Technical Specifications

CITY OF VANCOUVER, WA SEH PUMP STATION IMPROVEMENTS

FEBRUARY 2024

PROJECT NO. 219146 -006

PREPARED BY:

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DRAWINGS (BOUND SEPARATELY)

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Wherever submittals are required hereunder, all such submittals by the Contractor shall be submitted to the Engineer as delineated in this Section.

B. At the Pre-Construction Conference, the Contractor shall submit the following items to the Engineer for review:

1. A preliminary construction schedule.

2. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or-Equal") submittals listed in the Bid.

1.2 ENGINEER'S REVIEW PERIOD

A. For planning purposes, the Contractor shall assume a minimum of 14 days for review by the Engineer following receipt of submittal/resubmittal. If an expedited review is requested by the Contractor, the submittal shall identify the requested expedited review. The Engineer will attempt to accommodate the expedited review.

1.3 SUBMITTAL PROCEDURES

A. Verify that the material or equipment described in each submittal conforms to all requirements of the Specifications and drawings. Where the detailed specifications require specific submittal data, submit all data at the same time. The submittals are to be accompanied by the transmittal form attached at the end of this Section. The Engineer will return for resubmittal any information not accompanied by the specified transmittal form, properly completed.

B. Indiscriminate submittal of only manufacturer's literature is unacceptable and will be rejected.

C. The submittals shall be numbered as XXXXXX-YY-z., where XXXXXX is the specification section number, YY is the sequential number of the submittal, and Z is used for re-submittal labeled a through z. For example, the first submittal of an item from Section 32 13 13 – Concrete for Exterior Improvements would be numbered "32 13 13-01"; the first re-submittal of the submittal would be numbered "32 13 13-01-A".

D. A separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be rejected. A multiple page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Engineer.

E. Identify Project, Contractor, subcontractor or supplier, pertinent Drawing sheet and detail number(s), and specifications section number, as appropriate.

F. All Contractor shop drawings submittals shall be carefully reviewed by an authorized representative of the Contractor, prior to submission to the Engineer. Each submittal shall be dated, signed, and certified by the Contractor, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the Engineer of any Contractor submittals will be made for any items which have not been so certified by the Contractor. All non-certified submittals will be returned to the Contractor without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of the Contractor.

G. Do not mark the submittals in red. Ensure that any marks are duplicated on all copies submitted. Outline the marks on reproducible transparencies in a rectangular box.

H. Coordinate submission of related items.

I. Identify variations from Contract Documents and product or system limitation which may be detrimental to successful performance of the completed Work.

J. Provide space for Contractor and Engineer Review stamps.

K. Submit electronic submittals to:
c/o Jason King
100 East Bower St, Suite 110
Meridian, ID 83642
jking@kellerassociates.com

L. Electronic submittals:

1. Electronic submittals shall be submitted in PDF format and combined into a single file.

2. Engineer will return comments only.

3. Contractor is responsible for distributing copies of the submittal and Engineer's comments to concerned parties.

4. Engineer may require hard copies in lieu of an electronic submittal if, in the opinion of the Engineer, the electronic submittal is difficult to read.

M. Revise and resubmit submittals as required, identify all changes made since previous submittals.

N. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.4 DEVIATIONS FROM CONTRACT

A. If the Contractor proposes to provide material or equipment which does not conform to all of the Specifications and Drawings, the transmittal form accompanying the submittal copies shall indicate under "comments" the deviations.

1.5 SHOP DRAWINGS

A. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the Contractor is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.

B. Except as may otherwise be indicated herein, the Engineer will return submittal to the Contractor with comments. The Contractor shall make a complete and acceptable submittal to the Engineer by the second submission of a submittal item.

C. If submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.

D. If submittal is returned to the Contractor marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required.

E. If submittal is returned to the Contractor marked "AMEND-RESUBMIT," the Contractor shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the Engineer.

F. If submittal is returned to the Contractor marked "REJECTED-RESUBMIT," the Contractor shall revise said submittal and shall resubmit the required number of copies of, said revised submittal to the Engineer.

G. Fabrication of an item shall be commenced only after the Engineer has reviewed the pertinent submittals and returned copies to the Contractor marked either "NO EXCEPTIONS TAKEN" or “MAKE CORRECTIONS NOTED". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

1.6 ORGANIZATION

A. A single submittal transmittal form shall be used for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components..

B. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification

paragraph and subparagraph, drawing number, detail number, schedule title, room number, or building names, as applicable.

C. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

1.7 EFFECT OF ACCEPTANCE OF CONTRACTOR INFORMATION

A. Acceptance by the Engineer of any drawings, method of work, or any information regarding materials or equipment the Contractor proposes to provide shall not relieve the Contractor of his responsibility for any errors therein and shall not be regarded as an assumption of risk or liability by the Engineer or Owner, or by any officer or employees thereof, and the Contractor shall have no claim under the contract on account of the failure or partial failure or inefficiency of any plan or method of work or material or equipment so accepted. Such acceptance shall be considered to mean merely that the Engineer has no objection to the Contractor using, upon his own full responsibility, the plan or method of work proposed, or providing the materials or equipment proposed.

B. Approval of shop drawings by the Engineer is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the Plans and Specifications. The Contractor is responsible for dimensions which shall be confirmed and correlated at the job site, fabrication process and techniques of construction, coordination of his work with that of all other trades and the satisfactory performance of his work.

1.8 PRODUCT DATA AND SAMPLES

A. Where required in the Specifications and as determined by the Engineer, test specimens or samples of materials, appliances and fittings to be used or offered for use in connection with the Work shall be submitted to the Engineer at the Contractor's expense. Specimen or sample submittals shall be made with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination and tests to establish the quality or equality thereof, as applicable.

B. All samples and test specimens are to be submitted in ample time to enable the Engineer to make any tests or examinations necessary, without delay to the Work. The Contractor will be held responsible for any loss of time due to the neglect or failure to deliver the required samples to the Engineer as specified.

C. Samples are also to be taken during the course of the Work, as required by the Engineer.

D. Laboratory tests and examinations that the Owner elects to make will be made at no cost to the Contractor, except that, if a sample of any material or equipment proposed for use by the Contractor fails to meet the Specifications, the cost of testing subsequent samples will be borne by the Contractor.

E. All tests required by the Specifications to be performed by an independent laboratory are to be made, and the samples therefore furnished shall be at the sole expense of the Contractor.

F. Material used in the Work is to conform to the submitted samples and test certificates as approved by the Engineer.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 33 00

STANDARD SUBMITTAL FORM

Transmittal of Shop Drawing or Submittal

CONTRACTOR: <CONTRACTOR NAME>

Tracking No. XXXXXX

Item covered by this submittal _____

Refer to the following attachment(s) for a detailed description of the item.

Applicable specification section(s) _____

☐ First Submittal OR ☐ Resubmittal No. _____

☐ This item is as specified OR ☐ This item is a substitution/or equal

☐ Supplier/Subcontractor certifies:

- ☐ Conforms to contract
- ☐ Minor deviations as specifically noted
- ☐ Major deviations as specifically noted

Review Priority: ☐ 1 ☐ 2 ☐ 3

Due Date: XX-XX-XX (Engineer's standard review period is 14 days)

Notes to Engineer:

Date Received by Contractor: _____ Date Returned to Subcontractor/Supplier _____

Contractor Comments:

Deviations Specifically Noted

SECTION 01 35 13 – SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 GENERAL

A. The conveyance of industrial wastewater influent must not be interrupted during construction. As a result, phasing and sequencing of work is critical. Contractor shall take measures to maintain industrial wastewater influent conveyance at all times during construction.

B. Temporary pumping, piping, power, lighting, controls, instrumentation, alarms, security devices, and all required safety devices shall be provided by the Contractor whenever his work or interruption due to his work affects the existing industrial wastewater influent flows, treatment processes, pumping, piping, power, lighting, controls, instrumentation, alarms, etc.

C. Critical events in the sequence of construction are described in this Section and shall be utilized by the Contractor as a guideline. The construction constraints presented do not include all items affecting the completion of the work but are intended to describe the sequence of critical events necessary to minimize disruption to the ongoing conveyance of industrial wastewater influent. It shall be understood and agreed by the Contractor that the critical events described are not all inclusive and that additional items of work not described may be required to minimize disruption and ensure compliance. Deviation from or modification of these suggested sequences is permitted if techniques and methods known to the Contractor will result in reducing the disruption of the facility operation and maintain conveyance of industrial wastewater influent and is approved in advance by the Engineer.

D. The construction constraints described herein shall be incorporated into the Contractor's schedule as described in the General Conditions.

1.2 SUBMITTALS

A. A plan showing the size and location of the temporary bypass pumping facilities and piping shall be submitted to the Engineer at the same time as the outage plan required. All costs for design, provision, operation, and removal of temporary facilities and piping shall be the responsibility of the Contractor.

B. Outage Plan Submittal Requirements

1. Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities will require the temporary outage or bypass of the existing wetwell and valve vault. In these cases, the Contractor's work shall be coordinated with the operation of the plant in advance. In addition to the Construction Schedule, the Contractor shall submit a Request for Shutdown and a detailed outage plan and time schedule for each construction activity which will require a vault, pipeline, electrical circuit (other than lighting), control circuit, equipment, or other facilities to be removed from service.

2. The Request for Shutdown and outage plans shall be submitted to the Engineer for the Owner's review and acceptance a minimum of two weeks in advance of the time that such outages are required. The outage plans shall be coordinated with the construction schedule specified in the General Conditions and shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the Contractor's method for preventing bypassing the wet well and valve vault; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control, monitoring and alarms for the conveyance of industrial wastewater influent; and the manpower, plant and equipment which the Contractor shall provide in order to ensure proper operation of associated treatment units.

3. In addition, the outage plan shall describe the Contractor's contingency plan that shall be initiated in the event that his temporary facilities fail or it becomes apparent that the time constraints described in the approved Outage Plan cannot be met. The contingency plan shall conform to all specified outage requirements. All costs for preparing and implementing both the outage and contingency plans shall be borne by the Contractor.

1.3 OPERATION OF PUMP STATION FACILITIES

A. Operational functions or shutdown of the existing facility required to facilitate Contractor's operation will be done by the Owner’s personnel only.

B. The Owner’s operation and maintenance personnel will cooperate in every way that is practical in order to facilitate Contractor's operation. However, certain shutdown and connections may only be permissible at times other than normal working hours such as nights or weekends. No additional payment will be made to the Contractor for any night, weekend or holiday work or overtime payments. Contractor shall be sensitive to Owner’s overhead due to overtime pay and may be responsible for compensation if excessive outages are required.

C. If it is necessary for the proper operation or maintenance of portions of the existing facility, the Owner may require the Contractor to reschedule an approved shutdown. The Contractor shall then reschedule his operations so there shall be no conflict with necessary operations or maintenance of the plant. The Contractor shall, within two (2) working days, provide the Owner with a revised Request for Shutdown and a plan for rescheduling of the work in accordance with the requirements of the Contractor's Schedule.

1.4 OUTAGE PLANS

A. The Contractor shall not begin an alteration until specific written permission has been granted by the City in each case.

B. The Contractor shall provide bypass pumping provisions for a minimum flow rate of 1,000 gpm. The system shall include redundancy provisions, a flow meter with local read out, alarms, and SCADA notification system that monitors bypass pumps and wetwell level.

C. A conceptual bypass pumping plan indicating where flow is to be intercepted and discharged to is shown on the Construction Drawings sheet C-200. This plan required the construction of the permanent bypass pumping facilities prior to the shutdown of the lift station. The connection to the existing force main will require shut down of the lift station and Orchards lift station and shall be coordinated with the City consistent with this Specification.

D. The Engineer will coordinate the Contractor's planned procedure with the Owner's personnel. The Engineer and Owner have the authority to modify any proposed shutdown procedures if said work would adversely impact the plant facility's operations.

E. The Owner shall be notified in writing at least two weeks (2 weeks) in advance of the required outage if the schedule for performing the work has changed or if revisions to the outage plan are required.

F. The Contractor shall provide written confirmation of the shutdown date and time three working days (3 working days) prior to the actual shutdown.

G. The making of connections to existing facilities or other operations that interfere with the operation of the existing equipment shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall be completed as quickly as possible and with as little delay as possible and shall proceed continuously (24 hours a day and seven days a week, if necessary) during critical connections (i.e. while Orchard Lift Station is offline) to complete modifications and/or connections that disrupt operations of the Orchard Lift Station.

H. Any temporary facilities and night, weekend, or holiday work and overtime payments required during process interruptions shall be included in the bid price for the work.

1.5 CONSTRAINTS AND WORK SEQUENCE

A. The Contractor shall be responsible for development of the construction sequencing. In implementing the construction sequencing, the Contractor shall maintain the existing facilities in service until new facilities are constructed and are operational to supplement the existing capacity. When new facilities are operational and considered substantially complete, the bypass facilities may be taken out of service. The following general guidelines shall be used by the Contractor in planning the sequence of construction.

B. The following general information and guidelines shall be used by the Contractor in planning the sequence of construction. The list is not comprehensive, and items are not necessarily listed sequentially:

1. Permits. Contractor shall obtain all necessary permits.

2. Submittals. Contractor shall submit and obtain approval of all submittals prior to commencing the work.

3. Shutdown of Orchards Lift Station. This lift station shares a common forcemain with the SEH lift station. To install the bypass valve and the new isolation valve in the valve vault the Orchard lift station will need to be shutdown. Contractor to coordinate with City of Vancouver and Operations a minimum of 48 hours prior to needing to shut down the lift station. This work shall be completed from 10PM to 4AM and shall be offline for a maximum of 4 hours.

