divisions of this contract and bid shall be based on these sizes. Overload elements, contactors, circuit breakers, fuses, conductors, etc., shall be furnished to suit actual equipment installed. Advise Engineer of any equipment changes affecting electrical circuits.
- C. Any minor changes in the location of the conduits, outlets, etc., from those shown on the plans shall be made without extra charge, if so directed by the Engineer before installation.
- D. Contractor shall consult the architectural drawings for the exact height of all outlets not specified herein or on the drawings.
- E. Outlet locations shown on the drawings are approximate. Contractor shall study the building drawings in relation to spaces and equipment surrounding each outlet so that the lighting fixtures are symmetrically located according to ceiling tile and room layout. When necessary, with the Engineer's approval, outlet shall be relocated to avoid interference with structural features of the building.
- F. When conduit, insert or sleeves for outlet boxes and/or conduits are required, Contractor shall supply and install all conduits, inserts or sleeves and shall fully coordinate the installation thereof with other trades.

1.011 SUBMITTALS

- A. Submittals shall meet the requirements of Section 01300.
- B. All material shall be new and a standard product of a reputable manufacturer. Deliver to site in original factory cartons with full manufacturer's warranty. Each type of material or equipment shall be of the same manufacturer throughout the project.
- C. The Contractor shall submit for approval shop drawings and cutsheets for each item and system. Furnish catalog data for all items of material, except where the information is included with shop drawings. Shop drawings shall show the ratings of items and systems and how the components of an item and system are assembled, function together, and how they would be installed on the project. Data and shop drawings for component parts of an item or system shall be coordinated and submitted as a unit.
 - 1. Required for all electrical equipment and includes but is not limited to the following:
 - a. Qualification certificates

- b. Contract Cost Breakdown
 - c. Panelboards, switchboards and breakers
 - d. Light fixtures, standards and appurtenances
 - e. Switches and receptacles
 - f. Motor control centers, motor starters, VFDs
 - g. Equipment controllers and switches
 - h. Disconnects and fusible switches
 - i. Special switches, pushbutton stations and controls
 - j. Those specific items called out elsewhere in the specifications which require special coordination and/or details
 - k. Electric heaters and thermostats
 - l. SCADA & Telemetry systems
 - m. Computer & networking equipment & PLC equipment
 - n. Fans and grilles
 - o. Raceways, wiring devices, floor boxes, wires and cables
 - p. Generators & Transfer switches
 - q. All instruments, sensors & equipment
 - r. Instrumentation, metering, flow, level, temperature, pressure, etc., sensing equipment
- D. Single Submission. Data and shop drawings shall be supported and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission. Submit five (5) copies in one or more 3-ring binder notebooks, vinyl covered, with proper index and dividers.
- E. Context. The lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, cuts, diagrams and other data published by the manufacturer, to demonstrate conformance to the specification requirements; model numbers alone will not be acceptable. The contractor shall submit photometric performance curves for each lighting fixture to assure proper lighting distribution and quality at the design conditions. The data shall include the name and address of the nearest service organization. All cut sheets must be marked to show the actual model of each item used and all related appurtenances with proper model and part numbers.
- F. Shop Drawings. Shop drawings shall include complete construction details, dimensions, material descriptions, diagrams or pictures showing physical characteristics, performance and test data, description of operation, installation methods, wiring diagrams and any other data or information necessary for a complete evaluation. (Note: do not re-draw the

contract drawings. The drawings to be submitted under this subsection are all the supplemental drawings and manufacturers' specification drawings which are not included in the contract drawings.) Shop drawings are in addition and supplemental to the contract drawings.

- G. Identification. In addition to the requirements of Special Provisions, submittals shall be identified by the name of the system and applicable specification paragraph number.
 - H. Delivery Prior to Approval. No item of material or equipment shall be delivered to the site or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.
 - I. Compliance. Should the Contractor fail to comply with the requirements of these provisions, the Engineer reserves the right to select any or all items of materials and systems. Selection shall be final and binding upon the Contractor. Materials so selected or approved shall be used in the work at no additional cost to the Owner.
 - J. Departures. If departures from the contract drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings. Where such departures require raceways or equipment to be supported otherwise than as shown, the details submitted shall include loadings and type and kind of frames, brackets, stanchions, or other supports necessary. Approved departures shall be made at no additional cost to the Owner.
 - K. Electrical Diagrams. A complete electrical connection diagram for each item of equipment furnished under Division 16, which has electrically controlled components having more than one automatic or manual control device, shall be submitted for approval. Wiring diagrams shall identify each component, and one diagram shall show all interconnected or interlocked components. It is understood that the contract electrical drawings do not have to be submitted or copied for inclusion in this submittal.
 - L. Contractor agrees that submittals processed by the Engineer are not change orders; that the purpose of submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.
 - M. Late submittals will not be considered an excuse for time extension for the project.
- 1.012 SUBMITTAL RECORD DRAWINGS/ASBUILTS/O & M MANUAL (AT PROJECT END)
- A. Record Drawings. Corrections and changes made to the contract drawings during the progress of the work shall be recorded in a legible hand, in red pencil, continuously on a copied set of the contract drawings kept readily available at the project under construction. The purpose of these Record drawings is to provide the Engineer with an easy to read, complete record of the installation so that at the end of the project the Engineer can revise the original contract drawings to represent the actual installation. Color-coded and highlighted notes shall be used if these would make the Record Drawings easier to read. These drawings shall also include such information as all wiring labels, conduit sizes and labels, overload sizes and accurately locate all underground and under-slab piping and stub-outs. At the completion of the work, Contractor shall furnish the Engineer this set of drawings. Final payment to the Contractor will not be authorized until these drawings have been submitted to and accepted by the Engineer.

- B. Supplemental As-Built Electrical Drawings. As-Built Drawings supplementary to and not already included in the contract drawings shall be assembled and delivered to the Engineer in the form of five (5) bound copies. The Electrical Engineer will revise the original bid drawings by information supplied by the Contractor on the Record Drawings but any other electrical equipment or connections not shown on the bid drawings or Record Drawings shall be documented by supplementary as-built drawings supplied by the Contractor.
- C. The Contractor shall prepare and deliver five (5) copies of an Electrical Equipment Maintenance Manual for all electrical equipment installed on the project. This manual shall coordinate with and be an integral part of the plant O&M manual set and plant drawings. This manual, along with the plant electrical drawings and the Software Integrator's process control manual shall compose the electrical section of the plant O&M manual set. The Electrical Engineer will provide updated plant electrical drawings at the end of the project which have been revised by the Contractor's Record Drawings. The Contractor shall be responsible for providing all other drawings. The purpose of this manual is to provide one comprehensive document which illustrates and describes all the electrical equipment and instrumentation installed in the plant. The manual shall include but not be limited to drawings and specifications for the following items as applicable to this project:
1. Motor Control Centers and all related controls, protection and appurtenances.
 2. All electronic controls and all appurtenances.
 3. Instrumentation devices and telemetry equipment.
 4. Heating/Ventilating/Lighting equipment furnished under this Division.
 5. Thermostats.
 6. Electrical panel schedules and modifications to existing electrical equipment.
 7. Solenoid valves.
 8. Disconnects.
 9. Level Controllers/Float Controls.
 10. Motor starters, variable frequency drives, reduced voltage starters and similar equipment.
 11. Programmable Logic Controls (PLCs) and any other computer devices and their related peripheral equipment.
 12. Commented and annotated software listings of any software or programs developed under this Division uniquely for this installation.
 13. Commented and annotated documentation of any programmed set points or programmable setup parameters for any programmable equipment (for example, chart recorders, VFDs, instrumentation, telephone dialers, etc.).
 14. All electrical control panels supplied by equipment manufacturers.

15. All other electrical equipment or instrumentation, whether provided by the Electrical Contractor or not.
 - D. The manual shall be assembled in one or more white 3-ring binder notebooks with "D" style rings, each vinyl covered with a clear vinyl pouch on the outside spine and front to receive a cover title. Contractor shall insert printed spine and cover title sheets to match font style and size of the rest of the plant O&M manual set. Coordinate with the General Contractor.
 - E. The information contained in the manual shall be grouped in an orderly arrangement by category. It shall have a typewritten index and divider sheets between categories with identifying tabs.
 - F. The information included must be the exact equipment installed, not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets. Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by the equipment supplier are not acceptable.
 - G. It shall contain all information presented in the post bid equipment submittal in addition to: shop drawings, equipment wiring diagrams, operating and maintenance instructions, individual equipment operating and installation manuals, replacement parts lists, and equipment nameplate data for all equipment and systems installed under the project. Electrical and/or electronic equipment data shall contain step-by-step circuit description information and printed wiring diagrams designed to provide electronic service technicians with adequate information to diagnose and repair the components on each circuit board. Electrical and/or electronic equipment submittals shall contain step-by-step signal and control description information designed to provide maintenance personnel with an understanding of equipment operation in each mode of operation. Unit Control and Motor Control Center manuals shall be included with a complete functional description of operation in narrative form for each control center function.
 - H. Diagrams for each system shall be complete drawings for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless properly marked to indicate the exact field installation.
 - I. Manuals and documentation shall include calibration curves of every sensing device and a programming documentation sheet for every programmable device. The programming documentation sheet shall show the final operational value of every programmable parameter of every device. The purpose of this sheet is to provide maintenance personnel with a convenient source of information for programming the parameters of a replacement device should the old device fail.
 - J. Include all electrical devices provided under all Divisions. Coordinate with other Division Contractors.

1.013 INSTRUCTION OF OWNER EMPLOYEES

- A. Instruction of all electrical equipment shall be provided to insure proper use and care as well as firsthand operation of electrical equipment and components.
- B. Electrical Contractor shall provide one 8-hour working day of instruction to Owner designated personnel.

- C. The time for this instruction shall be scheduled shortly after start-up and at mutually agreed times. Contact Engineer for coordination.

1.014 TESTING

- A. Test the entire electrical installation to assure compliance with code and proper system operation.
 - 1. **Circuit Tests.** The Contractor shall test all wiring and connections for continuity and ground before any fixtures or other loads are connected. Tests shall be made with a 500 volt DC "Megger" type tester. If tests indicate faulty insulation (less than 2 megohms) such defects shall be corrected and tested again. Contractor shall provide all apparatus and material required to make tests and shall bear all expense of required testing.
 - 2. **Load Balancing.** Checks shall be made for proper load balance between phase conductors and make adjustments as necessary to bring unbalanced phases to within 15% of average load.
 - 3. **Ground Testing.** Measure the OHMIC value of the Electric Service Entrance metallic "System Ground" with references to "Earth Ground" using the "Multiple Ground Rod" method and suitable instruments. Maximum resistance to ground shall be less than 10 ohms. If this resistance cannot be obtained with the ground system shown, notify the Engineer immediately for further instruction. Certify in writing to the Engineer that the grounding test has been made and that the requirements of this portion have been met for the "System Ground".
 - 4. **Motor Tests.** Check all motors for proper rotation and for actual load current. Submit tabulation of motor circuits.
- B. Materials and instrumentation shall be provided by the Contractor.
- C. The Contractor shall notify the Engineer ten (10) working days prior to performance of any test.
- D. The Contractor shall certify in writing that the above tests have been completed and shall provide documentation of test data.