4. Bypass pumping and Outage Plan as indicated in this specification and on Contract Drawings Sheet C-200:

    a. Install plug in manhole to isolate wet well.

    b. Install and test bypass pumps, suction/discharge line, valves, flow meter, and SCADA alarm system.

        1) This includes the installation of the new isolation valve in the valve vault and bypass tee/valve on the existing forcemain.

    c. Installation and testing of bypass system shall by completed in less than 24-hours once the SEH lift station is offline.

5. Wet Well Cleaning. The Contractor shall be responsible for cleaning the wet well and removing all loose foreign material, oils, grease, waxes, and excessive mineral buildup prior to beginning demolition work. Utility water is not available and the Contractor shall provide the means to clean the wet well and dispose of the excess material.

6. Demolition. Demolition shall take place in phases in order to maintain conveyance of wastes and existing treatment level during construction.

7. Installation of new pumps, mechanical piping, instrumentation, valves, guiderails and other new materials as shown on M-100 and M-300.

C. Construction sequencing shall provide for maintaining existing flow rates, and be in accordance with the following criteria:

Prior to	Complete
Shutting down the SEH Pump Station and existing force main and utilizing the existing gravity bypass line.	Construction, inspection, testing, and approval of the new Bypass System, isolation valves, and piping as indicated on Sheet C-200 Bypass Pumping Plan. Installation and testing of all bypass pumping equipment in accordance with the Outage Plan.
Utilizing the new Bypass System, isolation valves, bypass forcemain connection, and piping	Construction, inspection, and approval of the connection of the bypass piping to the existing force main, new bypass port connection/valve, and new isolation valve in valve box. Coordination with the City and Operations to shutdown the Orchards lift station for 4 hours to install isolation valve in wet well.

Modifications and demolition of the existing wetwell and valve vault	Demonstration of bypass pumping efficacy for a continuous 24-hr period. Cleaning of existing wetwell.
Decommissioning of the temporary bypass pumping equipment	Substantial completion

1.6 ROAD ACCESS

A. The project site may be congested, and the Contractor shall conduct his operations to minimize interference with others. Access to the site shall be coordinated with Owner and SEH. Contractor shall obtain access passes through SEH. Contractor and subcontractor personnel will have to go through an initial 1 to 2 hour training with SEH to obtain access passes.

B. The project site entrance shall remain clear so vehicles can pull into the project site and to allow normal activities at the existing facility.

1.7 OPERATIONS AND MAINTENANCE ACCESS

A. Owner’s operations personnel must have continuous safe access to all process control equipment.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Temporary facilities and piping shall be located to minimize interference with Contractor's construction facilities and Owner's operation and maintenance of the facility. Unless otherwise specified, each temporary pipeline shall be of the same size as its connection to the existing or permanent facility at the downstream end of the pipeline with respect to the liquid or gas flow in the pipeline. Piping materials shall be suitable for the material being conveyed and be as specified in their respective specification sections.

B. When temporary electrical power supply controls, instrumentation or alarms are required for routine continuous operations of existing or new equipment, the Contractor shall provide the necessary equipment and appurtenances for such temporary power supply controls, instrumentation, or alarms. Prior to installing said equipment and appurtenances Contractor shall provide a submittal on the proposed components and installation for Engineer’s review and approval.

C. During all rehabilitation, modification and demolition work, safe working conditions for the Owner's and Contractor's personnel shall be maintained at all times. The foregoing includes, but is not limited to, proper trench excavation, the provision of temporary equipment guards, supports, warning signs, walkways, covers over openings, handrailing and protection of electrical equipment and power supply. All temporary facilities shall be constructed in accordance with applicable codes and regulations so that they operate safely

and properly. Valves to be temporarily shut off during the work shall be tagged as such and shall be wired shut with a crimped lead seal and padlocked. Electrical and mechanical equipment shall be similarly shut down.

END OF SECTION 01 35 13

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall submit technical operation and maintenance information for each item of mechanical and electrical equipment in an organized manner in the Owner's Manual. It shall be written so that it can be used and understood by the Owner's operation and maintenance staff. The Owner's Manual information shall also be submitted in electronic format using a USB flash drive.

B. All manuals supplied to the Owner by suppliers of Owner-furnished equipment, shall be inserted into the Owner's Manual by the Contractor. The Contractor shall be responsible for providing all other information.

1.2 OWNER'S MANUAL

A. The Owner's Manual shall include the following for each item of mechanical and electrical equipment (as applicable):

1. Equipment Summary: A summary table shall include the equipment name and equipment number, the manufacturer's model number, serial number, and other nameplate information specific to the equipment provided.

2. Operational Procedures: Manufacturer-recommended procedures on the following shall be included:

    a. Installation

    b. Adjustment

    c. Startup

    d. Location of controls, special tools, equipment required, or related instrumentation needed for operation

    e. Operation procedures

    f. Load changes, Calibration, Shutdown

3. Troubleshooting, Disassembly, Reassembly

    a. Realignment

    b. Testing to determine performance efficiency

    c. Tabulation of proper settings for all pressure relief valves, low and high pressure switches, and other protection devices

    d. List of all electrical relay settings including alarm and contact settings

4. Preventive Maintenance Procedures:

   a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.

   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

5. Parts List and Drawings:

   a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

   b. Drawings: Cross-sectional or exploded view drawings shall accompany the part list.

6. Wiring Diagrams: Include complete internal and connection wiring diagrams for electrical equipment items.

7. Shop Drawings: Include approved shop or fabrication drawings, complete with dimensions. Include performance curves for pumps furnished.

8. Safety: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

9. Documentation: All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

10. Spare Parts: This part shall contain spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the Owner in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the Owner in ordering. The Contractor shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents.

B. If manufacturer’s standard brochures and manuals are used to describe operating and maintenance procedures, modify such brochures and manuals to reflect only the model or series of equipment used on this project and features provided. Cross out neatly or remove extraneous material, or otherwise annotate or eliminate.

1.3 TRANSMITTAL PROCEDURE

A. Provide three (3) original paper copies and one (1) electronic copy in PDF format of all operating and maintenance information. For ease of identification, label each manufacturer's brochure and manual with the equipment name. Organize the information in 3-ring binders and use an indexing feature within the PDF submission, in numerical order, per specification section number. Include in the manuals a table of contents and tab sheets to permit easy location of desired information. Each binder shall include a cover sheet and spine label giving the project name, Engineer's project number, Contractor name and contact information, applicable subcontractor name and contact information, and supplier name and contact information.

B. The Contractor shall submit to the Engineer three identical Owner's Manuals a minimum of 90 calendar days prior to the scheduled startup of the equipment.

C. The Engineer will review the Owner's Manuals within 30 days following their receipt by the Engineer. The Contractor shall then make any corrections and changes noted and compile all the corrected Owner's Manuals for final submittal to the Engineer.

1.4 PAYMENT

A. Acceptable operating and maintenance information for the project must be delivered to the Engineer prior to the project being 75 percent complete or at least two weeks prior to startup of any equipment. Progress payments for work in excess of 80 percent completion or 2 weeks prior to startup will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

1.5 FIELD CHANGES

A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures are to be modified and supplemented to reflect any field changes or information requiring field data.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 78 23

SECTION 02 41 00 – DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTIONS

A. Work under this Section includes providing selective demolition of part of the existing facility shown on the drawing and as specified herein.

B. Work under this Section also includes EPA reporting, testing (unless previously provided to the Contractor), and disposal of structures containing asbestos. The EPA required reporting is required regardless if asbestos is encountered or not.

C. Prior to performing any demolition work, the area to be demolished shall be measured and agreed upon by the Engineer and Contractor. If demolition occurs prior to this measurement and agreement with the Engineer, the Engineer will measure only the area that, in the opinion of the Engineer, should have been the limits of demolition. Repairs to areas outside of these demolition limits, as determined by the Engineer, shall be replaced, or reconstructed at no cost to the Owner.

1.2 CONDITION OF STRUCTURES

A. Owner assumes no responsibility for actual conditions of items or structures to be demolished. Conditions existing at time of commencement of contract will be the responsibility of the Contractor.

1.3 PROTECTION OF FACILITIES

A. Protect from damage existing finish work that is to remain in place that becomes exposed during demolition operations.

B. Protect adjacent areas with suitable coverings when necessary to prevent surface damage, including protecting existing concrete and asphalt surfaces from concrete staining.

C. Remove protections at completion of work.

1.4 ENVIRONMENTAL CONTROLS

A. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

1.5 PERMITS

A. Obtain any permits for building, electrical, or plumbing demolition that may be required for the Work at no additional costs.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions of surrounding area that could be misconstrued as damage resulting from selective demolition work.

3.2 PREPARATION

A. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of adjacent facilities to remain.

B. Cease operations immediately if safety of structure or existing facility appears to be endangered. Take precautions to support structure/facilities until determination is made for continuing operations.

3.3 DEMOLITION

A. Demolish concrete flatwork only in areas shown on the drawings to be removed. However, the exact location may be adjusted in the field if required to avoid existing obstacles.

1. The line to be cut shall be marked on the surface along a string-line or straight edge with a marker that will not wash away from the action of the saw's cooling water. All cutting lines shall be marked along straight line prior to cutting.

2. Furnish and operate a power drive, self-propelled wheel mounted pavement sawing machine. The saw blade shall be either a wet cutting or dry cutting type. The depth of the saw shall be controlled by graduated positions set on the machine.

3. Concrete and asphalt slabs shall be cut by saw cutting the slab to full slab depth with one pass of the saw following exactly along the marked cutting line.

B. Where large power driven saws cannot be operated close enough to the end of the slab to completely cut it (i.e. at an abutting wall or foundation) use power driven impact tools and grinders to remove the slab and form a smooth neat joint.

C. Where slab thicknesses exceed the maximum depth of the cutting machine, cut a line as deep as possible with the machine and use power driven impact tolls and grinders to remove the slab and form a smooth neat joint.

D. Remove all foundations shown to be removed. Do not bury unless authorized by the Engineer at the time of demolition.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubble and other materials resulting from demolition work. Haul all materials from demolition to a disposal site obtained by the Contractor.

3.5 CLEANUP AND REPAIR

A. Upon completion of demolition work, remove tools, equipment, and demolished materials from site.

3.6 REPAIR

A. Repair demolition performed in excess of that required. Return structures and surfaces to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02 41 00

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install miscellaneous metal items as shown on the drawings and specified herein.

B. Provide shop fabricated and manufactured steel and aluminum.

1.2 STANDARDS

A. AISC "Code of Standard Practice."

B. ANSI A14.3 – American National Standard for Ladders – Fixed – Safety Requirements

C. ASTM A36 – Specification for Carbon Structural Steel

D. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

E. ASTM A153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

F. ASTM A283 – Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

G. ASTM A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

H. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

I. ASTM A786 – Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

J. ASTM B209 – Specification for Aluminum and Aluminum-Alloy Sheet and Plate

K. ASTM B221 – Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles, and Tubes

L. ASTM B429 – Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

M. ASTM B663 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

N. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

O. ASTM D1187 – Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

P. ASTM F1941 – Specification for Electrodeposited Coatings on Threaded Fasteners.

Q. ASTM F3125 – Specification for High Strength Structural Bolts, Steel, and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength

R. AWS D1.1 – Structural Welding Code – Steel

S. AWS D1.2 – Structural Welding Code – Aluminum

T. SSPC-SP 11 – Power Tool Cleaning to Bare Metal

U. SSPC-SP 2 – Hand Tool Cleaning

V. SSPC-SP 6 – Commercial Blast Cleaning

1.3 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Prepare shop drawings from field measurements where possible.

2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

C. Welder's Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Quality procedures and personnel according to the following:

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

2. AWS D1.2 – Structural Welding Code – Aluminum

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store and protect products with special custom wrapping and handling procedures to protect and touch-up shop primers at every stage of shipping.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturer's written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 MATERIALS – ALUMINUM

A. Extruded Aluminum: ASTM B221, 6063 alloy, T6 temper, 6061 alloy, T6 temper, or 6005 alloy, T5 temper, as standard with manufacturer.

B. Sheet Aluminum: ASTM B209, 5052 alloy, H32 or H22 temper, or 5005 alloy, H34 temper, as standard with manufacturer.

C. Extruded Structural Pipe and Round Tubing: ASTM B429, Alloy 6063-T6, standard weight, Schedule 40 pipe, unless otherwise required to meet performance requirements.

D. Bolts, Nuts, and Washers: Stainless steel.

E. Welding Materials: AWS D1.2; type required for materials being welded.

F. Miscellaneous Bolts and Nuts: ASTM A307

G. High Strength Bolts and Nuts: ASTM F3125 Grade A325

H. Concrete Anchors: Use cast in anchor bolts where cast in anchor bolts are shown on the drawings. Provide attachment to concrete with concrete anchors where shown on the drawings conforming to the following types. Use only type of concrete anchor shown on the drawings.

1. Expansion Anchors: Expansion anchors shall be wedge type with a single piece three section wedge to anchor the stud in the hole. The stud nut and wedge shall be ANSI 304 stainless steel.

2. Adhesive Anchors: Adhesive anchors shall be an all thread rod with a nut. The all thread rod and nut shall be ANSI 304 stainless steel. The rod shall be anchored in the hole using a premeasured adhesive capsule consisting of vinyl urethane methacrylate adhesive.