1.015 DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS AND CONTROLS

- A. At the point of substantial completion of the project, the Electrical Contractor shall provide necessary personnel to demonstrate the essential features of the following electrical systems:
 - 1. Service entrance equipment.
 - 2. (Via the Integrator) Motor Control Center and all related items such as controls, alarms, software, PLC and PC equipment, etc.
 - 3. Lighting system.
 - 4. Heating system.
 - 5. Ventilation.

6. Pumps, compressor, blowers, mixers, and related controls and alarm.
 7. Instrumentation
- B. Demonstrate each system once after all malfunctions have been corrected.
 - C. Time. Demonstration shall be held upon completion of all systems at a date agreed upon in writing by the Owner or his representative. This time shall be in addition to the instruction allowances provided.
 - D. Attending Parties. The demonstration shall be held by the Contractor and Electrical Subcontractor in the presence of the Owner or his designated representative, Electrical Engineer, Project Engineer, and the Equipment Manufacturer's representative.
 - E. Demonstration.
 1. Demonstrate by "start-stop operation" and "automatic operation", how to work the controls, how to reset protective devices or replace fuses, and what to do in case of emergency.
 2. All systems shall be exercised through operational tests in order to demonstrate achievement of the specified performance. Operational tests depend upon completion of work specified elsewhere in these Contract Documents. The scheduling of tests shall be coordinated by the Contractor among all parties involved so that the tests may proceed without delays or disruption by uncompleted work.

1.016 WARRANTY

- A. Warranty materials and workmanship for a period of one year from date of final acceptance for the project or through one entire system operating season if this exceeds year date.
- B. Provide written warranty for one year. Submit two written copies with Operation and Maintenance Manual.
- C. Warrantee includes all material and labor to repair or replace defective items within any system, and extends to material and labor required to repair adjacent surfaces disturbed by malfunction.
- D. Equipment, programming, and materials which do not achieve design requirements after installation shall be replaced or modified by the Contractor to attain compliance at no additional cost to the Owner. Following replacement or modification the Contractor shall retest the system and perform any additional procedures needed to place the complete system in satisfactory operation and attain design compliance approval from the Engineer.
- E. All panel lamps shall be guaranteed for 90 days. Guarantee will become effective only after substantial completion of the project.

1.017 ABBREVIATIONS

- A. The following is a list of abbreviations and terms most commonly used in the electrical industry.

A	Ampere		KV	Kilovolt
AC	Alternating Current		KVA	Kilovolt-Ampere
ATCC	Automatic Temp.		KV	Kilowatt
CC	Control Contactor		KWH	Kilowatt-Hour
AWG	American Wire Gauge		L	Lumen
BKR	Breaker		LV	Low Voltage
C	Conduit		Ma	Milliamp
CKT	Circuit		Max	Maximum
CT	Current Transformer		MC	Mech. Contractor
DB	Decibel		MCM	Thousand Circular Mils
DC	Direct Current		MECH	Mechanical
DFC	Down From Ceiling		Min	Minimum
DIAM	Diameter		MFR	Manufacturer
DPDT	Double Pole Double Throw		N	Neutral
ELEC	Electric, Electrical		OC	On Center
EC	Electrical Contractor		P	Pole
EMT	Electrical Metallic Tubing		PA	Public Address
EP	Explosion proof		PF	Power Factor
FA	Fire Alarm		PVC	Polyvinyl Chloride
FC	Footcandles		RI	Rough-In
FLR	Floor		SPST	Single Pole Single Throw
HGT	Height		SW	Switch
HP	Horsepower		TELCO	Telephone Company
HPF	High Power Factor		TTB	Telephone Terminal Board
IC	Intercom		V	Volt
ID	Ionization Detection		VFY	Verify
JB	Junction Box		W	Watt
WP	Weatherproof			

- B. Reference is made to current editions and publications of the following technical societies, organizations or bodies:

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
NBFU	National Board of Fire Underwriters
NECA	National Electrical Contractor's Association
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protective Association
OSHA	Occupational Safety and Health Act
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
MFR	Manufacturer
NEC	National Electrical Code / National Board of Fire Underwriters' Publication (latest adopted edition with amendments).

- C. Definitions.

1. "Furnish" Deliver to the job site

2. "Install" To enter permanently into the project
3. "Provide" Furnish and install
4. "Contractor" The company responsible for accomplishing Division 16 work.

1.018 BASIC ELECTRICAL SYMBOLS

- A. See drawings legend.

PART 2 PRODUCTS

2.01 GENERAL

- A. General requirements for materials.

2.02 PRODUCTS

- A. All materials must be of the quality herein specified. All materials shall be new, of the best quality and free from defects. They shall be designed to insure satisfactory operation and operating life in the environmental conditions which will prevail where they are being installed.
- B. Each type of material shall be of the same make and quality. The materials furnished shall be of the standard products of manufacturer's regularly engages in the production of such equipment.
- C. Fixtures and equipment shall be current models for which replacement items or component parts are readily available. Unless otherwise provided, all electrical items used shall be substantially the same as items of manufacturer which, on the date of opening bids, have been in successful commercial use and operation for not less than one year in projects and units of comparable size. The right is reserved by the Engineer to require the Contractor to submit a list of buildings where they have been in operation, so that such investigation as may be deemed necessary may be made before approval.
- D. Capacities of all equipment and material shall be not less than those indicated.
 1. Accuracy. Unless otherwise specified, each individual instrument shall have a minimum accuracy of ± 0.5 percent of full scale and a minimum repeatability of ± 0.25 percent of full scale.
 2. Field Tests: The Contractor shall perform whatever tests as may be requested by the Engineer or as may be needed otherwise to demonstrate compliance with the Contract Documents.
 3. Calibration. The Contractor shall provide job site visits and services of a manufacturer's technical field representative for calibration, testing and startup of instrumentation and equipment as needed. All instruments and systems shall be calibrated after installation, in conformance with the component manufacturer's instructions. This shall provide that those components having adjustable features are set carefully for the specific conditions and applications of this installation, and that the components and/or systems are within the specified limits of accuracy. Defective elements, which cannot achieve proper calibration or accuracy, either individually or within a system, shall be replaced. This calibration work shall be accomplished by the technical field representatives of the System

- Supplier whom the Contractor shall require to certify in writing that for each loop or system all calibrations have been made and that all instruments are ready to operate.
4. Proof of Conformance: The burden of proof of conformance to specified accuracy and performance is on the Contractor using its designated System Supplier. The Contractor shall supply necessary test equipment and technical personnel if called upon to prove accuracy and/or performance, at no separate additional cost to the Owner, wherever reasonable doubt or evidence of malfunction or poor performance may appear.
- E. Nameplates. Each major item of equipment shall have the manufacturer's name, address, serial and model numbers on a plate securely attached to the item.
 - F. Conformance of agency requirements. Where materials or equipment are specified to be constructed and/or tested in accordance with the standards of the following agencies or organizations, the Contractor shall submit proof of such compliance:
 1. The Institute of Electrical and Electronics Engineers (IEEE).
 2. The National Electrical Manufacturer's Association (NEMA).
 3. The Underwriter's Laboratories, Inc. (UL).
 - G. All meters, instruments, and other components shall be the most recent field proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise specified to match existing equipment.
 - H. Analog measurements and control signals shall be electrical as indicated herein, and shall vary in direct linear proportion to the measured variable, except as noted. Electrical signals outside control panel(s) shall be 4 to 20 milliamperes dc except as noted.
 - I. Environmental. All instrumentation shall be suitable for operation if required, in the ambient conditions at the equipment installation locations. Heating, cooling, and dehumidifying devices shall be incorporated with the outdoor instrumentation in order to maintain it within its rated environmental operating ranges. The Contractor shall furnish and install all power wiring for these devices (e.g., heaters, fans, etc.). NEMA 4 rated enclosures shall be furnished in all general purpose areas, unless otherwise specified. Equipment and systems shall be designed and constructed for satisfactory operation and long, low maintenance service under the following environmental conditions:
 1. Control Room: Temperature range: 32 degF through 120 degF. Thermal shock: 1.0% (1.8°F) per minute maximum. Relative humidity: 100 percent maximum
 2. Remote Site: Temperature range: 0 degF through 135 degF. Thermal shock: 1.0% (1.8°F) per minute maximum. Relative humidity: 100 percent maximum
 - J. Protection. Materials and equipment delivered to the site shall be stored and protected in such a manner as to effectively prevent damage from climatic conditions, condensation, dust, physical abuse. A location shall be chosen which will not interfere with the operations of other contractors or the Owner. Storage and handling shall be performed in manners which will afford maximum protection to the equipment and materials. It is the Contractor's responsibility to assure proper handling and on-site storage of instrumentation and control equipment in accordance with the manufacturers'

2.03 COMPLETED SYSTEMS

- A. All the systems mentioned shall be complete in every detail except where specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

2.04 NAMEPLATE AND EQUIPMENT LABELS

- A. Provide nameplates constructed of plastic laminated material engraved through black surface material to white sub-layer. Exception: Emergency distribution system component labeling - white letters on red background.
- B. Service Entrance Label. Refer to appropriate section.
- C. Panelboard Labels. Refer to appropriate section.
- D. Receptacle Labels. Refer to appropriate section.
- E. Motor Starter and Disconnect Labels. Refer to appropriate sections.
- F. Special Equipment Outlet Labels. Refer to appropriate sections.

PART 3 EXECUTION

3.01 INSTALLATION AND WORKMANSHIP

- A. Materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer to conform with the contract documents.
- B. The installation shall be accomplished by workmen skilled in this type of work.

3.02 CUTTING OF BUILDING CONSTRUCTION

- A. Obtain permission from the Engineer prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills except where space limitations prevent the use of such drills.
- B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.03 EXCAVATION AND BACKFILLING

- A. Provide all necessary excavation and backfilling for installation of underground electrical facilities. Depth per code requirements or as shown.
- B. Determine location of all existing underground gas, water, sewer, telephone and electric lines. Locate accurately on ground surface and for depth of same before excavation. Uncover by hand digging. Contractor shall be responsible for any damage or interruptions to these utilities, caused by himself, and other costs incurred by these interruptions.

- C. Do not undermine footings or bearing walls.
- D. Use power digging equipment only in direction away from existing facilities.
- E. Exercise standard safety precautions in excavation near power cables by using insulated handles, rubber gloves and footwear, etc.
- F. Do not place backfill until installation to be covered has been tested, inspected and approved.
- G. Backfill beneath building slabs, areas to be paved, streets, or sidewalks: 3/4" maximum crushed rock, gravel or sand. Other areas may be backfilled with excavated earth that has all large rocks and foreign matter removed.
- H. Backfill in layers not to exceed 6 inches. Compact thoroughly.
- I. Dispose of all debris and surplus earth as directed by the Owner.

3.04 PAINTING

- A. Painting in general will be covered under another Division 9 of these specifications, except items furnished under this Division that are scratched or marred in shipment or installation and/or require custom painting.
- B. Install equipment with manufacturer's standard finish and color unless otherwise specified. Refinish any marred or oxidized items restored to manufacturer's factory finish.
- C. Required surfaces or equipment with no standard finish; clean off grease and scale. Restore to smooth finish. Give one coat of primer, two coats finish.
- D. Paint and color as selected by Engineer.
- E. All exposed conduits on painted walls shall be painted to match wall and trim colors. Painting to be in accordance with Item (b.) above. Conduit labels shall be neatly affixed and shall not be painted over.