3. Undercut Anchors: Undercut anchors shall be an undercut style with a brazed tungsten carbide edge on the undercutting end to perform the self-cutting undercut as the anchor is installed. The anchor shall cut and undercut bearing area of at least 2.5 times the nominal anchor bolt size. The anchor stud shall be ANSI 316 stainless steel.

I. Stainless Steel Bolts and Nuts: Type 316 Stainless Steel

2.2 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application): Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolt material, anchor bolts and cap screws shall be in accordance with the following:

Structural Connections	ASTM A307, Grade A or B, hot-dip galvanized
Anchor Bolts	ASTM A307, Grade A or B, or ASTM A36, hot-dip galvanized
High Strength Bolts	ASTM F3125 Grade 325
Pipe and Equipment Flange Bolts	ASTM A193, Grade B- 7

B. Stainless steel bolts and nuts for corrosive service

1. Corrosive Service: All bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated below.

   a. All buried locations.

   b. All submerged locations.

   c. All locations subject to seasonal or occasional flooding.

   d. Inside hydraulic structures below the top of the structure.

   e. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump.

   f. All chemical handling areas.

   g. Inside trenches, containment walls, and curbed areas.

   h. Locations indicated by the Contract Documents or designated by the ENGINEER to be provided with stainless steel bolts.

2. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, Class 1, conforming to ASTM A193 for bolts and to ASTM A194 for nuts. All threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

   a. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

b. Antiseize lubricant shall be "PURE WHITE" by Anti-Seize Technology, Franklin Park, IL, 60131, AS-470 by Dixon Ticonderoga Company, Lakehurst, NJ, 08733, or equal.

C. Bolt Requirements: The bolt and nut material shall be free-cutting steel. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

D. Bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers fabricated of material matching the bolts shall be installed where indicated.

E. The length of each bolt shall be such that after the joint is made up, the bolt extends through the entire nut, but in no case more than 1/2-inch beyond the nut.

F. Adhesive Anchors: Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Adhesive anchors are required for drilled anchors for indoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring reinforcing bars. Threaded rod shall be stainless steel Type 316. Epoxy adhesive shall be Hilti HIT RE 500 V3.

2. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above and shall be Hilti HVA or Cobra Anchors. Threaded rod shall be galvanized steel.

G. Expanding-Type Anchors: Expanding-type anchors if indicated or permitted, shall be galvanized steel expansion type ITW Ramset/Redhead "Trubolt" anchors; Hilti "Kwik-Bolt;" or equal. Lead caulking anchors will not be permitted. Size shall be as indicated. Embedment depth shall be as the manufacturer recommends for the load to be supported. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.

H. Overhead Applications: Use Hilti HDA undercut anchors.

I. Miscellaneous Bolts and Nuts: ASTM A307

J. High Strength Bolts and Nuts: ASTM F3125 Grade A325

K. Concrete Anchors: Use cast in anchor bolts where cast in anchor bolts are shown on the drawings. Provide attachment to concrete with concrete anchors where shown on the drawings conforming to the following types. Use only type of concrete anchor shown on the drawings.

1. Expansion Anchors: Expansion anchors shall be wedge type with a single piece three section wedge to anchor the stud in the hole. The stud nut and wedge shall be ANSI 304 stainless steel.

2. Adhesive Anchors: Adhesive anchors shall be an all thread rod with a nut. The all thread rod and nut shall be ANSI 304 stainless steel. The rod shall be anchored in the hole using a premeasured adhesive capsule consisting of vinyl urethane methacrylate adhesive.

3. Undercut Anchors: Undercut anchors shall be an undercut style with a brazed tungsten carbide edge on the undercutting end to perform the self-cutting undercut as the anchor is installed. The anchor shall cut and undercut bearing area of at least 2.5 times the nominal anchor bolt size. The anchor stud shall be ANSI 316 stainless steel.

2.3 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

B. Nonshrink, Metallic Grout: Factory packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications.

2.4 FABRICATION

A. Workmanship: Conform to accepted shop practices. Form work true to details, with clean, straight, sharply defined profiles.

B. Fit and shop assemble items in largest practical sections, for delivery to site. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for intended use and, where applicable, to meet performance requirements.

D. Fabricate items with joints tightly fitted and secured.

E. Continuously seal joined members by continuous welds, unless otherwise indicated on Drawings.

F. Joints and Connections: Weld all joints, unless other fastening methods are shown, specified or specifically approved. Close fit exposed joints; making joints where least conspicuous. Unless otherwise shown or specified, use flat and countersunk beaded bolts or screws in exposed connections.

G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cutting, Drilling; Perform cutting, drilling, punching required for accurate fitting and assembly work. In addition, perform similar operations as required for attachment of work of other trades, provided that directions for such work are supplied prior to shop drawing approvals.

J. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

1. Provide anchor bolts for connecting to other work.

a. Drill and tap steel as required to receive bolted connections.

b. Make bolt holts 1/16-inch large than nominal bolt diameter.

K. Provisions for Attachment to Structure: Furnish miscellaneous metal items complete with framing, supports, hangers, bracing, anchors, and other devices shown specified or necessary for reinforcement and proper, secure setting or attachment to building construction.

L. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

M. Dissimilar Materials Protection: Insulate aluminum surfaces in contact with metals other than galvanized or stainless steel, or with plaster or concrete, by means of chromate gasketing or heavy coat of alkali-resistant bituminous paint.

N. Workmanship: Fabricate all items neatly and rigidly in accordance with details in first-class finished, workmanlike manner. Form curved work neatly to radii indicated. Provide members of sizes indicated and weld, bolt or rivet securely together. Furnish bolts, nuts, washers, and other fastening devices required for anchoring and securing work.

O. Welding: Use electric shielded-arc process in accordance with Welding Specifications of American Welding Society. Use only welding operators properly trained and highly skilled in arch welding. Grind smooth surface welds exposed to view.

2.5 SHOP FINISHING

A. Aluminum Metal Items: Aluminum guardrail and handrails shall be finished with a 0.7 mil clear anodized finished, unless noted otherwise. All structural aluminum elements such as beams, columns, ledgers, structural connectors, all stair framing elements, including treads, and hand and guard rails, shall be anodized.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.

B. Lintels: As detailed, galvanized finish.

1. Size loose lintels to provide bearing length at each side of opening equal to 1/10 of clear span but not less than 8 inches, unless otherwise indicated.

C. Door Frames for Overhead Door Openings: Channel sections, prime paint finish, unless otherwise indicated.

D. Overhead Door Supports: Fabricate supports for overhead doors from steel of sizes and shapes recommended by door manufacturer and with attached anchors as recommended by door manufacturer.

2.7 FINISHES – ALUMINUM

A. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).

2.8 FABRICATION TOLERANCES

A. Squareness: 1/8-inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16-inch.

C. Maximum Misalignment of Adjacent Members: 1/16-inch.

D. Maximum Bow: 1/8-inch in 48 inches.

E. Maximum Deviation from Plane: 1/16-inch in 48 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Clean and strip primed steel items to bare metal where site welding is required.

C. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

D. Embedded Items: Deliver miscellaneous metal items to be embedded or installed in concrete with setting instruction to concrete contractor for setting. Verify grade and line positioning of items as set, report errors or deviations in order that corrective adjustments may be made before placement of concrete or laying of masonry.

E. Coat all aluminum surfaces in contact with concrete with an approved bituminous coating or zinc chromate primer.

3.2 GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, thru bolts, lag screws, wood screws, and other connectors.

C. Concrete Anchors: Install concrete anchors in cast in place concrete and masonry according to the details shown on the drawings and as recommended by the anchor manufacturer. When installing concrete anchors in masonry always install anchors in masonry cells that have been grouted solid. Do not install anchors into hollow cell masonry.

D. Install items plumb and level, accurately fitted, free from distortion or defects.

E. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

F. Field weld components as indicated.

G. Perform field welding in accordance with AWS D1.1

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

H. Obtain approval prior to site cutting or making adjustments not scheduled.

I. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

J. Expansion, Contraction: Assemble and install work with adequate provisions to prevent objectionable distortion and overstressing from expansion, contraction. Where necessary, provide properly designed expansion joints, construct to be weather tight if to be exposed to the weather.

K. Field Touch-up: After installation of miscellaneous metal items, tough-up field bolts, field welds, uncoated connections and abrasions with ship protective coatings. Clean items of mud, dirt, and other objectionable foreign matter.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturer’s written instructions and requirements indicated on Shop Drawings.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

1. Clean surfaces of weld seams according to SSPC-SP 11, “Power Tool Cleaning to Bare Metal”.

3.6 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch

END OF SECTION 05 50 00

SECTION 05 52 20 – ALUMINUM METAL RAILINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required to design and install all aluminum pipe and tube handrails, balusters and fittings, as shown on the Plans.

1.2 REFERENCE STANDARDS

A. ADA Standards – Americans with Disabilities Act (ADA) Standards for Accessible Design

B. ASTM B429 – Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

C. ASTM C1107 – Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink)

D. AWS D1.2 – Structural Welding Code – Aluminum

E. IBC – International Building Code

F. OSHA Safety Requirements.

G. SSPC-PA-1 – Shop, Field, and Maintenance Painting of Steel

H. SSPC-SP 1 – Solvent Cleaning

I. SSPC-SP 11 – Power Tool Cleaning to Bare Metal

J. SSPC-SP 6 – Commercial Blast Cleaning

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Shop drawings: Indicate profiles, railing layouts, post locations, and removeable guardrail locations. Indicate component details, materials, finishes, connection and joining methods, attachment to supporting structure, and the relationship to adjoining work.

1. Submit design calculations for all handrail and guardrail shop drawings stamped by a professional engineer in the State where Work is to be done.

2. Submit design calculations for sleeve and anchorage of guardrail stamped by a professional engineer in the State where Work is to be done.

C. Submit manufacturer's instructions for installation and connecting methods.

D. Samples: Submit color samples for Owner review and approval.

PART 2 - PRODUCTS

2.1 RAILINGS – GENERAL REQUIREMENTS

A. Allow for expansion and contraction of members and building movement without damage to connections or members.

B. Dimensions: See drawings for configurations and heights.

C. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated.

2.2 STRUCTURAL PERFORMANCE

A. Code Requirements: All railings, guardrails and handrails shall conform to the code requirements for IBC and the State-approved OSHA. Railings, guardrails, and handrails, when part of the means of egress as defined by the governing codes, shall conform to the requirements of the most stringent of the codes or reference standards. The whole project areas shall be limited public use areas. The other areas of the project shall conform to the code and State-approved OSHA for industrial-commercial, non-public use unless otherwise indicated.

2.3 MATERIALS

A. Rail Section: Railing and handrails shall be round pipe design railing system unless otherwise indicated. Provide three (3) rails plus aluminum kickplate.

B. Rail Material: Aluminum shall be U.S. Alloy 6061 or 6063, T-5 or T-6. Aluminum pipe rail shall be not less than 1-1/2-inch diameter, Schedule 40 pipe. Aluminum pipe posts shall be not less than 1-1/2-inch diameter, Schedule 80 pipe

C. Aluminum Welding Materials: AWS D1.2; type required for materials being welded.

D. Sleeves: Sleeves for removable posts shall be of aluminum.

E. Fasteners: Fasteners, screws, and bolts shall be of stainless steel or aluminum. Handrail bracket fasteners and fasteners over water basins shall be stainless steel.

F. Brackets: Handrail brackets shall be aluminum with a finish that matches the handrail or railing of which they are a part.

2.4 FINISHES

A. Pipe railing system includes handrails, railing, tube caps, and other miscellaneous parts of rails shall be provided with a 0.7-mil clear anodized finish.

B. Coat all aluminum surfaces in contact with concrete with bituminous compound or zinc chromate primer.

2.5 MANUFACTURERS OR EQUAL

A. "C-V Pipe Rail" by CraneVeyor Corp.

B. "Wesrail" by Moultrie Manufacturing Co.

2.6 FABRICATION

A. Verify dimensions on site prior to shop fabrication. Fit and shop assemble sections in largest practical sizes for delivery and installation at site.

B. Supply components required for secure anchorage or handrails and railings.

C. Grind exposed welds smooth and flush with adjacent surfaces.

D. Make exposed joint butt tight, flush, and hairline.

E. Accurately form components required for anchorage of railings to each other and to building structure.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken packages, containers, or bundles bearing the label of the manufacturer.

B. Storage: All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

3.2 PREPARATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Supply items to be mounted to concrete, embedded in masonry, or place in partitions with setting templates and erection drawings to appropriate sections.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor hand railings to structure. Install in accordance with shop drawings and manufacturer's instructions.

D. All exposed welds shall be ground smooth and flush and shall be polished and anodized. Discoloration on exposed aluminum surfaces, whether or not due to welding, shall constitute a basis for rejection of the entire assembly.

3.4 REMOVABLE SECTIONS

A. Removable handrails sections shall be provided where indicated. The removable railing hardware's color shall match the railing system of which it is a part.

3.5 TOLERANCES

A. Maximum Variation from Plumb: 1/4-inch per floor level, non-cumulative.

B. Maximum Offset from True Alignment: 1/4-inch.

C. Maximum Out-of-Position: 1/4-inch.

END OF SECTION 05 52 20

SECTION 08 31 00 – ACCESS DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install access doors in locations as shown on the drawings and as specified herein.