3.05 CLEANUP

- A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, wiring devices, cover plates, light fixtures, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

3.06 WORKMANSHIP AND INSPECTION

- A. Workmanship shall be of the best quality and none but competent electricians shall be employed. All shall be under the supervision of a competent foreman. All completed work shall represent a neat and professional appearance.
- B. All work and materials shall be subject to inspection at any and all times by representatives of the Engineer.

PART 4 SPECIAL PROVISIONS

1.01 MEASUREMENT AND PAYMENT– City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16060 – GROUNDING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work consists of providing the complete grounding system shown on the drawings and specified herein. The requirements of all other sections of the specification are equally applicable to the work to be performed under this section.

1.02 GROUNDING SYSTEM

- A. This grounding specification is applicable to this and all other sections of the work. Provide all grounding systems and make connections mechanically secure and electrically continuous. Ground all line voltage electrical systems completely and effectively as required by code and as specified herein.
- B. Ground all raceway systems and equipment enclosures. Where not otherwise indicated, grounding conductor size shall conform to the most stringent of the governing codes.
 - 1. Ground the service and transformers in an approved manner.
 - 2. Provide grounding where indicated on the drawings.
 - 3. Grounding conductor connections shall be bolted except at inaccessible ground rods, buried ground conductors and reinforcing steel grounding conductor connections, where connections shall be brazed or crimped.
 - 4. Exothermic welded connections may be substituted for brazed connections subject to the Engineer's approval and demonstration on the project with actual test connections that the connections will be successfully made.
 - 5. Ground conductors, unless otherwise noted, shall be insulated and shall be run in conduit. In no case shall the grounding conductors be sized smaller than #12 AWG.
 - 6. Continuity of equipment ground shall be maintained throughout the entire raceway, cabinet and equipment enclosure system. Ground bushings and jumpers shall be used wherever normal conduit termination does not insure continuity. Where nonmetallic conduit is used for distribution or where direct burial cables are employed, install a green insulated equipment ground conductor with each circuit.
 - 7. Metal parts of lighting fixtures not otherwise grounded by bolted fastenings shall be bonded to conduit system with green ground wire. Receptacles shall be grounded to outlet boxes with green ground wire and machine screw.
 - 8. Motors and equipment shall be bonded to the equipment grounding system by a continuous green insulated equipment ground conductor run with each circuit through approved flexible conduit connections as permitted by code. Where flexible conduit size exceeds the code approved limits, provide a separate green grounding conductor inside each flexible conduit, bonded to the inside of the connection box and to the nearest accessible supply end conduit junction box.

9. Where concrete pad is provided for utility-furnished transformers, suitable grounding systems shall be provided under this section, including driven ground rods. Details on the drawings are to establish the general scope of work, but installation shall conform to the serving utility company requirements.

- C. Provide ground system as specified here and shown on Drawings.

PART 2 PRODUCTS

2.01 GROUNDING BUSHINGS/WEDGES

- A. On all feeders, install a grounding bushing with set screw connector.

2.02 CONNECTORS

- A. Cast, set screw or bolted type.

2.03 CONNECTONS

- A. Ground rod to ground conductor connections, exothermic weld process. Cadweld.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Grounding conductor connectors shall be made up tight and located for future servicing and to insure low impedance.
- B. The Grounding System shall comply with Article 250 of the N.E.C.
- C. All feeder and service raceways shall be grounded.
- D. All plug-in receptacles shall have the grounding stud connected to the insulated green equipment grounding conductor shown in all power system conduits.
- E. Connect all insulated green ground conductors on a grounding bus in the respective branch circuit panel. Provide a grounding bus in all existing panels which presently are not so equipped.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16120 – WIRE AND CABLE

PART 1 GENERAL

1.01 INTRODUCTION

- A. All wire and cable for electric circuits shall conform to the latest requirements for the current edition of the NEC and shall meet all ASTM specifications.
- B. Any requirements in this section shall be additional.
- C. Provide all wire and cable complete.
- D. Provide all wire appurtenances.
- E. Size as shown on drawings and/or in panel schedule or as required, if not shown otherwise.
- F. All wire and cable to be copper.
- G. No aluminum conductors are allowed except Electric Utility provided wire or unless specifically called out.
- H. Wiring size is generally standard AWG size. Branch circuit cross hatchings shown indicates minimum number of wires, without ground. Minimum size or as noted on plans, or panel schedules.

PART 2 PRODUCTS

2.01 WIRE

- A. Conductors shall be soft-drawn copper with insulation and outer covering as noted. Conductor sizes shall be standard American wire gauge sizes. Conductors No. 8 and larger shall be stranded. All control wiring below 12 gauge shall be stranded.
- B. Minimum branch wiring shall be No. 12, 600 volt and shall have color coded phase wires.
- C. #16 and lower AWG shall be type TFF or THHN 600 volt stranded.
- D. #14 through #10 AWG shall be type THW, THWN, or THHN 600 volt stranded conductor.
- E. #8 AWG and larger shall be type THHN or 600 volt stranded conductor.
- F. Conductors installed in underground conduits shall be THW, THWN or THHN as described above.
- G. Direct buried feeder and branch circuit cable shall be Type UF or USE as per NEC Article 338 and 339. Buried conductors shall normally be in PVC conduit. Direct buried conductors shall only be permitted upon prior approval by the Engineer.
- H. Contractor provided conductors between Utility Power source and meter base shall 0000-stranded aluminum THHN, THWN, or THHN-2.
- I. Conductors installed in the wiring channels or in ballast compartments of continuous row fixtures, and in raceway between junction box and recessed fixture to be RHH, 90 deg. C

(194 Deg. F) insulation. Do not reduce branch circuit conductor size below circuit protection in wiring channels. Other fixture wiring shall be Type "AF" or "SFF".

J. Wire size, insulation and manufacturer's name shall be clearly and permanently marked on conductor jacket.

K. Wire Color.

1. Wires shall be factory color-coded by integral pigmentation. Colored plastic tape permitted on #6 and larger where integral pigmentation impractical. Apply tape in spiral half-lap over exposed portions in manholes, boxes, panels, switchboards, and other enclosures.
2. Identify second system voltage conductors with different set of colors at all panels, disconnects, junction boxes and/or equipment with 3 ϕ power supply.

Conductor System Voltage	120/240	277/480	120/208
Phase A	Black	Brown	Black
Phase B	Red	Orange	Red
Phase C	Blue	Yellow	Blue
Neutral	White	Grey	White
Equip Gnd	Green or bare	Green or bare	Green or bare
Travelers	Grey or tan	Grey or tan	Grey or tan

2.02 CABLE

- A. Annealed copper in AWG and type as shown on drawings.
- B. All conductors shall have color coded pairs.
- C. Labels. All cables shall be labeled with a wire marker. The label shall be of the form "CBLXXX" where XXX is a unique number (for example: CBL132, CBL001, CBL567). The markers shall be permanently marked heat-shrink plastic, such as Kroy "Shrink Tube," or equivalent. All markers shall be shrunk to fit the cable with a manufacturer's approved heat shrinking device.

2.03 PULLING LUBRICANTS

- A. UL approved soap type only.

2.04 WIRE MARKERS

- A. Pre-marked, heatshrink type. All wires shall be marked. Each conductor shall be designated by a single unique wire number which shall be shown on all drawings. These numbers shall be displayed on all conductors at every terminal or termination using preprinted white wire markers with black numbers. The markers shall be permanently marked heat-shrink plastic, such as Kroy "Shrink Tube," or equivalent. All markers shall be shrunk to fit the wire with a manufacturer's approved heat shrinking device.

2.05 PULL WIRES

- A. Dry Location. #16 galvanized iron.

- B. Damp Locations, Under Slab, or Below Grade. #12 TW Copper or polypropylene pull rope.

2.06 WIRE CONNECTION AND APPURTENANCES

- A. Wire connections shall be made with pressure-type solderless connectors.
- B. Connections Between Aluminum and Copper. No aluminum is allowed.
- C. Oxide Inhibiting Compound. Alnox "UG", Idean "NOALOX", Penetrox "A".
- D. Inline Splicing Kits. 3M brand "Quick Splice", 5400 series.
- E. Waterproof Splicing. 3M Scotchcast.

PART 3 EXECUTION AND WORKMANSHIP

3.01 DELIVERY, STORAGE AND HANDLING

- A. Deliver to site in new standard coils or reels with approved tag denoting length, wire size, insulation type and manufacturer's name.
- B. Suitably protect from dirt, weather, and damage during storage and handling.

3.02 WIRE PULLING

- A. Do not pull wire until all work of any nature is completed which might damage insulation or fill conduit with foreign material. Conduits shall be clean and dry before pulling wire.
- B. Do not use mechanical means to pull #8 or smaller wires.
- C. Exercise care in avoiding injury to wire or insulation during pulling.
- D. Identify all wires or circuits with wire markers after pulling. For all control wiring and telemetering systems, wire markers in junction boxes and at solenoids shall bear same numbers as terminal blocks. Keep accurate up-to-date as-built records.

3.03 CIRCUITING

- A. Conduit may be routed at Contractor's best judgment unless directed otherwise. Home runs are diagrammatic for clarity, and may be grouped as desired. Size conduits accordingly with capacity for 25% fill. See Raceways this Division. All branch circuitry conduit shall have NEC sized ground provided.
- B. Any deviation in circuiting that is approved by the Engineer shall be recorded on as-builts and panel schedules in specifications.

3.04 SPLICING

- A. No splices or taps permitted in service or feeder circuits. Splices or taps in branch circuits permitted only in junction boxes where circuits divide.
- B. Splices to fixtures and equipment shall have a 6-inch minimum pigtail.

3.05 PULL WIRES

- A. Provide pull wires in all empty conduits for future use. Identify both ends with labels or tags reading "PULL WIRE" with a number for reference.

3.06 WIRE CONNECTION AND SPLICING

- A. Manufacturer's Instructions. Install connectors in strict accordance with manufacturer's instructions for specific conductor size, voltage and type of connection required.
- B. Insulation. Cover splices, joints and free ends of conductors with insulation equivalent to that of conductor, using insulating rubber tape and friction tape or plastic tape.
- C. Continuity. Where conductors are connected to metallic surfaces, remove any coating and polish surface. Remove lacquer coating of conduits where ground clamps are to be installed.
- D. Waterproof Splices. Waterproof splices and connections to fixtures and equipment as designated on drawings shall be Scotchcast, 3M or approved. Leave 18" pigtail for future splices.
- E. It is the responsibility of the electrical contractor to utilize proper protective tape as deemed by the equipment or motor and equipment temperature conditions, for a quality craftsmanship type job.
- F. No splices are allowed in control cables, telemetering or telephone cables above or below the ground unless in a junction box or control panel without permission from the Engineer.

3.07 ENCLOSURE SIGNAL AND CONTROL CIRCUIT WIRING

- A. Wiring installation: All wires shall be run in plastic wireways except (1) field wiring, (2) wiring run between mating blocks in adjacent sections, (3) wiring run from components on a swing-out panel to components on a part of the fixed structure, and (4) wiring run to panel-mounted components. Wiring run from components on a swing-out or front panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties, and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals. Signal and low voltage wiring shall be run separately from power and 120 V control wiring.
- B. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and secured to the inside face of the panel using adhesive mounts.
- C. Wiring to rear terminals on panel-mount instruments shall be run in plastic wireways secured to horizontal brackets run above or below the instruments in about the same plane as the rear of the instruments.
- D. Conformance to the above wiring installation requirements shall be reflected by details shown on the shop drawings for the Engineer's review.
- E. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be permanently marked heat-shrink plastic as described above.

3.08 ELECTRICAL TESTS

- A. Electrical insulation resistance tests for each of the following items shall be performed with respect to ground and adjacent cables.
1. All new switchboards, control wiring circuits, motor wiring circuits, panel boards and sub-distribution feeders from switchboards to panel boards.
 2. Perform continuity test to insure proper connection.
 3. Insulation resistance tests shall be performed at 1,000 volts D.C. for one-half minute.

MINIMUM INSULATION RESISTANCE	
Conductor of Circuit Size	Minimum Resistance
No. 14 and 12 AWG	1,000,000 ohms
25 - 50 ampere	250,000 ohms
51 - 100 ampere	100,000 ohms
101 - 200 ampere	50,000 ohms
210 - 400 ampere	25,000 ohms
401 - 800 ampere	12,000 ohms
Over 800 ampere	5,000 ohms

4. Insulation resistance shall in no case be less than following table.
5. These values are determined with all switchboards, panelboards, fuse holder, switches and overcurrent devices in place.
6. Test results shall be documented in an organized typewritten manner documented as "Insulation Resistance Test Report" and submitted to the Engineer in triplicate prior to acceptance.
7. Tests shall be done in the presence of the Engineer or his representative. Seventy-two (72) hour notice shall be given prior to testing.
8. Any circuit not meeting test requirements shall be replaced and retested until it meets test requirements.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 16130– RACEWAY AND BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide raceway system complete. All sizes shown on the diagrams shall be considered minimums. All sizes and lengths provided in the conduit or wiring schedules shall be considered minimums and estimates. Contractor shall be responsible for selecting sizes that will properly accommodate all wires and cables. Contractor should assume that not all conduits are shown on the diagrams or in the schedules.
- B. All project wiring, including cables, shall be in conduit unless otherwise noted herein or on drawings.
- C. Sizes as shown on drawings or as required, if not shown on drawings. Conduit shall be filled no more than 25%. Provide pull wires in all empty conduits for future use. Identify both ends with labels or tags reading "PULL WIRE" with a number for reference.
- D. Chases, openings, sleeves, hangers, anchors, recesses, equipment, pads of framing for fixtures provided under other divisions only if specified or shown. Otherwise, provided under this Division. In any event, this Division shall be responsible for correct size and location.
- E. Codes and Standards. NEC shall govern use and installation of conduit types. Standards for conduits shall be as defined by ANSI, Federal and UL specifications. Standards for nonmetallic per NEMA TC-2. Any requirements of this section shall be additional.
- F. Labels. Any raceway which is not wholly contained in one room and whose full length is not clearly visible shall be labeled at each end, junction, size change, or any other place where a label would clarify its identity. The label shall be of the form "CXXX" where XXX is a unique number (for example: C132, C081, C567). A unique number shall be used for each raceway and shall be displayed and noted on the Record Drawings. The labeling means shall be a machine printed nylon wrap-around wire-tie style tag made for the purpose of labeling pipe or conduit. Other means of labeling may be submitted to the Engineer for approval. Hand-written indelible ink labels are not acceptable.
- G. The electrical contractor shall furnish and install all plant raceways, including instrumentation and signal raceways. Contractor is responsible for furnishing and installing all circuits and raceways necessary for a complete, working system, whether or not they are shown or described in the contract documents. The Division 16 Electrical plans do not show all conduits and those that are shown are shown schematically (not necessarily in their correct, installed, positions). Contractor should verify all conduits' location and size by actual manufacturers' data. Contractor shall coordinate with other division contractors to make sure that raceways shall be installed in the proper places and shall be the proper sizes and materials. Electrical Contractor shall also connect all power conductors to 120V/240V/480V plant devices, including instrumentation meters and recording devices furnished under other divisions. Electrical Contractor shall connect all analog 4-20mA current loop signal circuits.
- H. Consult the contract drawings for additional information, including the use of stainless steel raceway in many locations. Special study should be given to the manufacturers' equipment plans to assure that appropriate conduits and conductors are installed so that all components are properly connected.

PART 2 PRODUCTS

2.01 RIGID GALVANIZED STEEL CONDUIT (RGS)

- A. Required in all concrete or block work unless otherwise specified. Required for all stub-ups. Required for all transitions from underground PVC when passing through concrete. Required in all outdoor areas or wet locations.
- B. Constructed to CSA C22.2 No. 45 rigid zinc coated steel.
- C. Rigid fittings to be galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Rigid fittings shall have the same coating system as the conduit bodies and used to manufacturer's specifications. Erickson couplings, watertight split couplings (OZ or equivalent) permitted.

2.02 ELECTRICAL METALLIC TUBING (EMT)

- A. Hot dip galvanized, electrogalvanized or sherardized, steel tubing. Permitted only in conditioned indoor locations or where specified.
- B. Couplings and Connectors. Raintight; steel or malleable iron type using a split corrugated compression ring and tightening nut or stainless steel locking disc. Indenter or set screw fittings shall only be acceptable in office and laboratory rooms.

2.03 PVC CONDUIT

- A. Schedule 40 rigid polyvinyl chloride type with ground wire. Generally required for all underground installations. Not permitted in any concrete or block work. Not permitted for stub-ups, even in protected areas (except power pole risers). Not permitted in attics.
- B. Pre-formed PVC elbows and fittings unless otherwise noted on drawings.
- C. PVC Conduit for Schedule 1 – Water System Improvements shall be of type as supplied and purchased from local PUD. PVC Conduit for Schedule 1 – Water System Improvements shall include all elbows nad fittings as required for installation.

2.04 RIGID ALUMINUM CONDUIT

- A. Permitted only in specified areas.
- B. Fittings to be copper free cast aluminum.

2.05 FLEXIBLE CONDUIT, DRY LOCATION.

- A. Galvanized flexible steel. Permitted only in specified areas. Generally, use PVC coated flex for all flex locations.
- B. Fittings galvanized malleable iron or steel, Thomas and Betts "squeeze" type or approved.

2.06 FLEXIBLE PVC CONDUIT, WET LOCATIONS

- A. Liquid Tight, PVC weatherproof for damp and wet locations.
- B. Fittings Thomas and Betts or approved.

2.07 SURFACE METAL RACEWAY

- A. Formed steel type, standard factory painted finish. Where choice of colors is available, consult Engineer for color selection.
- B. All hinged type raceways to have piano type hinges.
- C. Surface metal raceways only allowed where specifically called out on drawings, or unless prior approval by Engineer.

2.08 RIGID STAINLESS STEEL CONDUIT (SS)

- A. Solid stainless steel. Required in most outdoor environments or as specified.
- B. Fittings to be threaded stainless steel. Stainless steel Erickson couplings, watertight split couplings (OZ or equivalent) permitted so long as all components are of the same stainless steel alloy and are water proof.

PART 3 EXECUTION

3.01 CONCEALED WORK

- A. In general, install raceways concealed in construction except where shown otherwise on the Drawings or unless specifically approved by Engineer.

3.02 CLEAN & DRY

- A. Install conduit dry and free of debris using approved plugs or caps. Cap and securely support conduits prior to concrete pour.

3.03 ROUTING

- A. Conduit in general may be routed at Contractor's best judgment unless directed otherwise. All conduits in or under concrete floors shall be recorded on as-builts as distances from walls in feet or inches. Home runs are diagrammatic for clarity and may be grouped as desired.

3.04 RIGID GALVANIZED STEEL CONDUIT (RGS)

- A. All connections shall be watertight. Install RGS for all raceways in concrete or where subject to damage. Running thread or set screw type fittings not approved.
- B. Conduit in Slab.
 - 1. Minimum 3" concrete cover. Space not less than 8" on center and as wide as possible where converging at panel, etc.
 - 2. Do not interfere with placement of reinforcing steel. Place conduit between upper and lower layers.
- C. Expansion Joints. Install offset or sliding type where embedded conduits cross building expansion joints. Sliding type to have bonding strap and clamp.
- D. Floor Stub-Ups - Accessible Floor Areas. Install rigid conduit with threaded coupling set flush with finished floor. Seal with flush, threaded pipe plug.

- E. Raceways that stub-up above floor: Install at such depth that the exposed raceway is vertical and no curved section of the elbow is visible.

3.05 RIGID ALUMINUM CONDUIT

- A. Do not install aluminum conduit in earth, cinders or concrete.
- B. May be used in lieu of steel where conduit is run in attics or above suspended ceilings where not subject to physical damage.
- C. Not allowed where attached to concrete or masonry. Not allowed where other adjacent metals might electrolytically react with the aluminum.

3.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Install for wiring in frame construction and for wiring in furred ceilings and above suspended ceilings. May be used for exposed work in unfinished areas where not subject to damage, but only upon prior approval by the Engineer.

3.07 PVC RACEWAYS

- A. Use of PVC outside of building 5' and beyond. See Plans for Special Applications.
- B. All bends shall be manufactured. Site-made heat bends may be approved by the Engineer on a case by case basis.

3.08 FLEXIBLE CONDUIT

- A. Provide flexible raceway connection to motors and equipment subject to vibration with 90 degrees loop minimum to allow for isolation. Use liquid tight. Provide bonding jumper when required by code.

3.09 SURFACE METAL RACEWAYS

- A. Install parallel to a building surface (i.e., wall, ceiling, floor). Fasten to surface as recommended by manufacturer. Mount so raceway is in the least visible location. Allowed only upon prior approval by Engineer.

3.010 UNDERGROUND CONDUIT

- A. Install with minimum cover of 36" over PVC and 30" over (RGS) finished grade.
- B. Install underground marking tape. Bury 6-8 inches below grade, directly above conduit.
- C. Install with 3" per 100' downward slope from buildings or section high points toward junction boxes, which are to be provided with drainage facilities.
- D. Cap off watertight all conduits stubbed out for future use. Place #12 TW pull wire with tag at both ends.
- E. Call for inspection prior to backfilling of any trenches, concrete pours containing conduits, and/or covering of conduits. Give a minimum of 48 hours notice prior to cover up.
- F. Keep an accurate up-to-date location record of all underground and under floor conduits with dimensions from wall lines parallel and perpendicular.

- G. Underground Marking Tape for all Underground Electrical and Telephone. 6" wide, yellow, low density polyethylene, 4-mil thickness. Imprinted with "CAUTION - STOP DIGGING - BURIED ELECTRIC LINE BELOW" and current date. Somerset "Protect-A-Line". Tape for telephone, network and signal line similar except green. All underground wiring and cabling shall be in conduit.

3.011 RACEWAY BENDS

- A. Conduit Bending. Bends in 1" size and larger shall be factory ells or made with manufactured mechanical bender. All entry ells shall be long radius type.

3.012 BUSHINGS

- A. Factory insulated.
- B. All panels, junction boxes and metal raceways shall have bushings when entered or exited by a conduit of any type.

3.013 RACEWAY SUPPORT DEVICES

- A. All hardware such as inserts, straps, bolts, nuts, screws and washers shall be galvanized or stainless steel. No cadmium plated steel shall be allowed.
- B. Trapeze Hangers, Channel. 1-1/2" x 1-1/2" galvanized or stainless, 12 gauge. Kindorf.
- C. Rods. Minimum 3/8" diameter.
- D. Beam Clamps. Hardened point set screws. Compatible with structural members.
- E. Pipe Strap. Approved type. Perforated plumbers tape not acceptable.