B. Refer to the Construction Drawings for location of Varius Access Doors and design requirements.

1.2 STANDARDS

A. "Architectural Sheet Metal Manual" by Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACCNA).

B. ASTM A36: Standard Specification for Structural Steel

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the City of Vancouver Requirements

B. Shop Drawings: For each type of door, showing all data required for installation and anchoring. Drawings to include profiles, accessories, location, adjacent construction interface, dimensions, and installation and anchoring instructions

C. Manufacturer's Data: Submit manufacturer's product data and installation requirements.

D. Provide manufacturer's warranty. Material shall be free of defects and workmanship for a period of 5 years form the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B209 plate alloy 3003-H 14 or 5005-H 14, 1/4-inch minimum thickness and 6063 T5 extruded frame.

B. Steel ASTM A36 grade, 1/4-inch minimum thickness.

C. Stainless Steel: Type 316.

D. Neoprene: Closed cell foam, ASTM C509, 10 pounds per cubic foot density.

E. Odor Control and Debris Gaskets: EPDM rubber, ASTM D2000 M2MAA607

2.2 FABRICATION

A. Wet Well Hatch: Safety barrier doors shall be designed to combine covering of the opening, fall through protection and controlled confined space entry. One safety barrier door shall be installed inside the existing concrete opening for the wet well as shown on the Drawings.

1. Doors shall be reinforced to support 100 psf and 300 lb concentrated Live Load with a maximum deflection of 1/150th of the span. Loading requirements and size are indicated on the drawings for each access door.

2. Provide frame anchors (8) min.

3. Provide with continuous 1/8” neoprene seal.

4. Latch: Type 316 stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle.

5. Lift assistance: Provide compression spring operators enclosed in telescopic tubes or equivalent. An automatic hold open arm shall lock the cover in the open position.

6. Hinges, Lift Assist Devices, Locks and Handles, and Hardware: Stainless Steel, Type 316.

7. Material shall be 6061-T6 aluminum for bars, angles, and extrusions; 1/4-inch diamond plate shall be 5086 aluminum. Safety grate shall be rated at 300 pounds per square foot and designed to meet OSHA 29 CFR 1910.23 requirements. Cover without safety grate shall be rated at 150 pounds per square foot. Hatch frame shall be of extruded aluminum, with a continuous anchor flange.

8. Cover hinges shall be grade 316 stainless-steel. Hinge shall be fastened to the frame extrusion and diamond plate with grade 316 stainless steel bolts and ny-lock nuts. All hardware shall be stainless steel except for the rail nuts, which shall be in aluminum.

9. Each hatch shall be supplied with a recessed padlock clip. Padlock to be provided by Owner. Each door shall be equipped with a cover stay. Door shall lock open in the 90-degree position.

10. Grate openings shall allow for visual inspection, limited maintenance, and float adjustments while the safety grate fall through protection is left in place. Design shall assure that the fall through protection is in place before the doors can be

closed, thereby protecting the next operator. Each grate shall be provided with a permanent hinging system, which shall lock the grate in the 90-degree position once opened. Each grate shall have a pull open arm, designed so the grate can be pulled open, with the grate acting as a barrier between the operator and the pit. The opening arm shall also be equipped with a controlled confined space entry lock to said in controlling unauthorized entry to the confined space. The grating system shall allow anyone to make visual inspection and float adjustments without entering the confined space.

11. Each aluminum safety grate shall be coated with a safety orange color, promoting visual awareness of the hazard. The coating shall be provided by manufacturer and shall be a thermosetting, powder coat finish with a minimum thickness of 2-4 mils and shall be baked at 350-375 degrees Fahrenheit until cured.

12. Safety barrier shall be as manufactured by ITT Flygt (Safe Hatch), USF Fabrication, Bilco, or approved equal.

2.3 FINISH

A. Mill finish aluminum with lacquer on exposed sides and bituminous coatings on concealed surfaces that come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver products in manufacturer’s original packaging. Store materials in a dry, well-vented area.

B. Verify rough openings are correctly sized and located. Coordinate access door with pump guide rails.

C. Coordinate with trades installing adjacent materials. Anchor firmly to lid by casting into concrete or equivalent fasteners as approved.

D. Install in accordance with Manufacturer’s instructions and approved shop drawings.

E. Test units for proper function and adjust until proper operation is achieved.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 00

SECTION 09 90 00 – PAINTING AND COATING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required for all painting and coatings as specified herein. All materials, equipment, piping and miscellaneous surfaces shall be coated except for those indicated under Part 1.7. Work includes but is not to be limited to cleaning and preparation of surfaces, paint materials, and the application of all paint and other materials. Provide third party inspection of surface preparation, application and testing of coating and painting during application.

1.2 DEFINITIONS

A. The term paint, coatings, or finishes as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. Dry Film Thickness (DFT): The minimum dry film thickness, without any negative tolerance.

C. Submerged Metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.

D. Submerged Concrete and Masonry Surfaces: Surfaces which are or will be:

1. Underwater.

2. Inside structures which normally contain water.

3. Below tops of walls of water containing structures.

E. Exposed Surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.

F. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.

G. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.

H. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

1.3 REFERENCE STANDARDS

A. Codes and Standards: In addition to the requirements of these Specifications, the work to be performed under this Section is to comply with the following codes and regulations:

1. The Society of Protective Coatings Specifications (SSPC):

a.	SSPC SP-1	Solvent Cleaning.
b.	SSPC SP-2	Hand Tool Cleaning.
c.	SSPC SP-3	Power Tool Cleaning.
d.	SSPC SP-5	White Metal Blast Cleaning.
e.	SSPC SP-6	Commercial Blast Cleaning.
f.	SSPC SP-7	Brush-Off Blast Cleaning.
g.	SSPC SP-10	Near-White Blast Cleaning.
h.	SSPC SP-11	Power Tool Cleaning to Bare Metal.
i.	SSPC-SP-12	High- and Ultrahigh-pressure Water Jetting.
j.	SSPC-SP-13	Surface Preparation of Concrete
k.	SSPC-SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

2. Underwriters' Laboratory (UL):

a.	UL 3P83	Drinking Water System Components - Health Effects.

3. National Association of Corrosion Engineers Standards (NACE):

a.	RP0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

4. Applicable Standards of American National Standards Institute, Inc. (ANSI)

5. National Association of Pipe Fabricators (NAPF):

a.	NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

6. American Society for Testing and Materials (ASTM):

a.	ASTM D4262	Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
b.	ASTM D4263	Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

c. ASTM D4285 Test Method for Indicating Oil or Water in Compressed Air.

d. ASTM D4541 Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

1.4 QUALITY ASSURANCE

A. Pre-Application Conference: Prior to commencement of any paint application, the Engineer will hold an on-site pre-application meeting. The purpose of meeting is to establish a working understanding between all parties and to discuss items that pertain directly to the paint application.

B. Painter's Qualifications: The work specified under this Section shall be performed by or under the supervision of a qualified painter. The Contractor shall be required to document the painter's experience, competence and ability to comply with the requirements of these Specifications and to complete the work in a timely manner. The Painter or Applicator shall have the following qualifications:

1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work. Provide qualifications of applicator and references listing five similar projects completed in the past two years.

2. Manufacturer approved applicator when manufacturer has approved applicator program.

C. Coatings Inspection: Surface preparation, mixing, thinning, coating application, and measurement of dry film thicknesses shall be performed by a NACE Certified Coatings Inspector. Each requirement of this specification shall be met and approved by the Inspector prior to moving on to the next step in the progression of the coating’s specification.

D. Standard Products: All paints in a paint system are to be the standard products. All products applied in any paint and coating system shall be from a single manufacturer.

E. The NACE Inspector must approve all surface preparation prior to the application of coatings. This will include surface cleanliness, the degree of sandblast and surface profiles.

F. At a minimum of every four hours or more often when conditions change during surface preparation and coatings application, environmental conditions IE: Relative Humidity, dew-point, surface temperature and the dew-point/surface temperature depression must be measured and recorded. The use of a sling psychrometer and US weather bureau barometric chart or approved equal such as Defelsko or Elcometer test instruments shall be used to measure the environmental conditions.

G. Warranty Inspection: A warranty inspection will be conducted at the end of the one-year warranty period from the substantial completion date. The Contractor and a representative of the coating material manufacturer may attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the Owner. The Owner may, by written notice to the Contractor, reschedule the warranty inspection to another date within the warranty period.

H. Quality Assurance Responsibility: The Contractor is responsible to obtain and pay for the services of the NACE inspector referred to above.

1.5 SUBMITTALS

A. Before any paint materials are delivered to the job site, submit a complete list of all materials proposed to be furnished and applied under this Section. Include schedule of where and for what use coating materials are proposed in accordance with requirements for Product Data. Any coating or paint materials ordered by Contractor prior to receiving submittal response from Engineer indicating that the submitted material is accepted shall be at the risk of the Contractor.

B. For each paint, furnish the paint manufacturer's specific application instructions and the following information:

1. Paint manufacturer’s data sheet for each product proposed, including statements on the suitability of the materials for the intended use.

2. Surface preparation recommendations

3. Type of primer, if required

4. Maximum dry and wet mil thickness per coat

5. Minimum and maximum curing time between coats, including atmospheric conditions for each

6. Curing time before submergence in water

7. Thinner to be used with each paint

8. General ventilation requirements

9. Atmospheric conditions during which the paint is not to be applied

10. Allowable methods of application

11. Maximum allowable moisture content and minimum age of plaster, concrete and wood surfaces at time of paint application

12. Compatibility of shop and field applied coatings (where applicable)

C. Reports: Submit the following to the Engineer:

1. Reports on visits to project site to view and approve surface preparation of structures to be coated.

2. Reports on visits to project site to observe and approve coating application procedures.

3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are “shop coated.”

1.6 DELIVERY AND STORAGE

A. Deliver, store, and handle products in accordance with manufacturer's requirements. All materials are to be delivered to the job site in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions.

B. Only the approved material shall be stored at the job site and stored only in designated areas restricted to the storage of paint materials and related equipment. All paint is to be stored in enclosed structures and protected from weather and excessive heat or cold. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45- and 90-degrees Fahrenheit, unless otherwise recommended by the manufacturer.

C. Store flammable materials to conform with State and local safety codes. Protect emulsion type paints from freezing. Take precautions to prevent fire and spontaneous combustion.

D. Materials exceeding storage life recommended by the manufacturer will be subject to rejection.

E. Remove unspecified and unapproved paints from Project site immediately

1.7 SURFACES NOT REQUIRING PAINTING

A. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, aluminum, chromium plate, and weathering steel, except where (1) required for electrical insulation between dissimilar metals, (2) aluminum is in contact with concrete or masonry, and (3) color coding of equipment and piping is required.

B. Copper, bronze, aluminum, weathering steel, and stainless steel,

C. Glass, porcelain, and plastics do not require painting.

D. Prefinished architectural finishes such as acoustical tile, cabinets, and wall panels do not require painting.

E. Prefinished electrical items such as motor control centers, switchboards, switchgear, panelboards, transformers, and disconnect switches do not require painting.

F. Exposed electrical conduits shall be painted to match the color of the adjacent wall or equipment to which they are attached, except that non-submerged conduit attached to unpainted masonry and concrete surfaces need not be painted.

G. Exterior concrete slabs, exterior sidewalks, exterior concrete stairs and exterior concrete curbs.

H. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

1.8 MAINTENANCE

A. Extra Materials: Include minimum 1 gallon of each type and color of coating applied. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type and color.

PART 2 - PRODUCTS

2.1 PAINT AND COATING SYSTEM APPLICATIONS

A. Prepare surfaces and apply paint and coating systems in accordance with the following schedules for all surfaces.

Surface Preparation	Description
SSPC SP-1	Solvent Cleaning
SSPC SP-2	Hand Tool Cleaning
SSPC SP-3	Power Tool Cleaning
SSPC SP-5	White Metal Blast Cleaning
SSPC SP-6	Commercial Blast Cleaning
SSPC SP-7	Brush off Blast Cleaning
SSPC SP-10	Near White Blast Cleaning
SSPC SP-11	Power Tool Cleaning to Bare Metal
SSPC SP-12	High- and Ultrahigh-Pressure Water Jetting
SSPC SP-13	Surface Preparation of Concrete
SSPC SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

Paint and Coating Application Schedule		
Surface to be Painted or Coated	Surface Preparation	Paint System
Ferrous Metal, Submerged or Buried	SSPC – SP-10	System 3
Ferrous Metal, Exposed Inside Wet Well and Valve Vault	SSPC – SP-10	System 3

2.2 PAINT AND COATING SYSTEMS

A. Furnish primers and finish coatings as shown on the following coating table schedule. If manufacturers have changed their coating products and the products shown below are no longer available, provide the product that the manufacturer recommends as the improved version of the product shown.

B. Where dry film thicknesses are not shown, the DFT shall be as recommended by the manufacturer for the product and service shown in the Application Schedules above.

C. Paint and Coating Systems:

System	Tnemec Company
3*	Tnemec N69 Hi-Build Epoxoline II 8 mils primer Tnemec HS Epoxy 104 10 mils finish

*System 3 does not require a NACE Inspector

2.3 OTHER COATINGS

A. Factory Applied Coatings and Touchup: Field touchup shall consist of touching up the shop prime coat to achieve the film thickness, continuity and coating specified in accordance with the paint system data sheets. Badly damaged shop coatings shall be removed, and the surfaces recoated in accordance with the specified system requirements.

B. Aluminum Metal Insulation: Where aluminum surfaces come in contact with concrete or with metals not compatible with aluminum, paint the dissimilar materials with a prime coat of zinc-chromate primer or a coating of heavy-bodied bituminous paint.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Prepare all surfaces prior to application of paint or coatings. Comply with surface preparation requirements of the Society for Protective Coatings (SSPC). If the paint or coating manufacturer recommends a surface preparation different than that shown, follow the more stringent surface preparation requirement.