3.014 RACEWAY SUPPORT AND INSTALLATION

- A. Support conduits at intervals not greater than 10' and within 3' of any fitting, outlet or junction box, or cabinet, or as required by the NEC.
- B. Secure single runs with pipe strap.
- C. Hollow Masonry. Galvanized or stainless toggle bolts.
- D. Concrete, Solid Masonry. Expansion shields and galvanized or stainless machine screws or standard preset inserts.
- E. Metal Surfaces. Galvanized or stainless machine screws or bolts.
- F. Wood Construction. Galvanized or stainless wood screws, or galvanized J-Nail.
- G. Suspended from Ceiling. Pipe hanger and rod.
- H. Damp Locations. Install clamp backs under each clamp on exposed surface conduits to prevent moisture accumulation.
- I. Support multiple runs with trapeze hangers where conduits run exposed and parallel. Attach to structure with hanger rod as follows:

1. Steel Members. Galvanized or stainless beam clamps.
 2. Concrete. Concrete inserts set flush with surface, insert reinforcing rod through insert opening where provided.
 3. Wood Framing. Ceiling hanger flange, galvanized or stainless wood screws.
- J. When more than two conduits would use the same routing, group together on a patented channel support system (such as Unistrut).
- K. Damp Locations. Install clamp backs under each clamp on exposed surface conduits to prevent moisture accumulation.
- L. Run all exposed conduits parallel and plumb to structure lines. In building interior locations, conduits shall be concealed in walls or ceilings wherever possible and exposed work shall run parallel to building lines. Conduits shall not be routed on floors in areas subject to foot traffic. In exterior locations conduit shall be routed below grade. Where concrete or asphalt slabs exist they shall be saw cut, conduits installed, and the cut repaired to original condition. Exposed conduits and/or raceway shall be installed perpendicular or parallel to building lines.
- M. Maintain 6" minimum separation from hot water lines. Do not run conduit beneath boilers or heating units.

3.015 SEALING OF RACEWAY PENETRATION

- A. Exterior Wall Surfaces Above Grade. Seal around all penetrations with caulking approved by Engineer. For concrete construction above ground level, cast raceway in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement.
- B. Exterior Surfaces Below Grade. Cast raceway into wall (or floor) or use manufactured seal assembly (such as OZ type "FSK") cast in place.
- C. Roofs. Provide mopped, lead, roof jack where raceway penetrates roof membrane.

3.016 SEALING OF RACEWAYS

- A. All conduits to and from hypochlorite generation room shall be sealed on both ends. Pack tightly around conductors in raceway. This includes all light fixture boxes, receptacle boxes, heater junction boxes and chlorinator junction boxes.
- B. Both ends of conduits to and from reservoir control boxes shall be sealed on both ends.
- C. Seal interior of all raceways which pass through building roof or through outside walls of the building, above or below grade. Seal on the end inside the building, using duct sealing mastic, non-hardening compound type, specially designed for such service. Pack around the wires in the raceways.
- D. For exterior wall penetrations below grade, install OZ type "CBS" sealing bushing at interior end of penetrating raceway. Threaded fittings only are permitted in entering raceways ahead of the sealing bushing.
- E. Appropriate sealing devices such as "EYS" series fittings shall be used where hazardous locations exist as classified by NEC.

3.017 CLEANUP

- A. At time of final cleanup, thoroughly clean all raceways of any debris. This includes wire ends and pieces of insulation.

3.018 PAINTING

- A. All exposed conduits on painted walls to be painted to match wall and trim colors.
- B. See Basic Methods this Division.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 16131 - OUTLET AND PULL BOXES

PART 1 GENERAL

1.01 PROVIDE AS NEEDED OR SHOWN ON DRAWINGS

- A. Provide outlet and pull boxes as required to enclose devices, permit pulling conductors and for wire splices and branches.
- B. Provide all outlet and pull box appurtenances.

PART 2 PRODUCTS

2.01 OUTLET AND PULL BOX SIZES

- A. Flush wall switch or receptacle to be 4 inch square, 1-1/2 inches or more deep, with single or two gang plaster ring mounted vertically except where noted to be mounted horizontally such as possibly counter back splashes. Where three or more devices are at one location, use one piece multiple gang box, with suitable plaster ring. Install not more than one device per gang unless otherwise noted on the plans.
- B. Wall bracket and ceiling surface mounted lighting fixture outlet to be 4 inch octagon, 1-1/2 inches deep with 3/8 inch fixture stud where required. Wall bracket outlet to have single gang plaster ring.
- C. Surface outlets where exposed conduit is allowed, to be same as flush outlet boxes without plaster ring but with cadmium or galvanized device plate.
- D. Junction boxes for branch circuits to be not less than 4 inch square, 1-1/2 inches or more deep. Boxes with 1 inch conduit terminating in same, to be 4-11/16 inches square.
- E. Liquid tight outlet and junction boxes to be 4 inches square, 1-1/2 inches or more deep and be fitted with neoprene gaskets. Outlet and junction boxes in filter room shall all be liquid tight.
- F. Liquid tight PVC junction boxes shall be "Carlton" high impact gasketed PVC molded box with screwdown cover and stainless steel screws. Catalog No. E989R or equivalent. Exterior junction boxes may be PVC or galvanized as directed by Engineer.
- G. Exterior exposed and equipment mounted junction boxes shall be cast electro galvanized, gasketed and painted to match equipment. Exterior junction boxes may be PVC or galvanized as directed by Engineer.

2.02 GREATER THAN 150 VOLTS

- A. Device boxes containing multiple devices for system rated over 150 volts to ground are permitted only with steel barrier manufactured especially for the purpose of dividing the box into separate compartments for each device having exposed live parts.

2.03 IN CEILINGS

- A. Junction or pull boxes in suspended ceilings shall be supported from structure independently from ceiling suspension system.

2.04 OUTLET BOX GROUNDING

- A. All flush outlet boxes serving receptacles (12-V or more) shall be equipped with a green grounding screw.

2.05 DEVICE BOXES CONTAINING EMERGENCY AND NORMAL DEVICES.

- A. Permitted only with steel barrier manufactured especially for the purpose of dividing the box into two completely separate compartments.

2.06 DEVICE BOXES CONTAINING POWER AND TELEPHONE OR TELEMETERING.

- A. Permitted only with steel barrier manufactured especially for the purpose of dividing the box into two completely separate compartments.

PART 3 EXECUTION

3.01 PLUMB, SQUARE

- A. All boxes to be fastened securely in place at the proper depth plumb with equipment, walls and fixtures for proper installation of switches, outlets and covers.

3.02 HARDWARE

- A. All conduits shall be secure and attached to boxes with proper hardware.

3.03 REMOUNT

- A. All boxes not meeting the above requirements shall be removed and remounted as directed by the Engineer or his representative.

3.04 FLUSH WITH WALL

- A. Except for surface mounted boxes or boxes above accessible ceilings, all boxes shall have flush edge (box or plaster ring) even with the finished surface of the wall or ceiling.

3.05 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

- A. Provide as shown and/or specified. Provide templates, where required, to other trades for drilling and cutting to insure accurate location of electrical fixtures (outlets and devices). Provide all wiring, devices, plates and connections as required by said fixtures.

3.06 CONNECTION TO EQUIPMENT

- A. Furnished under this or other Divisions of the specifications, or by others. Provide outlet boxes of sizes and at locations necessary to serve such equipment. Outlet box required if equipment has pigtail wires for external connection, does not have space to accommodate circuits wiring or requires a wire different from circuit wiring used. Study equipment details to assure proper coordination.

3.07 BLANK COVERS

- A. Provide blank covers or plate over all boxes that do not contain devices or are not covered by equipment.
- B. No blank outlet and pull boxes will be allowed in finished walls or ceilings without permission from the Engineer.

3.08 LIGHTING FIXTURE BOXES

- A. In ceilings of acoustical material. Locate in accordance with approved ceiling layout plans and so that fixtures replace full size ceiling tiles wherever possible.

3.09 ELECTRICAL OUTLETS

- A. Coordinate the work of this Section with the work of other sections and trades. Study all drawings that form a part of this contract and confer with the various trades involved to eliminate conflicts between the work of this Section and the work of other trades. Check and verify outlet locations indicated on Architectural drawings, door swings, installation details and layouts of suspended ceilings and locations of all plumbing, heating and ventilating equipment.
- B. Centered on Built-in Work. In the case of doors, cabinets, recessed or similar features, or where outlets are centered between two such features, such as between a door jamb and a cabinet, make these outlet locations exact. Relocate any outlets which are located off center.
- C. Vertical and Horizontal Relationships. Where more than one outlet is shown or specified to be at the same elevation or one above the other, align them exactly on centerlines horizontally or vertically. Relocate as directed all such outlets (including lighting, receptacle, power, signal and thermostat outlets) which are not so installed, at no additional cost to Owner.
- D. Device Outlet Height. Measure from the finished floor to the centerline, unless otherwise noted.
- E. Switches: 4 feet, set vertically
- F. Receptacles: 12 inches, set vertically or as indicated
- G. Other: As shown on the plans or as directed by Engineer
- H. Ceiling Location. For acoustical material locate outlet either at the corner joint or in the center of a panel, whichever is closer to the normal spacing. Locate all outlets in the same room in same panel position.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 16140– WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

- A. Work consists of providing and installing switches, receptacles, and other devices shown on the drawings and specified herein.
- B. Furnish and install wiring devices of number, rating and type shown on drawings or called out in these specifications.
- C. Devices to include appropriate outlet box, cover, wall plate and other necessary installation materials for a complete and satisfactory operation system.
- D. In general, all devices shall be by one manufacturer unless specifically called out otherwise in these specifications or on drawings.

PART 2 PRODUCTS

2.01 APPROVED DEVICES

- A. Manufacturer's with equivalent devices meeting specifications. Bryant, Hubbell, Arrowhart and Leviton. Numbers have been listed as to style, grade and as a guide.
 - 1. Wall Switches. Heavy duty AC quiet type, Federal Specification W.S. 896 (de).
 - a. Single Pole. Hubbell; 20 amp, 120/277 VAC.
 - b. 3 Way. Hubbell; 20 amp, 120/277 VAC.
 - c. 4 Way. Hubbell; 20 amp, 120/277AC.
 - 2. Receptacles. Heavy duty AC, Federal Specification WC-596a.
 - a. Single. Hubbell; 20 amp, 125VAC.
 - b. Duplex. Hubbell; 20 amp, 125VAC.
 - 3. Combination Devices.
 - a. Combination Switch and Receptacle. Hubbell; 20 amp 125VAC receptacle and switch.
 - b. Two Single Pole Switches. Hubbell; 20 amp, 120/277VAC.
 - 4. Groundfault Interrupter Receptacle.
 - a. Duplex Receptacle, Hubbell 20 amp, 125VAC, GF15 Series.
 - 5. Cover Plates.
 - a. Nonconductive smooth plastic. All switches and dimmers to be gauged and covered by one plate. All wall plates to be standard size and meeting Federal specification WW-455A noncombustible, supplied with

metal mounting screws matching color of plate. Hubbell NP Series - match existing. All switches and devices shall be ganged wherever possible.