B. ASTM D4259 – Wet Abrasive Blasting, Vacuum Assisted Dry Abrasive Blasting or Centrifugal Shot Abrasive Blasting

1. Shot Blasting – Before blasting fill defects and holes with filler recommended by the coating manufacturer. Blast with dustless steel shot to remove laitance, residue and loose material to roughen the surface to a texture of No. 40 to 60 grit sandpaper.

C. Surface preparation requirements of the Society for Protective Coatings (SSPC) are as follows:

1. SSPC – SP-1 – Solvent Cleaning

2. SSPC – SP-2 – Hand Tool Cleaning

3. SSPC – SP-3 – Power Tool Cleaning

4. SSPC – SP-5 – White Metal Blast Cleaning

5. SSPC – SP-6 – Commercial Blast Cleaning

6. SSPC – SP-13 – Mechanical or Chemical Cleaning

D. Preparation of Concrete and Masonry Surfaces: Unless otherwise specified, concrete surfaces which are to receive any paint coating shall be allowed to age for a minimum of 28 days. Moisture content shall be tested with a Delmhorst Instrument Company moisture detector prior to application of paint or coating. The moisture content of the concrete shall be within the limits recommended by the manufacturer of the paint or coating before any paint or coating is applied.

3.2 APPLICATION

A. Workmanship: All work shall be done in a workmanlike manner so that the finished surface will be free from runs, drips, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such a manner as to produce an even film of uniform thickness, completely coating all corners and crevices.

B. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in a first-class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Spray equipment shall be equipped with mechanical agitators, pressure gauges, and pressure regulators. Spray nozzles shall be of the proper sizes.

C. Each coat of paint shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs and other adjacent areas and installation shall be protected by taping, drop cloths or other suitable measures.

D. Paint Properties, Mixing and Thinning. All paint, when applied, shall provide a satisfactory film and smooth, even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application, adhesion and subsequent coats. Paints shall be thoroughly stirred, strained and kept at a uniform consistency during application. Coatings consisting of two (2) or more components shall be mixed in accordance with manufacturer's instructions. Where necessary to suit conditions of the surface, temperature, weather and method of application, and with the Engineer's approval, the paint may be thinned immediately prior to use by the addition of not more than one pint per gallon of the proper thinner; provided that in no case shall the paint be reduced more than necessary to obtain the proper application characteristics. Where specifically permitted by the Specifications, certain paints may be thinned more than the maximum indicated above. Paint thinner shall be as recommended by the paint manufacturer.

E. Atmospheric Conditions: Except as specified or required for certain water-thinned paints, paints shall be applied only to surfaces that are thoroughly dry and only under such combination of humidity and temperatures of the atmosphere and surfaces to be painted as will cause evaporation rather than condensation.

1. In no case shall any paint be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation without suitable protection, as accepted by the Engineer. Where painting is permitted during damp weather or when the temperature is at or below 40 degrees F, the surfaces shall be heated to prevent moisture condensation thereof.

2. Bar metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to paint application.

3. While any painting is being done and for a period of at least eight (8) hours after the paint has been applied, the temperature of the surfaces to be painted, the painted surfaces and the atmosphere in contact therewith shall be maintained at or above 40 degrees F and 5 degrees above the dew point.

4. All paint, when applied, shall be approximately the same temperature as that of the surface on which it is applied. The use of fans or heaters shall be required in enclosed areas where conditions causing condensation are severe.

F. Method of Paint Application: Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead or any lead compound which may be destroyed or affected by hydrogen sulfide or any gas likely to be found in wastewater treatment plants.

G. Electrical and mechanical equipment, on which the manufacturer's coating is found, shall be touch-up primed and painted with two (2) coats of the specified paint system to match the color scheduled.

H. No paint shall be applied to any surface until it has been prepared as specified and approved by the Engineer. Unless otherwise specified, the primer or first coat of paint shall be applied by brush to ferrous surfaces. All subsequent coats for all ferrous surfaces may be either brush or spray applied. Unless stated otherwise, prime and finish coats shall be applied at the rate recommended by the manufacturer for the services involved. After prime coat is dry, all suction spots shall be touched up before succeeding coats are sprayed. All coats for concrete and masonry shall be brushed or rolled unless otherwise specified. Before painting or repainting existing surfaces, the Contractor shall test-paint a small area on the actual surface to show that the color matches the existing surfaces.

I. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the prime and intermediate coats have been inspected by the Engineer.

J. Film Thickness and Continuity: The actual surface area covered per gallon of oil and varnish vehicle paint for various types of surfaces shall not exceed those recommended by the manufacturer. All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Except as specified, no less than two (2) coats shall be applied.

K. Special Requirements: Hangers shall be painted, except for the final coat, prior to installation. Paint underside of all ungalvanized equipment bases and supports with at least two (2) coats of rust inhibiting primer prior to setting the equipment in place. Paint bolt and bolt holes in flanges, such as those used with couplings or wager type valves, where hold and bolt as finally installed will be exposed to weather or moisture, prior to assembly to prevent rusting of the unprotected metal.

3.3 FIELD INSPECTION AND TESTING

A. Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors.

B. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the underlying coats have been inspected and accepted by the NACE Inspector.

C. Film Thickness: All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications and the Manufacturer's recommendations as stated in the product data sheets. The dry film thickness of each coating application will be measured using the SSPA-2 standard. The minimum/maximum thickness requirements shall meet the perimeters outlined in this standard. Where the minimums and maximums do not meet the requirements of this standard, corrections must be made.

D. Continuity: Holiday testing will be performed in accordance with NACE RP0188. All surfaces below the waterline shall be tested.

In testing for continuity, all pinholes and holidays located shall be repainted to the required dry film thickness. All ferrous metal surfaces shall meet minimum continuity requirements outlined the NACE RP0188 standard. All holiday repairs will be re-tested following the repairs.

E. It is intended that the dry film thickness and the continuity of painted ferrous metal surfaces be subject to continual field check by the Contractor's quality control subcontractor. Dry-film thickness will be measured by an Elcometer or Mikrotest magnetic type dry-film thickness gauge. Continuity will be tested by a low voltage wet sponge transistorized device, as manufactured by Tinker-Rasor (Model M-1), or equal. The Contractor's quality control subcontractor shall use inspection devices that are in good working condition for detection of holidays and measurement of dry-film thickness. The Contractor's subcontractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry-film thickness gauge and certified instrumentation to test accuracy of holiday detectors. Provide safe and suitable ladders or temporary scaffolding and adequate illumination to facilitate inspection.

3.4 PROTECTION OF PAINT SURFACES

A. Where protection is provided for painted surfaces, such protection shall be preserved in place until the paint film has properly dried and the removal is authorized. Items which have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is completely dry and hard.

B. After delivery at the site of materials for permanent erection or installation, all shop-coated metalwork shall be repainted or retouched from time to time, which specified paint, whenever, in the opinion of the Engineer, it becomes necessary to maintain the integrity of the film.

3.5 CLEANUP

A. Upon completion of all painting, remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other paint-related damage.

END OF SECTION 09 90 00

SECTION 40 05 00 – PIPING, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.

B. The mechanical drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. Where pipe supports and spacings are indicated on the drawings and referenced to a standard detail, the Contractor shall use that detail. Where pipe supports are not indicated on the drawings, it is the Contractor's responsibility to develop the details necessary to design and construct all mechanical piping systems, to accommodate the specified equipment, and to provide all spacers, adapters, and connectors for a complete and functional system.

C. Piping system drawings are diagrammatic and are intended to show approximate location of equipment and piping. Dimensions given on the plans in figures take precedence over scaled dimensions. Verify dimensions, whether in figures or scaled, in the field. The Contractor shall be responsible for the installation of complete and workable systems whether completely detailed on the plans or not.

D. The Contractor shall ascertain locations of apparatus, fixtures, equipment, and piping in the field, and layout work accordingly. The Owner reserves the right to have minor changes in location of piping and equipment made up to the time of installation without additional cost.

1.2 REFERENCE STANDARDS

A. All mechanical work shall conform to latest edition of the International Mechanical Code.

B. Commercial Standards

1.	ASTM B 88	Hard Copper Tube
2.	ASME B 16.22	Copper Fittings
3.	ANSI/ASME B 1.20.1	Pipe Threads, General Purpose (inch)
4.	ANSI B 16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
5.	ANSI/AWWA C 207	Steel Pipe Flanges for Water Works Service; Sizes 4 in through 144 in.
6.	ANSI/AWWA C 606	Grooved and Shouldered Joints
7.	ANS/AWS D1.1	Structural Welding Code

8.	ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile
9.	ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
10.	ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement
11.	ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.3 CONTRACTOR SUBMITTALS

A. At a minimum, the following information shall be submitted for review and approval prior to ordering piping materials.

1. Manufacturer specifications for each pipe type, including all references to acceptable standards as referenced in each individual pipe section.

2. Indicate fittings and manufacturer recommended connections.

3. Pressure ratings.

4. Lining and coating type, thickness, and application procedures.

5. Fitting types and manufacturer recommended applications and acceptable installation procedures and tolerances.

B. Fabrication Drawings: The Contractor shall submit piping fabrication drawings show in all fittings, pipe material, supports, and all dimensions for proper installation of piping system as illustrated on mechanical drawings.

1.4 QUALITY CONTROL

A. Certifications: Necessary certificates, test reports, and affidavits of compliance shall be obtained by the Contractor. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricators or a recognized quality control program. An outline of the program shall be submitted to the Engineer for review prior to the manufacture of any pipe.

B. Where the assistance of a manufacturer's service representative is advisable, in order to obtain recommended pipe joints, supports, or special connections, the Contractor shall furnish such assistance at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Lining: Application, thickness, and curing of pipe lining shall be in accordance with the applicable sections of Division 40 unless otherwise indicated. Fittings and couplings shall be lined with the same material required for the pipeline in which the fittings and couplings are installed.

B. Coating: Application, thickness, and curing of pipe coating shall be in accordance with the applicable sections of Division unless otherwise indicated. Pipes above ground or in structures shall be field-coated in accordance with Section 09 90 00 – Painting and Coating.

C. Pressure Rating: Piping systems shall be designed for the maximum expected pressure as indicated on the drawings and individual pipe specifications.

D. Grooved Piping Systems: Piping systems with grooved joints and fittings may be provided in lieu of flanged, joint systems for exposed ductile iron piping. To assure uniform and compatible piping components, all grooved fittings, couplings, and valves shall be from the same manufacturer. The Contractor shall make the coupling manufacturer responsible for the selection of the correct style of coupling and gasket for each individual location.

E. Tests: Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The Contractor shall be responsible for performing material tests.

F. Welding Requirements: Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of ANSI/AWS D1.1 - Structural Welding Code. Welding procedures shall be submitted for the Engineer's review.

G. Welder Qualifications: Welding shall be done by skilled welders and welding operators who have adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9, by an independent local, approved testing agency not more than six (6) months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. Qualification testing of welders and materials used during testing is part of the Work.

H. Joining Dissimilar Materials: Di-electric unions shall be used at the junction of two dissimilar metallic pipes as required by the local adopted plumbing code. It shall be the responsibility of the Contractor to identify any such conditions whether indicated in the Project Drawings or not. Di-electric unions shall be lead free, appropriate for the two dissimilar metals and be stamped with an approved UPC seal.

2.2 PIPE FLANGES

A. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207. Flange faces shall be perpendicular to the axis of the adjoining pipe. Flanges for miscellaneous small diameter

pipes shall be in accordance with the standards indicated for these pipes. Flanges shall have pressure ranges corresponding to the following:

1. 150 PSI or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service-Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 Ib class.

2. 150 to 275 PSI: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5 150 Ib class.

3. 275 to 700 PSI: Flanges shall conform to ASME B16.5, 300 Ib class.

4. AWWA flanges shall not be exposed to test pressures greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

B. Blind Flanges: Blind flanges shall be in accordance with AWWA C207, or as indicated for miscellaneous small pipes. Blind flanges for pipe sizes 12-inches and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.

C. Flange Coating: Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: Bolts and nuts shall conform to Section 05 50 00 – Metal Fabrications. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.

E. Insulating Flanges: Insulated flanges shall have bolt holes 1/4-inch diameter greater than the bolt diameter.

2.3 INSULATING CONNECTIONS

A. Insulating Flange Sets: Unless otherwise specified, insulating flange sets shall be provided at all locations where dissimilar metals are connected. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers, and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inch or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2 inch, insulating sleeves and washers shall be two (2) pieces and shall be made of polyethylene or phenolic material. Steel washers shall be in accordance with ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength. Insulating gaskets shall be full-face.

1. Insulating Flange Manufacturers, or equal

a. JM Red Devil, Type E

b. Maloney Pipeline Products Co., Houston

c. PSI Products, Inc., (Frost Engineering Service Co., Costa Mesa, California).

B. Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved. Threaded insulating connections shall be of nylon, teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

C. Insulating Sleeve Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a sleeve of an insulating compound material compatible with the fluid service in order to obtain insulation of all coupling metal parts from the pipe

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. Cast mechanical-type couplings shall be provided where indicated. The couplings shall conform to the requirements of AWWA C606 - Grooved and Shouldered Joints. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Metal Fabrications. Mechanical-type couplings shall be bonded. The Contractor shall have the coupling manufacturer's service representative verify the correct choice and application of couplings and gaskets, and the workmanship, to assure a correct installation. To assure uniform and compatible piping components, grooved fittings, couplings, and valves shall be furnished by the same manufacturer as the coupling. Grooving tools shall be of the same manufacturer as the grooved components.

B. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations.

C. The wall thickness of grooved piping shall conform to the coupling manufacturer’s recommendations to suit the highest expected pressure.

D. To avoid stress on equipment; equipment connections with mechanical-type couplings shall have rigid-grooved couplings or flexible type coupling with harness in sizes where rigid couplings are not available, unless thrust restraint is provided by other means.

E. Manufacturers of couplings for steel pipe, or equal

1. Gustin-Bacon (Aeroquip Corp.) (banded or grooved)

2. Victaulic Style 41 or 44 (banded, flexible)

3. Victaulic Style 77 (grooved, flexible)

4. Victaulic Style 07 or HP-70 (grooved, rigid)

F. Manufacturers of ductile iron pipe couplings, or equal

1. Gustin-Bacon, (Aeroquip Corp.)

2. Victaulic Style 31 (flexible or rigid grooving)

Note: Ductile iron pipe couplings shall be furnished with flush seal gaskets.

2.5 SLEEVE-TYPE COUPLINGS

A. Sleeve-type couplings shall be provided where indicated. The Contractor will not be allowed to substitute a sleeve-split coupling for the sleeve coupling unless approved by the Engineer.

B. Construction: Sleeve couplings shall be in accordance with AWWA C219 - Standard for Bolted Sleeve- Type Couplings for Plain-End Pipe. Couplings shall be steel with steel bolts, without pipe stop. Couplings shall be of sizes to fit the pipe and fittings indicated.

1. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.

2. The coupling shall be either 5- or 7- inches long for sizes up to and including 30-inches and 10-inches long for sizes greater than 30-inches, for standard steel couplings, and 16-inches long for long-sleeve couplings.

3. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

4. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Metal Fabrications.

C. Pipe Preparation: Where indicated, the ends of the pipe shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12-inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof- test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

2.6 GASKETS

A. Gaskets for wastewater and sewerage applications shall be Buna N (NBR), Grade 60, or equivalent suitable elastomer and shall be rated for a temperature range of -30°F to 150°F.

B. The flanged joint rating for pressure and temperature performance shall match or exceed the working pressure and temperature of the pipe system in which it is installed.

C. Flange gaskets in ductile iron pipe shall be full-faced type with a minimum thickness of 1/8 inch. Flanged gaskets shall be the high performance type satisfying the special requirements of ANSI/AWWA C111/A21.11, Appendix C, Section C.2 with a minimum of two bulb type rings molded into both faces of the gasket.

2.7 FLANGE COUPLING ADAPTERS

A. Flange coupling adapters shall only be used where shown on the drawings or accepted by the Engineer. Otherwise, the Contractor shall only use dismantling joints if additional flexibility is required for the pipe installation.

B. Flange coupling adapters shall be designed for a water working pressure not less than the design pressure of the pipe on which they are to be installed and shall be equipped with suitable rubber gaskets.

C. Couplings shall be Romac RFCA, or equal. Thrust ties shall be provided for all flexible couplings to sustain the force developed by the test pressure. Anchor studs will not be acceptable.

2.8 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, pumps and other vibrating equipment, and where indicated. Flexible connectors for service temperatures up to 180 degrees F shall be flanged reinforced neoprene or butyl single-arched spools, rated for a working pressure of 40 to 150 psi, or reinforced flanged duck and rubber, as best suited for the application. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise indicated. The connectors shall be a minimum of 9-inches long, face-to-face flanges, unless otherwise indicated. The final material selection shall be approved by the manufacturer. The Contractor shall submit manufacturer's shop drawings and calculations.

B. Grooved pipe flexible mechanical couplings may be used in lieu of the above paragraph on pumps only. The Contractor shall submit manufacturer's shop drawings and calculations.

2.9 MISCELLANEOUS

A. Expansion Joints: Piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be flanged end, stainless steel, Monel, rubber, or other materials best suited for each individual service. The Contractor shall submit detailed calculations and manufacturer's Shop Drawings of all proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature, and pressure ratings.

B. Piping Connection to Equipment: Where piping connects to mechanical equipment such as pumps, compressors, and blowers, the piping shall be brought to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected to the equipment. The piping shall not impose excessive stress to the equipment connection so much to cause misalignment of the equipment. The Contractor shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the Engineer for review.

C. Restrained Joints: Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be designed by the pipe manufacturer in accordance with Manual M11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed. Where harness sets are installed near the suction and discharge of the pump. Harness bolts shall have zero elongation to prevent misalignment of the pump imparted by the thrust within the piping system. Thrust restraints systems shall be manufactured by Victaulic, "Depend-O-Lok"; Dresser, "Style 38"; Ford Meter Box Co., Inc., "Style FC1 or FC3"; and Smith-Blair, "Style 411."

D. Pipe Threads: Pipe threads shall be in accordance with ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

E. Air and Gas Traps: Air and gas pipes shall slope to low points and be provided with drip legs, shut-off valves, strainers, and traps. The traps shall be piped to the nearest drain. Air and gas traps shall be not less than 150 lb iron body float type with copper or stainless steel float. Bracket, lever, and pins shall be of stainless steel. Drain traps shall have threaded connections acceptable manufacturers include Armstrong International, Inc. and Spirax Sarco, Inc.

2.10 COUPLINGS

A. Flexible Pipe Couplings – Smith Blair OMNI 441 coupling system or approved equal. Couplings shall be lined and coated with a minimum thickness of 0.012" fusion-bonded epoxy or approved equal. Coating must comply with ASTM C213 and AWWA C550.

2.11 DISMANTLING JOINTS

A. Dismantling joints shall be Romac Style DJ400, Smith Blair Model 975 or approved equal. Dismantling joints shall be coated with fusion bonded epoxy per AWWA C213. Provide high strength stainless steel bolts, nuts and tie rods. Use anti seize lubricant when assembling all stainless steel hardware.

2.12 TAPPING SADDLES

A. Tapping saddles shall have a ductile iron body meeting ASTM A536, Grade 65-45-12. Gasket shall be Nitrile Butadiene Rubber (NBR) for water and sewer service. Saddles shall have two, 2" straps constructed of Type 304 stainless steel with GMAW and GTAW welds. Stainless steel shall be passivated for corrosion resistance. Casting shall be coated with fusion bonded black nylon, 10 – 12 mils thick, with a dielectric strength of 1,000 v/mil. Threads as required for installation of instrumentation.

B. Bolts, nuts and washers shall be Type 304 (18-8) heavy gauge stainless steel.

C. Saddles shall comply with AWWA C800 and shall have a pressure rating of 350 psi for pipe sizes up to 24 inch.

D. Provide Romac 202 service saddles or equivalent.

2.13 MECHANICAL RESTRAINT

A. Type: Standard mechanical joint restraint gland, restraint devices for MJ fittings and appurtenances to conform to ANSI/AWWA C111 or ANSI/AWWA C153.

B. Product: EBAA Iron Series 2000 PV (for PVC Pipe) or EBAA Iron Series 1100 Megalug (for DIP) or approved equal, and to meet requirements of ASTM F1674.

C. Application: Approved for above ground installation and below ground where specifically specified on the Plans.

D. Pipe joints shall be restrained 30 ft. or a minimum of two pipe joints (whichever is longer) upstream and downstream of a mechanically restrained fitting.

2.14 BOLTS AND ANCHORS

A. Bolts and anchors for fittings, pipe couplings, valves, piping and accessories shall comply with Section 05 50 00 – Metal Fabrications.

PART 3 - EXECUTION

3.1 GENERAL

A. Care shall be taken to ensure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are property installed as follows:

1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection. Each gasket shall be centered properly on the contact surfaces.

2. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

3. Bolts shall be initially hand-tightened with the piping connections properly aligned. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC recommended torque for the bolt material.

4. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.

5. After installation, joints shall meet the indicated leakage rate. Flanges shall not be deformed nor cracked.

B. Soldered Pipe Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook", using lead-free solder alloy complying with ASTM B 32.

C. Brazed Joints: Construct joints according to AWS's "Brazing Handbook Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS ASB.

D. Lined Piping Systems: The lining manufacturer shall take full responsibility for the complete, final product and its application. Pipe ends and joints of lined pipes at screwed flanges shall be epoxy-coated to assure continuous protection.

E. Core Drilling: Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and reinforcing bars.

F. Cleanup: After completion of the Work, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site. The entire piping system shall be handed over in a clean and functional condition.

G. Backfill: All buried pipes shall be backfilled with ¾" minus gravel, compacted to 95% modified proctor.

H. Protective Coating: All pipes shall be coated in accordance with Section 09 90 00-Painting and Coating.

3.2 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact Defective or damaged materials shall be replaced with new materials.

3.3 PIPING INSTALLATION

A. Cut piping accurately for fabrication to measurements established at the construction site and work into place without springing and/or forcing.

B. Remove burrs and cutting slag from pipe by reaming or other approved cleaning methods.

C. Make changes in direction with proper fittings.

D. Arrange piping so as not to interfere with the removal of other equipment, ducts, or devices. Do not block access doors, windows, or access openings. Provide unions in the piping at connections to all equipment. Unions must be accessible.

E. Make connections of dissimilar metals (such as copper and steel) with insulating couplings suitable for at least 175 psi working pressure at 250 degrees F.

F. Cap or plug open ends of pipes and equipment with PVC caps or expanding neoprene plugs to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton, waste, or similar materials are not acceptable.

G. Install all piping systems so they can easily be drained. Provide hose bibs at low point of water lines.

H. Slope all soil and waste lines within the building at 1/4 inch fall per foot in the direction of flow unless otherwise noted on drawings.

3.4 YARD PIPING INSTALLATION

A. If excavation enters an area of petroleum or other contamination, stop work and notify the Engineer for verification of piping and gasket material usage.

B. Install pipe per manufacturer's specific instructions. Do not install pipe without continuous support under the barrel or where a dry joint connection cannot be made.

C. Install pipe with a minimum of 5 feet of cover or as indicated on the drawings. Insure that the pipe has adequate cover from sub-grade as listed above and installed below frost depth.

D. Mechanical Joint Pipe

1. Gland shall be placed on spigot end of pipe with lip extension toward the joint, and the rubber gasket shall be slipped on the pipe with its thick edge toward the gland.

2. The gasket and joint surfaces shall be thoroughly wetted using a soapy solution made with vegetable soap or similar soap as recommended by the manufacturer.

3. After inserting the spigot end of the pipe to full depth and pressing the gasket firmly into place in the bell, the gland shall be moved into place, the bolts inserted, and the nuts finger tightened. The nuts shall then be tightened gradually with a wrench - a half turn at a time, moving wrench from one nut to another repeating until all nuts are uniformly tight. Final tightness shall be with a torque wrench: 60 - 90 pounds torque for ¾" bolts. Install gland retainer on thrust retainer glands as recommended by the manufacturer.

E. Pressure Pipelines: All buried pipe installations shall be capable of withstanding maximum thrust at test pressure. All fittings associated with this project shall be fully restrained.

F. When pipe installation is suspended at the end of each day, assure that no dirt or other foreign material is allowed in pipe or fittings. Block or plug the open end of the pipe to prevent creep, uplift or floating, entrance of water, dirt, or other materials.

G. Place pipe anchors on all pipes installed on slopes 20% and greater.

H. Do not operate existing or active valves without the authorization of the Engineer.

I. Install pipe end markers to surface. Pipe marker to be 2x4 wood stud, painted green for sewer, purple for reclaimed or utility water or irrigation, or blue for potable water. Attach finder wire attached to stub and 2x4.

3.5 WORKMANSHIP

A. Care shall be taken at all times to protect floors, stairways, and walls during the make-up, erection of piping, and placing of equipment. The Contractor shall remove all stains and repair all damage before final acceptance of the work.

3.6 TESTING

A. Test all pressure piping at 50 psi of water. If leaks occur, repair and retest. Testing to be witnessed by the Owner.

B. Repair defects which develop under tests promptly and repeat tests. No caulking of screwed joints, cracks, or holes will be permitted. Repair leaks in screwed joints by replacing pipe or fitting or both with new material.

C. Repair leaks in copper tubing by melting out joint, thoroughly cleaning both tubing and fitting, and resoldering.

3.7 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

END OF SECTION 40 05 00

SECTION 40 05 19 - DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required for the installation of all ductile iron pipe, couplings, fittings, and jointing materials where shown on the Plans, including all piping installed under buildings that is connected to PVC yard piping.

B. Coordinate Work with all other trades.

C. All ductile iron pipe and fittings to be glass-lined with grooved (Victaulic) joints.

1.2 REFERENCE STANDARDS

A.	AWWA C104	Cement-Mortar Lining for Ductile-Iron and Grey-Iron Pipe and Fittings for Water
B.	AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
C.	AWWA C110	Ductile-Iron and Gray-Fittings, 3 in through 48 in for water
D.	AWWA C111	Rubber Gasket Joints for Ductile-Iron and Grey-Iron Pressure Pipe and Fittings
E.	AWWA C115	Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
F.	AWWA C151	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other Liquids
G.	AWWA C153	Grey-Iron and Ductile-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
H.	AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances

I. State Plumbing Code, as applicable.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 40 05 00 – Piping, General and include, but not limited to the following information:

1. Pipe Manufacturer information, including pipe class and pressure rating and joint design.

2. Pipe Manufacturer information regarding epoxy, glass, and cement-mortar lining, including lining thickness and descriptions of material properties.

3. Certifications: The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section and as specified in the referenced standard and the following supplemental requirements:

   a. Physical and chemical properties.

   b. Hydrostatic test reports.

4. Submit manufacturer's certification that pipe and fittings meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

   1. The Contractor shall perform said material tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor; provided, that the Contractor's schedule is not delayed for the convenience of the Engineer.

B. Reject any pipe which does not conform to specifications or is cracked, chipped, or otherwise unacceptable.

C. Use the type, size, and strength rating of the pipe as specified in the proposal or as shown on the Plans.

PART 2 - PRODUCTS

2.1 GENERAL

A. All pipe and fittings used shall be glass lined with grooved (Victaulic) joints.

2.2 MATERIALS

A. Use ductile iron pipe conforming to AWWA C151 pressure class 150 minimum unless otherwise required by the plans. Nominal pipe laying lengths shall be 20 ft. The pipe and associated fittings shall be of the diameter as indicated on the drawings. The interior lining shall be as indicated below. Exterior coatings other than factory applied asphaltic topcoat shall be as indicated in Section 09 90 00 - Painting and Coating.

B. Use Class 150 grey-iron or ductile iron fittings conforming to AWWA C153 unless otherwise required by the Plans.

C. Use grooved fittings as identified on the plans per Section 40 50 00 – Piping, General. All valves shall be grooved type.

D. Use mechanical joint fittings, spools, and couplings for <u>all below grade</u> piping whether shown or not and for above grade locations if mechanically restrained and shown on the Plans to provide a complete functional pipe system. Pipe and fittings shall conform to AWWA C110, C111, and C153. The pipe manufacturer shall provide gasket bolt sets for each pipe and spool provided. All buried valve connections shall be mechanical joint.

E. Joint Design: Ductile iron pipe and fittings shall be furnished grooved type connections as shown in the drawings. Where not specifically identified in the plans flange joints may be used. Grooved and flange joints shall be per Section 40 05 00 – Piping, General.

F. Glass Lining: Ductile iron pipe and fittings shall be glass-lined and shall be manufactured in full compliance with ASTM B1000 – Standard Practices for Casting Preparation and Test Procedure of Porcelain Enamel-lined Pipe, Fittings, and Valves for Use in the Municipal Wastewater, Sewage, and Water Treatment Industry. Minimum wall thickness shall be ANSI Thickness Class 53. The glass lining shall be suitable for handling sewage, primary sludge, digested sludge, and scum. It shall be smooth, continuous, and suitable for prevention of grease and form build-up. The glass lining shall be capable of withstanding thermal shock of 350 degrees F (430 degrees to 80 degrees) without crazing, blistering, or spalling.

1. Criteria: The glass lining shall consist of a vitreous material to meet or exceed the following criteria:

a. Unaffected by scraping with a sharp knife, simulating the effects of rodding.

b. Unaffected by continuous application of live steam from a steam generator, immediately followed by a cold-water quench.

c. Unaffected by a 8 percent sulfuric acid solution at 148 degrees F for a ten-minute period.

d. Minimum thickness: 10 mils by micro test.

e. Spark tested: In accordance with ASTM B1000.

f. Hardness: 5-6 mohs.

g. Density: 2.5 – 3.0 g/cu cm, measured by ASTM D 792 – Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

G. Exterior Coating:

1. The exterior surfaces of the pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer and finish coat conforming to the requirements of Section 09 90 00 – Painting and Coating.

2. All buried mechanical joints, piping and fittings shall be wrapped with a polyethylene 8-mil thick liner low-density film. All buried ductile iron piping shall be provided with a bituminous tar coating on the pipe exterior.

H. Bolts and Nuts: The flange and MJ bolts shall comply with the material specified in Section 05 50 00 – Metal Fabrications.

I. Gaskets shall be as specified in Section 40 05 00 – Piping, General.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect pipe and components against dirt and damage during shipment and storage.

B. The pipe shall be handled according to the manufacturer’s specifications to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment that might damage the pipe coating/exterior is prohibited. Stockpiled pipe shall be supported on padded skids, sand or earth berms free of rock exceeding 3 inches in diameter, sand bags, or suitable means so the coating will not be damaged. The pipe shall not be rolled and shall be secured to prevent accidental rolling.

C. Keep jointing material sealed when not in use.

D. Unload and string out pipe in accordance with manufacturer's recommendations and in a manner approved by the Engineer.

3.2 INSTALLATION

A. The pipe shall be installed in accordance with AWWA C600 and per manufacturer's specific instructions. Do not install pipe without continuous support under the barrel or where a dry joint connection cannot be made.

B. Coat all mechanical joints with low density polyethylene film sleeve as per AWWA C105, except where concrete encased as shown.

C. Where necessary to raise or lower the pipe due to unforeseen obstruction or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed 75 percent of the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount that will be detrimental to the strength and water tightness of the finished joint.

D. Field cutting shall be performed in accordance with manufacturer’s specific instructions. Repair of glass-lined pipe shall be performed with Induron’s Glass Repair Epoxy Kit or manufacturer approved equal and associated instructions.

3.3 INSTALLATION OF PIPE APPURTENANCES

A. Protection of Appurtenances: When the joining pipe is dielectric-coated, buried appurtenances shall be coated in kind. Where pipe is encased in polyethylene sleeves, buried appurtenances shall also be encased in polyethylene.

B. Installation of Valves: Valves shall be handled in a manner to prevent any injury or damage to any part of the valve. Joints shall be thoroughly cleaned and prepared prior to installation. The Contractor shall adjust all stem packing and operate each valve prior to installation to insure proper operation.

C. Valves shall be installed so that the valve stems are plumb in the location indicated.

3.4 PIPELINE TESTING

A. The Contractor shall furnish all test equipment, labor, material, and devices at no extra cost to the Owner. Leaks shall be repaired to the satisfaction of the Engineer, and the system shall be re-tested until no leaks are found at no extra cost to the Owner.

END OF SECTION 40 05 19

SECTION 40 05 62 - PLUG VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide plug valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 REFERENCE STANDARDS

A. ASTM A 126 Gray Iron Castings for Valves

B. ASTM A 536 Ductile Iron Castings

1.3 SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 40 05 51 – Valves, General.

B. Contractor shall indicate actuator position for each valve in submittal. Valves installed in horizontal piping shall have the plug swing upward when opening, no exceptions.

PART 2 - PRODUCTS

2.1 ECCENTRIC PLUG VALVES (1/2 INCH TO 72-INCH)

A. Construction: Eccentric plug valves shall be of the non-lubricated, eccentric plug design with cast iron bodies conforming to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings, with grooved (Victaulic) connections.

1. The plugs and shafts shall be of cast iron or ductile iron conforming to ASTM A 536 - Ductile Iron Castings, and the plugs shall be glass-lined.

2. Valves shall be provided with grooved (Victaulic) connections

3. The seats shall be of nickel or stainless steel welded to the body.

4. All top and bottom shaft bearings shall be of permanently lubricated stainless steel or Teflon coated stainless steel.

5. Grit seals of Teflon, Nylatron, or similar suitable material shall be at the top and bottom plug journals.

6. Valves shall have an unobstructed port area of 100 percent of full pipe area.

7. All eccentric plug valves shall have a pressure rating of not less than 150 psi WOG, for bubble-tight shut-off in the standard flow direction, and 25 psi WOG in the reverse flow direction.

8. When equipped with worm gear actuator, the pressure rating shall be 150 psi WOG in both directions.

9. The stem seal shall consist of field adjustable packing, replaceable without removal of the actuator, or of self-adjusting U-cup packing.

2.2 ACTUATORS

A. Unless otherwise indicated, eccentric plug valves 3-inch and smaller shall have operating levers; larger valves shall have worm-gear actuators.

B. Contractor shall coordinate actuator position for ease of operation by Owner and to ensure plug shall swing upward when installed in horizontal piping.

2.3 MANUFACTURERS, OR EQUAL

A. DeZurik Corporation

B. Val-Matic

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plug valves shall be installed in strict accordance with the manufacturer's published recommendations.

B. Unless otherwise directed, the following rules shall be observed for the installation of eccentric plug valves on sewage, sludge, or other liquid systems containing solids, silt, or fine sand:

1. The valves shall be positioned with the stem in the horizontal direction.

2. In horizontal pipelines, the plug shall swing upwards when opening, to permit flushing out of solids. Coordinate location of valve actuator so plug swings upward prior to ordering valves.

3. The orientation of the valve shall prevent the valve body from filling up with solids when closed; however, where the pressure differential through the valve exceeds 25 psi, the higher pressure for valves without worm gear, electric, or air operators shall be through the valve to force the plug against the seat.

4. Valves which may be closed for extended periods (stand-by, bypass, or drain lines) and valves with reversed flow (higher pressure on downstream side, forcing the plug away from its seat), shall be equipped with worm gear operators for all sizes.

5. For special applications or when in doubt, consult with the manufacturer prior to installation.

END OF SECTION 40 05 62

SECTION 40 05 65.23 – SWING CHECK VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide swing check valves and appurtenances, complete and operable, in accordance with the Contract Documents where required.

1.2 REFERENCE STANDARDS

A.	ANSI/AWWA C 508	Swing-Check Valves for Waterworks Service, 2 in. through 24 in.
B.	ASTM A 126	Gray Iron Casting for Valves, Flanges, and Pipe Fittings;
C.	ANSI/ASME B 16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 300;
D.	ASTM B 584	Copper Alloy Sand Castings for General Applications
E.	ASTM B 584 or B 148	Aluminum-Bronze Castings, or of Buna-N;
F.	ASTM B 763	Copper Alloy Sand Castings for Valve Application, or
G.	ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch);
H.	ASTM B 16	Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines.

1.3 SUBMITTALS

A. The Contractor shall furnish submittals in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.1 SWING CHECK VALVES (3-INCH AND LARGER)

A. General: If not specified otherwise, swing check valves for water, sewage, sludge, and general service shall be of the outside lever and spring or weight type, in accordance with ANSI/AWWA C 508 - Swing-Check Valves for Waterworks Service, 2 in. through 24 in. NPS. Valves shall have full-opening passages, designed for a water-working pressure of 150 psi. They shall have a flanged cover piece to provide access to the disc.

B. Body: The valve body and cover shall be of ductile iron conforming to ASTM A 536 – Ductile Iron Castings for Valves, Flanges, and Pipe Fittings, with grooved (Victaulic) ends.

C. Disc: The valve disc shall be of ductile iron, or bronze conforming to ASTM B 584 - Copper Alloy Sand Castings for General Applications.

D. Seat and Rings: The valve seat and rings shall be of stainless steel T304 or T316 Type.

E. Lining & Coating: The valve shall be glass-lined and coated.

F. Hinge Pin: The hinge pin shall be of 316 stainless steel.

G. Manufacturers, or equal

1. Val-Matic
2. American Flow Control
3. Mueller Company

PART 3 - EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with manufacturers recommendation

END OF SECTION 40 05 65.23

SECTION 40 05 78.11 – AIR RELEASE VALVES FOR WATER AND WASTEWATER SERVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide air-release, air/vacuum, combination air valves, and appurtenances, complete and operable in accordance with the Contract Documents.

1.2 REFERENCE STANDARDS

A. Commercial Standards:

1. AWWA C512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Technical Manual: Furnish operation and maintenance information in accordance with Section 01 78 23 – Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 GENERAL

A. All valves specified in this Section shall meet the applicable requirements of Section 40 05 51 – Valves, General.

2.2 AIR RELEASE VALVES

A. Air Release Valves: Air release valves shall be hydro-mechanical devices that automatically vent small pockets of air as they accumulate at high points in a system while the system is operating and pressurized. Valves shall be installed at high points within pressurized mechanical and yard piping systems. Valves shall be designed for a minimum water-working pressure of 150 psi, unless otherwise indicated. The valves shall be suitable for operation with wastewater. They shall have long float stems and bodies to minimize clogging. Each sewage air valve shall be furnished with the following backwash accessories, fully assembled on the valve:

1. Inlet shut-off valve
2. Blow-off valve
3. Clear water inlet valve
4. Rubber supply hose; and
5. Quick connect couplings.

B. Materials of Construction: Air vacuum and air release valves shall be constructed of the following materials:

No.	Item	Material	Reference Standard
1	Body & Cover	Cast Iron	ASTM A 126
2	Float	Stainless Steel	ASTM A 240
3	Seat	Buna-N	
4	Baffle	Cast Iron	ASTM A48

C. Manufacturers, or Equal:

1. Val-Matic, Model 801A

2. ARI

D. Size: Air vacuum and air release valves are to have a 2-inch inlet size unless called out otherwise in the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Air and vacuum release valves, shall have piped outlets to the nearest acceptable drain, firmly supported, and installed in such a way as to avoid splashing and wetting of floors and obstruction of traffic.

END OF SECTION 40 05 78.11

SECTION 40 70 13 - IN-LINE LIQUID FLOW MEASURING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide in-line liquid flow measuring systems, complete and operable, in accordance with the Contract Documents. The transmitter portion of the system shall be remotely mounted as shown on Contract Drawings.

1.2 REFERENCE STANDARDS

A. Commercial Standards:

1.	ISA – S 5.1	Instrumentation Symbols and Identification
2.	ANSI – B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
3.	ANSI/AWWA C207	Steel Pipe Flanges for Waterworks Service – Sized 4-inch through 144-inch
4.	ANSI/AWWA C700	Cold Water Meters
5.	ASME Report	Fluid Meters, Sixth Edition, 1971

1.3 SUBMITTALS

A. Shop Drawings: At a minimum, the following information shall be submitted with each meter supplied:

1. Data sheets and catalog literature for the flow meter and the microprocessor-based signal converter.
2. Connection diagrams for equipment wiring.
3. Materials of construction and connection fittings.
4. Recommended spare parts list.