- b. Engraved Device Wall Plates. Unless shown otherwise, provide engraved plates for panels and devices. Letter height shall be 3/16" (minimum), color of filling to be white or black, as appropriate for contrast. Before ordering, submit a sample of the above wall plate with engraving. A name plate schedule will be supplied by Engineer at the time of submittal.
- c. Weather Resistant (WP) Cover Plates. Hubbell; self-closing HBL5221, provide appropriate gasket to box.
- d. Telephone and TV Cover Plates. Hubbell; NP737 - 5/8" hole.
- e. Cover plates in unfinished areas and where exposed conduit is used.
 - 1) Raised galvanized to be used in unfinished areas or where conduits run exposed. Labeling of switch shall be by Melamine Plate attached to cover plate. Verify areas with Engineer prior to installation of cover plates.

2.02 PLUG MOLD

- A. Provide plug mold for surface mounting as shown on drawings, with proper number of receptacles as shown. All plug molds to be grounded. Submit plug mold with wiring devices.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Devices and finish plates shall be installed plumb with building lines.
- B. Finish plates and devices shall not be installed until final painting is complete. Scratched or splattered finish plates and devices will not be accepted.
- C. Wall mounted receptacles shall be installed vertical 48" above floor, or as shown.
- D. Receptacles shall be checked for line to neutral, line to ground and neutral to ground integrity.
- E. Install GFI receptacle circuits at all locations.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16410– ENCLOSED SWITCHES AND BREAKERS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide all disconnects, fused and unfused, required by code for equipment furnished under this and other Divisions of these specifications.

PART 2 PRODUCTS

2.01 DESCRIPTION

- A. Switch shall be heavy duty type, shall be quick-make, quick-break and shall be horsepower rated. Switch shall have copper blades as required to open all ungrounded conductors and shall be single throw unless noted.
- B. Enclosure shall have interlocking cover to prevent opening door when switch is closed. Interlock shall include a defeating scheme.
- C. Enclosure shall be suitable for location in which mounted.
- D. Fusible disconnects shall be as above with addition of fuse space and clips to accept only Class R fuses.
- E. Enclosure shall have provisions for a padlock.
- F. Labels.
 - 1. All labels shall be laminated plastic and attached directly to the cover.
 - 2. Include the following information on the labels: Load served, proper voltage and phase.
- G. Disconnects shall be:
 - 1. Minimum 600 VAC, 100 amp rated.
 - 2. NEMA Type 12.
 - 3. Non-fusible.
 - 4. Three pole or two pole as needed, with neutral
 - 5. Surface Mounted
 - 6. Siemens Catalog Number HNF series; or approved equal.
- H. Disconnects shall be provided at all motor locations where the load is remotely located from the room the breaker panel is located in. Manufacturer provided equipment shall come already equipped with disconnects.

PART 3 EXECUTION AND WORKMANSHIP

3.01 MOUNTING

- A. Secure solidly to wall or approved mounting frame. Disconnects supported only by raceway are not acceptable.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16411– FUSES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide all fuses as required. Fuses shall be UL Class R rejection type with characteristics noted below unless otherwise noted in the diagrams.

PART 2 PRODUCT

2.01 DESCRIPTION

- A. Fuses. All fuses shall be current limiting type unless specified otherwise. Class K1 for all except motor circuits; Class K5 motor load type for motors. Provide 10% spare fuses, but not less than ten (10) of any one size and type.
- B. Provide a laminated plastic label and attach directly to the cover of fused enclosures.

PART 3 EXECUTION

3.01 DESCRIPTION

- A. Fuses. Install in all fusible devices provided under this contract.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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SECTION 16420 – ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide a complete control system, including, PLC, HMI, relay controls, radios, and running software in a single enclosure.). Provide programmable logic controller (PLC) along with manuals, cables, O&M manuals, etc., to implement the control system.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. The PLC shall be by, Allen Bradley, Compactlogix based system. PLC shall utilize Ethernet LAN connections for communication. Processor shall have sufficient memory and tags to control all of the existing WWTP functions.
- B. Processor shall be sized to allow other existing Plant I/O to be added in the future to bring all existing items into the SCADA system. I/O cards shall be provided based upon contract drawings and site inspection of other processes.
- C. PLC shall mimic the existing control conditions of the relays and timers for the Parkson Biolac blower and rake controls.

2.02 COMPONENTS

- A. Provide all equipment shown on the contract drawings.
- B. Provide loop isolators as may be required, whether shown on the drawings or not.
- C. Laminated nameplates shall indicate all controller operations and shall label all panels and enclosures. See the electrical drawings for the ID tag schedule.
 - 1. Panel Nameplates. Material shall be laminated plastic fastened to the panel with stainless steel screws. Letters ½" white on black background.
 - 2. Component Nameplates. Material shall be laminated plastic fastened by adhesive. Letters 3/16" white on black background.
- D. Stainless Steel Equipment ID Tags shall identify miscellaneous equipment. See the electrical drawings for the ID tag schedule. Devices shall be tagged with engraved or embossed stainless steel tags attached by stainless steel beaded chain.
- E. All painting shall be in a first class craftsmanship manner. Paint finish shall be smooth and free from rough surfaces such as sand, dust and scratches.
- F. Panels arriving to job site shall be inspected for scratches, dents, etc. Any panel found unacceptable shall be returned to panel manufacturer for repainting at panel suppliers and manufacturer's expense.
- G. A panel mounted MOV surge protector shall be installed to protect all electronics.

2.03 CONTROL PANEL

- A. Control panel shall house all VFD's, PLC, HMI, relays, terminal strip, power supply, DIN Rail, HOA switches, Lock out safety switches and wiring necessary to control (3) 50 hp blowers, 4 rakes, (20) 4" actuated valves, (4) 6" modulating valves, (4) 6" air flow meters, and (4) DO sensors. Only half of the items will be installed at this time, except the blowers.
- B. Enclosure shall be Nema 12 with fans and filters
- C. Line reactors and breakers shall be included for VFDs.
- D. A backup UPS shall be provided
- E. Enclosure shall have an internal light.
- F. A primary disconnect shall be provided to remove all power to the control panel.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Integrator shall:
 - 1. Work with Contractor to provide instruments for proper mechanical mounting
 - 2. Connect DO Sensors and program operation
 - 3. Connect Pressure Transducers, Valve Actuators, and Flow sensors into the Control Panel.
 - 4. Reconnect existing rakes and blowers into new system.
 - 5. Program the control panel for all operation.
 - 6. Set up screens on HMI and configure for SCADA integration.
- B. Contractor shall be responsible for all other support of the Integrator. Electrical connections and electrician services can be provided by the Contractor or Integrator within the contract to the City. Contractor is responsible to ensure that the complete air piping and efficiency upgrades are working and acceptable to the Owner.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16421 – PLC, HMI, AND SCADA PROGRAMMING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Complete System. The Integrator shall provide a complete, functioning, finished control system, including ladder logic programs for the PLC, custom designed operator interface screens for the HMI, and a tags memory space in the PLC for transferring status and alarms. The finished work shall be operator-friendly and acceptable to the Engineer and Customer.
- B. The Integrator shall be the City Integrator of Record, The Automation Group, Inc. www.tag-inc.us.
- C. The Contractor shall, at minimum, procure programming services from the Integrator. Instrumentation may be purchased from the Integrator. Control panels must come from the Integrator or from a Primary Process supplier for extended aeration treatment lagoons as manufactured by Parkson, Corp or Bioworks, Inc.
- D. Integration services shall be purchased by the Contractor. All charges by the Integrator shall be included in the bid price.

1.02 WORK INCLUDED

- A. Program the PLC and all PLC modules.
- B. Program the HMI.
- C. Produce a basic user's manual.
- D. Program a fully operational primary treatment SCADA system, with expandability to take on additional wastewater treatment plant functions.

1.03 RELATED DOCUMENTS

- A. Division 17 – Operating Strategy

PART 2 PRODUCTS

2.01 PURCHASED MATERIALS

- A. The Contractor shall supply all cables, manuals, etc., necessary for the completion of the work.

2.02 PLC SOFTWARE

- A. PLC software shall be RSLogix 5000 Standard by Rockwell Automation, w/ Ladder logic language.

2.03 HMI SOFTWARE

- A. HMI Development software shall be RSView Studio by Rockwell Automation with the full development suite package bundle.

2.04 SCADA SOFTWARE

- A. SCADA software package shall be obtained from the City Integrator of Record. The Integrator shall provide software and any computer equipment necessary to set up SCADA servers and workstations. The SCADA software shall be capable of controlling the water and wastewater treatment systems.

2.05 HISTORICAL TRACKING SOFTWARE

- A. Historical tracking software shall be obtained from the City Integrator of Record.

PART 3 EXECUTION

3.01 DELIVERED DOCUMENTATION

- A. Provide (2) binders, each containing the following:
 1. CD w/ copies of all the files developed under this section
 2. Control Manual, describing how to use the controls and a listing of alarm messages and their meanings w/ troubleshooting tips.
 3. PLC ladder logic listings, fully annotated and commented.
 4. HMI screen shots and configuration listings.
 5. Autodialer configurations and manual.

3.02 HMI OPERATIONS

- A. Operator Interface Terminals (HMI). The HMIs shall display information in a graphic, pictorial, format. Status and set-point screens shall be available by intuitive screen navigation buttons.
- B. Processes Monitored. The PLCs shall be programmed to monitor and display on the operator interface terminal wet well levels, alarms, tank levels, pressure readings, valve actuator positions, effluent quality, motor status, and other conditions typically required by a wastewater operator.

3.03 PLC OPERATIONS

- A. General. The PLC shall be programmed to automatically resume plant operations after a power interruption and to bring all plant loads online in a sequential fashion so as to prevent high peak power loading. This timed startup shall be executed on each load that has its MCC selector switch set to AUTO (or REMOTE). Loads which are in HAND or MANUAL shall not be under PLC control. The PLC shall keep track of running time of all monitored loads and present that information on appropriate HMI screen(s) even if there is a physical elapsed time meter connected to the load. Each load that is running in AUTO (or REMOTE) and is therefore under PLC control shall be automatically stopped if the PLC detects a loss of phase or overload.

3.04 PLC ALARM FUNCTIONS

- A. General. The PLC shall monitor the status of the motors and equipment and report phase loss failures, overloads, failure to run, high or low wet wells, power outages, last motor is running, overflow, loss of standby motor, etc. When an alarm condition is detected the PLC shall display the alarm status screen on the HMI, turn on the horn (if available) and the ALARM light.
- B. Scope. Alarms shall be processed for all pertinent inputs available to the PLC.

3.05 COMPLETE SYSTEM

- A. This Division contains a rudimentary description of the PLC, HMI and PC software. The Contractor shall be responsible for designing a complete software system that is documented, operator-friendly and acceptable to the Customer and Engineer.

END OF SECTION

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SECTION 16424 – VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 SCOPE

- A. Provide variable frequency drives (VFDs) for devices as indicated on drawings or other Sections of Specifications. Locate as per drawings.

1.02 CODES AND STANDARDS

- A. The Drive manufacturing facility shall be ISO 9002 certified.
- B. The VFD shall be UL listed.

1.03 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are Allen Bradley Powerflex 70.

1.04 SUBMITTALS

- A. The Variable Frequency Drive proposed for this Section must be pre-approved through the pre-bid submittal process as outlined in Section 01300.

1.05 TESTING AND QUALITY ASSURANCE

- A. All printing circuit boards shall be completely testing and burned-in before being assembled into the completed Drive. The Drive shall then be subjected to a preliminary functional test, minimum one hour burn-in and computerized final test. The burn-in shall be at 104°F, at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation.
- B. Drive manufacturer shall conduct complete electrical testing, component x-ray, component decap or delamination and failure analysis by qualified individuals in the case of drive component failure.

PART 2 - PRODUCTS

2.01 DRIVE GENERAL REQUIREMENTS

- A. The adjustable frequency controller shall be microprocessor-based, pulse width modulated design with switching logic power supply operating from the DC bus. The controller shall produce an adjustable AC voltage/frequency output so to vary the speed of the driven equipment. User Interface shall be common for all horsepower ratings The controller shall consist of the following sections:
 - 1. The controller switching frequency shall be adjustable and permit standard operation at 5,000 Hertz or less. The switching technology shall also include a scheme specifically design to reduce the dv/dt of the output supply.
 - 2. The controller shall be equipped with a minimum of three percent DC bus reactor or input line reactor.
 - 3. The controllers' solid state converter input rectifier devices shall have a 1600 volt PIV rating.

4. The controller shall have an overload rating of 110% variable torque, 150% constant torque for one minute.
5. RMS harmonic content of output current shall be less than five percent of fundamental current.
6. Controller shall be able to withstand repeated output terminal line-to-line short circuits without component failure.

2.02 ENCLOSURE

- A. Each variable frequency drive shall be provided with a free floor standing or wall mount enclosure with front access, suitable for mounting all components required of a given unit. Enclosures shall be provided to meet NEMA /UL type 1 or NEMA / UL type 12 as specified.
- B. Each drive may alternatively be mounted in a single control cabinet with UL approved partitioning from low voltage control circuits.
- C. Enclosure / cooling fans and filter ratings.
 1. Each enclosure shall provide adequate cooling for the components within and shall include positive ventilation. On NEMA / UL type 12 enclosures, all filters shall meet the strict requirements of UL certification for type 12 enclosures. NEMA 12 enclosures with NEMA 1 filters are not acceptable.
 2. All enclosures shall be equipped with a fan control scheme to reduce filter maintenance, increase fan life, decrease audible noise and save energy. This is to be accomplished by employing a control relay to disable enclosure fans when drives are not in run mode.
- D. Each enclosure shall include a pad-lockable circuit breaker.
- E. Each enclosure door shall have a mounted operator interface / digital keypad and display.
- E. Nameplates for identification of equipment and operating functions shall be included on cabinet door as specified.

2.03 CONTROLLER

- A. Environment
 1. The controller's operating criteria shall be in accordance with the following.
 - a. Operational ambient temperature range, 0°C to 40°C. Storage ambient temperature range: -40° C to 70° C (-40° to 158°F). The relative humidity range is 5% to 95% non-condensing.
 - b. Operational humidity, up to 90 percent non-condensing.
 - c. Altitude, below 3,300 feet above sea level
 - d. De-rating values for operation above 3,300 feet.
 - e. Nominal frequency, 60 Hertz plus or minus 3 Hz.
 - f. Shock: 15G peak for 11ms duration.

- g. Vibration: 0.152 mm (0.006 inches) displacement, 1G peak
- h. Efficiency, 97.5% percent at full speed and full load. (Reduced efficiency of 6.5 for low harmonic options.)

B. Input Power

1. The drive(s) shall be supplied as 6 or 18 pulse in configured packages. Nominal voltage, 480 volts plus ten percent or minus five percent, 3-phase, 3 wire. The controller shall include an under-voltage feature to permit trip-free operation down to 35 percent under-voltage.
2. Displacement power factor for 6 and 18 pulse converters shall be limited to between 1.0 and 0.95, lagging, over the entire speed range.
3. For 6 pulse drives with passive harmonic filters, a contactor circuit shall be present to reduce leading power factor under light or no load conditions.
4. The drive shall be designed to operate on an AC supply source that may contain line notching and up to 10% harmonic distortion to allow for operation of drives on an IEEE-519 dedicated system. An input isolation transformer shall not be required for protection from normal line transients. If line conditions dictate the use of a transformer, the K factor shall be 4.0 or less.
5. The drive shall include an MOV protection - phase to phase and phase to ground with provisions to remove ground connection if needed.
6. Protection shall be provided for AC line or DC bus over-voltage at 130% of maximum rated or under-voltage at 65% of minimum rated and input phase loss.
- 7.

C. Features

1. The controller shall have features in accordance with the following:
 - a. Digital keypad and display module shall provide parameter setting, adjustments and monitoring of control functions and faults. Display messages shall be in English.
 - b. Serial communication port shall allow connecting to a programmable controller interface.
 - c. Independent acceleration/deceleration settings providing separate adjustments to allow either setting to be adjusted from 0.0 seconds to 3600.0 seconds. A second set of remotely selectable Accel/Decel settings shall be accessible through digital inputs. Programming capability shall allow the user to produce Accel/Decel profiles with linear or "S-Curve" characteristics that provide changing Accel/Decel rates.
 - d. Power loss feature shall allow logic ride through capability.
 - e. Time delay automatic restart shall allow restart after resettable controller fault conditions with programmable attempts.

- f. Coasting motor restart shall permit the controller to restart into a coasting motor without damage or tripping. The coasting motor restart feature shall allow switching from bypass mode to VFD mode while operating, without shutdown.
- g. Control inputs and outputs shall be isolated.
- h. An Economizer feature shall automatically reduces the output voltage when the drive is at a constant speed and partial load. The reduced voltage will minimize flux current in a lightly loaded motor and reduce kW usage. If the load increases, the drive shall automatically return to normal operation.
- i. The drive shall have the capability for both internally mounted or externally mounted communications interface cards. Internal cards shall use drive power. Externally mounted cards shall be separately powered and connected to the drive via a cable. The following protocols must be available:
 - DeviceNet
 - EtherNet/IP
 - ControlNet Coax
 - ControlNet Fiber
 - Remote I/O
 - Profibus
 - Modbus
- j. Three adjustable set points shall be available to lock out continuous operation at frequencies, which may produce mechanical resonance. Set points shall have a bandwidth adjustable from 0Hz to 60Hz.
- k. A user programmable restart function shall be provided to automatically restart the equipment after restoration of power after an outage. A maintained 2-wire start input shall be required for this function.
- l. Start-Up Routines shall be included in the controller to allow the user to commission the drive quickly and accurately.
- m. A sleep / wake mode feature shall provide the capability to use an analog input as a Start – Stop command. This shall be a separate input or the speed reference. A signal level below the “sleep” level shall act as a stop command and signal level above the “wake” level as a start command. Sleep / wake time and level shall be fully programmable.
- n. The controller shall have protective functions in accordance with the following:
 - i. Input line side MOV (metal oxide varistor) transient protection.
 - ii. Electronic over-current trip instantaneous and inverse time overload protection.
 - iii. Over-temperature protection.

- iv. Current limit trip protection.
- v. Input line over and under voltage trip protection.
- vi. Ground fault trip protection.

D. Output Power

1. The output voltage shall be adjustable from 0 to rated motor. The inverter section will produce a pulse width modulated (PWM) waveform using IGBTs.
2. Drives shall have software to limit the reflected wave due to long cable lengths to a maximum of 2.25 times the bus voltage or 1600V, whichever is less, up to cable lengths of 600ft (183m).
3. Standard on all ratings up to 200HP; Common Mode Capacitors with jumpers for removal when used on an ungrounded system or resistive grounded system. Internal Common Mode Cores on the drive output.
4. Drive shall have a programmable current limit from .1 amps to 150% of drive rated amps. Current limit shall be active for all drive states including accelerating, constant speed and decelerating. Both the source of the current limit value and the gain for responsiveness adjustment shall be programmable. The drive shall employ a PI regulation scheme with an adjustable gain for smooth transition in and out of current limit.
 - a. Output current shall be available as follows:
 - i. Normal Duty ratings:
 - ii. 110% Overload capability for up to 1 minute
 - iii. 150% Overload capability for up to 3 seconds
 - iv. Heavy Duty ratings:
 - v. 150% Overload capability for up to 1 minute
 - vi. 200% Overload capability for up to 3 seconds
5. The drive shall provide UL Listed Class 10 motor overload protection to comply with N.E.C. Article 430. Overload protection shall be speed sensitive and adjustable. To accommodate a variety of motors with different speed range capabilities, the frequency at which the overload begins to derate shall be programmable. A minimum of two different levels of accumulated overload shall be signaled as alarm conditions. A parameter shall be available to directly read the level of accumulated overload.

E. Control/Logic

1. Operation of the drive with motor disconnected.
2. Controlled shut down with no component failure in the event of an output phase to phase or phase to ground short circuit and annunciation of any fault condition.
3. Thermal manager to sustain operation and provide full protection of the power devices by reducing PWM frequency and output speed as needed.
4. PWM carrier frequency shall have a default setting with capability for adjustments within a range of 2-10 kHz (Output current derating is permitted for operation with carrier frequencies set higher than default.)

5. Multiple programmable stop modes including: Ramp, Coast, Fast Brake, DC-Brake, Ramp-to-Hold and S-curve.
6. Multiple acceleration and deceleration rates.
7. All adjustments to be made with the door closed.
8. Adjustable output frequency up to 420 Hz.
9. The digital interface shall be used for all set-up, operation and adjustment settings. All adjustments shall be stored in nonvolatile memory (EEPROM). No potentiometer adjustments shall be required. The drive shall provide EEPROM memory for factory default values.
10. The last eight fault codes shall be stored in the fault buffer. In addition, information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and other status conditions shall be stored at the time of fault. Information shall be maintained in the event of a power loss. The last eight alarm codes shall also be stored for additional troubleshooting reference.
11. Drive shall be controlled by a remote PLC over network communication for normal operation. In addition manual controls shall be initiated by an emergency bypass float and relay control system as shown in Contract drawings.

F. Operator Interface

1. Interface to the drive shall be provided via a removable Human Interface Module (HIM) with integral display. This unit must have a minimum 7 line by 21-character backlit LCD display with graphics capability to display drive operating conditions, fault / alarm indications and programming information with full text support in multiple languages, including but not limited to English, German, French, Italian, Spanish, Portuguese and Dutch. The drive must also be capable of displaying all speed values in either Hertz or RPM.
2. The keypad shall include programming keys, drive operating keys (Start, Stop, Direction, Jog and Speed Control), numeric keys for direct entry and an ALT (alternate function) key to allow common drive programming or operating functions to be accessed directly.
3. Removable HIM shall be mounted to the exterior of the enclosure.
4. A Hand/Off/Auto switch with indicator light lamps and a Bypass/Test/Run switch with mode indicator lamps shall be provided. Switches and lamps shall be clearly labeled.
5. Enclosure exterior shall include a 24V mechanical hour meter connected to a drive output and record all motor run times including bypass mode.

G. Adjustments and I/O

1. REFERENCE SIGNALS:
 - a. The drive shall be capable of the following speed reference signals:
 - i. Digital MOP
 - ii. Jog

- iii. HIM (Program/Control panel)
 - iv. Analog Input signals (2)
 - v. Preset Speeds (7)
 - vi. Communication module commands
- b. Analog input references shall be independently scaleable, both from the analog input side and from the speed reference side. A bi-polar analog signal (-10V to + 10V) may also be used to control direction.
 - c. The drive shall have over speed protection in the event that the output frequency exceeds the maximum reference by a specified amount.
 - d. All reference signals may have a trim signal applied to them for finer resolution and accuracy. Trim source and amount shall be programmable.

2. LOSS OF REFERENCE:

- a. The drive shall be capable of sensing the following reference loss conditions;
 - i. Remote potentiometer wiper loss
 - ii. 2-10V DC signals below 1 volts (reset at 1.5 volts)
 - iii. 4-20ma signals below 2 ma (reset at 3 mA)
- b. In the event of loss of an analog input reference signal, the drive shall be programmable to act in the following way:
 - i. Fault the drive
 - ii. Alarm and maintain last reference
 - iii. Alarm and go to preset speed
 - iv. Alarm and go to minimum speed
 - v. Alarm and go to maximum speed
 - vi. Alarm and maintain last output frequency
- c. Signal loss detection must be available regardless of the function of the analog input

2.04 OUTPUT FILTER

A. GENERAL:

- 1. An output filter or motor terminator circuit shall be provided to prevent overstressing the motor insulation system. An output sine wave filter, dv/dt filter or motor terminator circuit shall be included for each variable frequency drive, whenever the cable length between the motor and variable frequency drive exceeds the motor voltage withstand capability.
- 2. Output terminator circuits shall be provided as the first choice except in extreme cases of motor lead length or inaccessibility of the motor such as in a down-hole well pump motor. In all other cases, use of filter should be based upon the recommendations of the variable frequency drive and motor manufacturers, whenever the actual voltage peaks at the motor terminals exceed the NEMA-MG1 limits.

B. FEATURES:

1. The filter shall be three phase, 600 volt class motor-protecting type consisting of suitable values of inductance, capacitance and resistance to form a damped, low pass filter.
2. The filter shall be a low-loss type specifically designed to reduce the voltage wave form dV/dT. The filter shall allow cable lengths at minimum exceeding the actual application distances with a waveform resulting in voltage spikes at the motor terminal which are within the NEMA-MG1-Part 31 voltage stress levels.
3. The filter shall be suitable for mounting within the variable frequency drive enclosure.
4. When Terminators are used they shall be mounted within 5 feet of the motor.

2.05 CONTROLS

A. GENERAL:

1. Each VFD shall include all relays, switches, fuses, indicating lights and other components required for a complete functional system.
2. Each VFD shall include a suitably sized and protected isolating control power transformer.
3. Each VFD shall include status indicators, controller and system fault condition displays and operating controls installed on the front door of the enclosure.

B. CONTROL / PILOT DEVICES:

1. Relays shall be standard, latching type and pneumatic or solid state time delay type. Relays shall be provided with the number of contacts as required.
2. Pilot devices shall be heavy duty type.

C. OPERATION:

1. Controls for each VFD shall consist of all devices as necessary for the following operation:
2. Stop/Start and Speed Control: The stop/start and speed control shall respond to a drive mounted selector switch. With the switch in position, "AUTO", stop/start and speed control shall be based upon a stop/start contact and Ethernet speed signal from the PLC. With the switch in position, "HAND," stop/start control shall be based upon remote stop/start pushbuttons located on the drive panel. Speed control when in position, "LOCAL", shall be based upon drive mounted speed potentiometer.
3. Drive Disable Control: The Drive Disable control shall respond to a remote stop pushbutton located adjacent to the driven equipment. When activated, the driven equipment shall stop output to motor immediately in all operating modes and allow motor to coast.
4. Motor Over-Temperature Shutdown: The motor over-temperature control shall respond to a remote contact which activates on motor over- temperature. When

over-temperature is detected, the driven equipment shall produce a fault code and coast to a stop.

D. AUXILIARY FEATURES:

1. Each variable frequency drive shall be provided with the following auxiliary features:
 - a. Status Indicators: Status indicators shall include separate pilot lights for indication of motor run, and bypass mode.
 - b. Contact Outputs: Contact outputs shall include separate dry contacts for remote indication of motor run and drive fault or alarm condition.
 - c. Speed Output: Speed output shall include a 4 to 20 mA DC signal for remote indication of motor speed.
 - d. Stopping and displaying a fault
2. The drive shall be provided with an Ethernet communications port for default operation and control by station PLC.
3. The control panel shall provide a real time clock for time stamping events and fault conditions.

2.06 SPECIFIED DRIVE MODEL

- A. Drive will accept three phase 480VAC input and output to a 3-phase 20Hp motor in Heavy Duty mode.
- B. Allen Bradley Powerflex 70; or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install as per the contract drawings, manufacturers' recommendations, and in accordance with all applicable code and ordinance.

3.02 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the Owner and a copy to be kept on file at the service center.
- B. Manufacturer's certified personnel shall program the VFDs to match the motor load characteristics to integrate with other systems.

3.03 SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the Drive products offered shall be locally available at both the specifying and installation locations.

3.04 WARRANTY

- A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

PART 4 - SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16490 – COMPONENTS AND ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDES

- A. Provide the following components and accessories.

PART 2 PRODUCTS

2.01 EQUIPMENT ID TAGS

- A. Provide equipment ID tags, both laminated plastic and embossed stainless steel, as described in the tag schedules on the electrical drawings and as described in these specifications (especially the Enclosed Controllers specifications).

2.02 SPARES

- A. Contractor shall furnish various spare parts as required in the drawings and specifications. For example, Contractor shall furnish:
 - 1. One of each of the different types of floats used in the project.
 - 2. Two of each of the different types of relays.
 - 3. Twelve spares of each of the different types of terminal blocks
 - 4. Four of each type and color of indicator lamp bulbs
 - 5. Six spares of each of the different types of fuses
 - 6. Four spares of each type of luminaire lamp used
 - 7. Ethernet switch

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install per manufacturer's recommendations and instructions.
- B. Installation shall be performed in the arrangement and position as shown on the drawings.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT – City of Veneta WTP air piping and efficiency improvements

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

SECTION 16740 – ETHERNET NETWORK

PART 1 GENERAL

1.01 WORK INCLUDES

- A. Provide all cables, conduit, junction boxes, routers, switches, hubs, patch cables, and appurtenances as required for the network system.
- B. Provide the network as shown on the drawings.

PART 2 PRODUCTS

2.01 DETAILS

- A. All wiring and connectors shall be to Category 5e or Category 6 standards.
- B. Cables, 10/100BaseT: Provide all ethernet cables needed to network the computer.
- C. Receptacles shall be modular 10Base-T style. Cables shall be Category 5e or Category 6. All components of the network shall be approved for Category 5e or Category 6 Ethernet Network use.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Permanent network routing, such as between PLC and Transfer Switch, shall be to Category 5e or Category 6 specifications and shall be contained in raceway and terminated in permanently mounted panels.

PART 4 SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

- A. Payment for this, and all items, shall be included within the total lump sum price of the overall project as shown on the bid form. Progress payments will be made based on the progress complete percentage of the schedule of values, as approved by the Engineer.

END OF SECTION

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DIVISION 17 –OPERATING STRATEGY
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SECTION 17102

OPERATING STRATEGY SECONDARY
TREATMENT PROCESS

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SECTION 17102 – OPERATING STRATEGY – SECONDARY TREATMENT PROCESS

PART 1 GENERAL

1.01 SUMMARY

- A. This section provides a summary of the operational strategy and operational requirements for the secondary treatment portions of the treatment process.
- B. This section also provides a description of the required controls, SCADA, and operational considerations that the system integrator will utilize to develop the SCADA, controls, programming, screens, and other aspects of the operational side of the components discussed in this section.

1.02 RELATED DOCUMENTS

- A. Process drawings and other drawings in the plan set.
- B. Division 16 – Electrical

1.03 SUBMITTALS

- A. Contractor shall provide submittals of the planned integration, programming, screen designs, and other aspects of the SCADA and overall control system for review and approval before the work is undertaken.
- B. Other submittals may be required during the programming and integration process to coordinate and finalize the screen designs and control systems.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Hardware
 - 1. Hardware requirements for PLC's, networking, communications, etc. are described in Division 16.
- B. Software
 - 1. Software requirements for programming, SCADA, and other operations can be found in Division 16.
- C. Other Material Requirements
 - 1. When not specified, controls and SCADA components should be from Rockwell, Allen Bradley or approved equal.

PART 3 SYSTEMS INTEGRATOR REQUIREMENTS

3.01 SCREEN DESIGNS

- A. The screen designs and programming for the secondary treatment process will provide for operator control of pumps, valves, blowers, etc. The many instruments and sensors will also be available to the operator.

- B. The contractor will be able to view a representation of the actual equipment in pictorial graphic form. The graphics will resemble the shape and layout of the equipment.
- C. The operator will be able to quickly see what equipment is operating and what is not based on the color of equipment of indicator "lights" on the screen.
- D. The operator will be able to see flow meter readouts, totalizing, pressures, and any other feedback and signal provided by the equipment and sensors in this part of the operation.
- E. The secondary treatment process will have its own screen unless more than one screen is required to communicate the information.
- F. The Systems Integrator shall plan the screens and submit a sketch or preliminary design indicating the plan for programming and screen development for these facilities.

PART 4 OPERATING STRATEGY SUMMARY – SECONDARY TREATMENT PROCESS

4.01 SECONDARY TREATMENT PROCESS OPERATING STRATEGY

- A. Three Blowers will be run in a rotation pattern to equalize hourly wear.
- B. Two Blowers are required for maximum airflow, with the third blower as a standby.
- C. A pressure transmitter at the discharge of each blower will be used to maintain a minimum air pressure in the system. This pressure is required for the air lift pumps and sludge aeration to work properly. An air pressure rising to quickly and to an extreme pressure will alert the system that the discharge isolation valve on the blower header is closed.
- D. Air to each aeration basin will be controlled by both cycling the VFD speed and modulating a 6" air valve. A DO sensor in each basin will report back to the controller the current DO levels. If levels are too low the VFD speed will be increased. If DO levels are too high the VFD speed will be decreased. If the VFD speed cannot be decreased without maintaining the minimum discharge pressure at the blower, then the modulating valve(s) will close as required to decrease airflow.
- E. Each aeration basin will be independently controlled. If DO varies between the basins, individual air flow control will be varied using the 6" modulating air valve. Airflow to each basin will be monitored using the 6" air flow sensor.
- F. Actuators installed on the 4" valves will be opened and closed manually by the operator on the control screen. In the future, these actuators will allow the control system to create oxic and anoxic zones for denitrification. I/O to control this will be installed at this time. The actuators will have feedback position sensors installed.
- G. The controller will take over the existing functions of rake control. Currently the rake skims the top of the clarifier using a timer. The new timer will be software based.
- H. The system will make historical records of:
 - 1. Dissolved Oxygen
 - 2. Temperature
 - 3. Air flow through sensors
 - 4. Blower run times and speed
 - 5. Pressure discharge
 - 6. Blower alarms events from overcurrent

- I. 7. Rake faults

PART 5 SPECIAL PROVISIONS

5.01 MEASUREMENT AND PAYMENT

A. Wastewater Treatment Plant Improvements

- 1. Payment for Operating Strategy – Secondary Treatment Process and other work in this section shall be included as a portion of the lump sum price for the project as stated in the Bid Form for the Project. No separate measurement for these quantities will occur.

END OF SECTION

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