B. Test Data: Signed, dated, and certified calibration data for each flow metering system which requires factory testing, submitted before shipment of equipment.

C. Certifications: The Contractor shall provide Manufacturer's certification of proper installation and certification of satisfactory field testing.

D. Owner’s Manual: Submit Owner’s manual as specified in Special Provisions, to include operation and maintenance data and other information for the equipment.

1.4 QUALITY ASSURANCE

A. Each flow metering system shall be hydraulically calibrated at a facility which is traceable to the National Institute of Standards and Technologies. The calibration procedure shall conform to the requirements of ANSI/NCSL Z 540-1 Calibration. A real-time computer-generated printout of the actual calibration data shall be submitted to the Engineer at least 30 days prior to shipment to the site.

B. Accuracy Requirements: Unless otherwise indicated, flow meters shall be guaranteed to register flow to an accuracy of plus and minus 0.3% of actual flow throughout the range indicated.

C. Guarantees, Warranties: After completion the Contractor shall furnish to the Owner the manufacturer’s written guarantee that the metering system swill operate within the published accuracies and flow ranges and meet these specifications. The Contractor shall also furnish the manufacturer’s warranties as published in its literature.

PART 2 - PRODUCTS

2.1 GENERAL

A. All meters shall be capable of operating at an minimum ambient temperature ranging from -4 to 140 degrees F.

B. All meters shall be rated for NFPA hazardous areas, see Drawings for further information.

C. The Contractor shall be responsible for confirming necessary cable length with meter manufacturer prior to ordering any meter equipment.

2.2 ELECTROMAGNETIC (MAG) FLOW METERS

A. The electromagnetic flowmeter shall consist of a flow sensor based on Faraday’s Law of Electromagnetic Induction, the flow of liquid through the sensor induces an electrical voltage that is proportional to the velocity of the flow.

B. Electromagnetic flowmeter systems shall be the low frequency electromagnetic induction type which produces a DC pulsed signal directly proportional to and linear with the liquid flow rate. Complete zero stability shall be an inherent characteristic of the flowmeter system. Each magnetic flow metering system shall include a metering tube, signal cable, transmitter, and flowmeter grounding rings.

C. Meter Tube: The tube shall be constructed of 304 or 316 stainless steel tube with ductile iron flanged or Carbon Steel connections and include a minimum of two (2) self-cleaning electrodes. The electrodes shall be constructed of materials conforming to the manufacturer's recommendation for the intended service. The meter housing shall be IP67 or IP68, rated for a submergence depth of 3 meters for a duration of 48 hours. Grounding rings shall conform to the manufacturer's bore and material recommendation for the intended service. Grounding rings shall be designed to protect and shield the liner's edge interface from abrasion at the meter end.

D. Performance Requirements: The flow metering system shall conform to the following:

No.	Item	Units	Value
1	Time Constant	Secs	0.5 – 1,000
2	Accuracy	%	0.5 of Full Flow
3	Repeatability	%	0.25 full scale
4	Power Consumption	watts	50 or less
5	Power Requirements	VAC	120

E. Transmitter: The microprocessor-based signal converter/transmitter shall be remote mounted outdoors on disconnect support structure and shall have the following:

1. Transmitter shall be suitable for installation outdoors, subject to direct sunlight and full temperature range at installed location. Transmitter housing to be NEMA 4X, with min. IP65 ingress protection. Provide with sun shield and/or other accessories as recommended by manufacturer.

2. DC pulse technique to drive flux-producing coils and capability to convert DC pulse signal from the tube to a standardized flow VDC pulse contact and a 4-20 mA DC signal into a minimum of 700 ohms.

3. Six digit LCD displays for flow rate, percent of span, and totalization. An operator interface with keypad which responds to English text entry.

4. Integral low flow cutoff and zero return to produce a consistent zero output signal in response to an external dry contact closure.

5. Automatic range change and capability to measure flow in both directions.

6. Programmable parameters including meter size, full scale Q, magnetic field frequency, primary constant, time constant.

7. Data retention for minimum of five (5) years without auxiliary power (main or battery).

8. Self diagnostics and automatic data checking.

9. Protected terminals and fuses in a separate compartment which isolates field connection from electronics.

F. Manufacturers, or equal

1. Endress+Hauser

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's published instructions, under the supervision of the manufacturer's representative, under the general review of the Engineer. All installations shall be accomplished by competent craftsmen in a workmanlike manner.

B. Final acceptance of the equipment is contingent on satisfactory operation after installation.

3.2 INSTALLATION

A. The meters shall be installed in easily accessible locations for ease of reading and maintenance, and where shown, for balancing of flow in several lines, in conjunction with throttling and shut-off valves. Where possible, all meters shall be installed in such a way to provide the manufacturer's recommended straight approach and straight piping downstream. All meters, shut-off and balancing valves shall be firmly supported from the structure or from the floor with approved supports. In-line meters shall be installed to provide full-line flow and not less than the manufacturer's recommended head at all items.

B. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures as per the manufacturer's recommendations. Provide sufficient cable from meter vault to location where local display will be located. Confirm cable lengths prior to submitting shop drawings.

3.3 TESTING

A. Equipment shall be prepared for operational use in accordance with manufacturer's instructions, including bench test and calibration, where required.

B. Each item shall be subjected to an operating test over the total range of capability of the equipment. Where applicable, tests shall be conducted in accordance with the Test Code of the Standards of the Hydraulic Institute. The Contractor shall notify the Engineer one week in advance of all tests to be conducted on site.

3.4 CLEANUP

A. After completion and testing of its work, the Contractor shall remove all debris from the site, clean all meters, controls, cabinets, and other metering appurtenances, to hand over each system in perfect operating condition.

3.5 MANUFACTURERS SERVICE REPRESENTATIVE

A. Erection and Startup Assistance: During erection and startup of the magnetic flow meters, the Contractor shall obtain all necessary assistance from an experienced factory service representative to ensure a correct and first-class installation, in accordance with the manufacturer's instructions.

END OF SECTION 40 70 13

SECTION 40 73 00 - PRESSURE MEASURING AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide pressure measuring systems, complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Shop Drawings shall be submitted in accordance with the Contract Documents

PART 2 - PRODUCTS

2.1 GENERAL

A. Liquid filled pressure gauges shall be provided where shown on the Contract Drawings.

B. Annular Seals: Gauges and pressure sensing devices shall be provided with a flanged annular seal for all high solids (raw sewage, scum, and sludge) applications, including clarifier scum and sludge, waste activated sludge, return activated sludge, thickener feed sludge, thickened sludge, and anaerobically digested sludge. Annular seals shall be provided, whether shown on the drawings or not, for these applications.

2.2 PRESSURE GAUGES

A. Gauges shall be industrial quality type with Type 304 or 316 stainless steel movement and stainless steel or alloy case. Unless otherwise shown or specified, gauges shall have a 4½-inch dial, ¼-inch threaded connection, a Type 304 or 316 stainless steel snubber adapter, and shut-off valve. Gauges shall be installed with an annular seal as described below. Gauges shall be calibrated to read in applicable units, with an accuracy of ± 1 percent, to 150 percent of the working pressure or vacuum of the pipe or vessel to which they are connected. Gauges for pumps shall read in read in psi. All gauges shall be vibration and shock resistant. Gauges shall be 0 to 50 psi.

B. Approved manufacturers, or equal, as approved by Engineer

1. Ashcroft
2. Foxboro
3. Rosemont

2.3 ANNULAR SEALS FOR PRESSURE MEASURING SYSTEMS

A. Annular seals shall consist of an Isolator Ring and Type 304 or 316 stainless steel calibration/evacuation accessory. Any required instrument manifolds shall be Type 316 stainless steel, minimum size of ½" with NPT connection of size required for pressure sensing device. Pressure transmitters, switches and gauges shall be shipped to annular seal manufacturer for factory assembly, evacuation and calibration.

B. Isolator ring shall include a valve and/or quick release device to allow instruments to be removed while the piping is in service and to prevent loss of fill fluid.

C. Materials of Diaphragm: Seals shall be of Type 304 or 316 Stainless Steel for center section and end plates with Neoprene or EPDM diaphragm. Fill fluid shall be Silicone Fluid.

D. Approved manufacturers, or equal, as approved by Engineer

a. Onyx Valve, Model PSW

PART 3 - EXECUTION

A. Pressure measuring systems shall be handled, installed, calibrated, loop-tested, pre-commissioned, and performance tested.

END OF SECTION 40 73 00

SECTION 43 25 00 - SUBMERSIBLE NON-CLOG PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install three (3) submersible new non-clog pumps, discharge elbows, guide rails, lifting chains. and associated appurtenances and controls as specified herein and as shown on the Drawings.

1.2 REFERENCE STANDARDS

A.	ASTM - A36/A36M-04	Standard Specification for Carbon Structural Steel
B.	ASTM A 48/A 48M	(2008) Standard Specification for Gray Iron Castings
C.	NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

D. NEMA Standards Publication MG 1-1998 (latest version) Motors and Generators

E. National Electric Code (NEC)

1.3 SUBMITTALS

A. Shop Drawings, at a minimum, shall have the following information and be submitted with each pump supplied:

1. Pump performance curves showing the following:

   a. head, capacity, horsepower demand, NPSH required, pump efficiency over the entire operating range of the pump, performance curves at intervals of 5 Hz from minimum speed to maximum speed for each centrifugal pump equipped with a variable speed drive; the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions; and

   b. the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration with the stable operating range as wide as possible based on actual hydraulic and mechanical tests.

2. assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights

3. bearing life calculations

4. rail system

5. typical installation guides

6. Electrical motor data

7. Technical manuals and parts list

8. Printed warranty

9. Management system certificate ISO 9001

10. Manufacturer’s equipment storage recommendations

B. Factory Test Data shall be signed, dated, and certified factory test data for each pump system which requires factory testing, submitted before shipment of equipment.

C. The Contractor shall provide Manufacturer's Certification of proper installation and certification of satisfactory field testing.

D. Submit Owner’s Manual as specified in Special Provisions, to include operation and maintenance data and other information for the equipment.

1.4 QUALITY ASSURANCE

A. Pump, motor, and controls shall be coordinated by the Contractor to provide operable pumping systems as indicated by the Drawings and Specifications.

B. The motor horsepower shall not be exceeded when the pump is operating anywhere on its curve.

C. Pump seals shall be designed for complete water-tightness at 65 feet submergence for 30 minutes, and data on factory testing and quality control shall be submitted with the Shop Drawings.

D. Firms regularly engaged in manufacture of pumping equipment of types required, whose equipment has been in satisfactory use in similar service for not less than 5 years. Manufacturer shall have authorized factory warranty service for pumps supplied available within 50-mile driving distance of the Project Site.

E. The Contractor shall correct all defects in the pumping system upon notification from the Owner within 1 years from the date of Substantial Completion. Corrections shall be completed within 5 days after notification.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Submersible Wastewater Pumps shall be submersible non-clog wastewater pumps capable of pumping raw unscreened sewage in a NEC Class 1, Division 1, Group D hazardous location. Three new pumps shall be furnished and installed in the Lift Station wet well.

B. New discharge elbows and guiderails shall be provided for all new pumps as shown on the drawings.

C. The submersible pumps shall have a semi open multi vane self-cleaning impeller designed to transport wastewater with fibrous materials like wet wipes. Pumps shall be capable of pumping sewage under the following conditions of service:

D. Operating Conditions

Criteria	Unit	Value
Design Flow Capacity (per pump) Max. point	gpm	1,800
Design Flow Pump Head, TDH	ft	30
Design Flow minimum efficiency (wire-to-water)	Percent	78
Driver		
Duty	Continuous	
Drive	Variable Speed	
Maximum Motor Speed	rpm	1800
Maximum Motor Size	hp	20

Item	Unit	Value
Fluid Service		Raw Industrial Wastewater
Ambient Environment		Wet well, submerged
Ambient Temperature	Degrees F	30 to 120
Ambient Relative Humidity	Percent	30 to 100
Fluid Temperature	Degrees F	40 to 80
Fluid pH Range		5 to 8.5
Fluid Specific Gravity		1.0
Project Site Elevation	Feet	170

E. The Contractor shall ensure the pump vendor examines the site conditions, intended application, and operation of the pump system and recommends the pump that will best satisfy the indicated requirements.

F. Pumps shall be designed and provided to be raised, lowered, and supported on a vertical stainless steel guide rail system.

2.2 MATERIALS OF CONSTRUCTION

A. Unless otherwise specified elsewhere, all non-clog submersible pumps shall be constructed of the following materials:

Item	Material	Construction
Pump Casing	Casing and motor housing shall be close-grain cast iron conforming to ASTM A-48 Class 40 standards. Insert rings shall be made of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron)	Casing shall form the volute and shall be a single piece with smooth flow passages. A replaceable bottom plate assembly shall be used to seal between the impeller and the casing. The casing shall have a centerline discharge to allow for guide rails.

Item	Material	Construction
Connections	Machined metal-to-metal quick disconnect type	The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted discharge connection. The material of the guide bars shall Stainless steel AISI 316.
Impeller	Impeller shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron)	Impellers shall be dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller shall have vanes hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.
Shaft	ASTM A479 S43100-T	The shaft shall be totally isolated from the liquid being pumped and shall have a maximum deflection at the lower seal of .002 inches.
Shaft Seals	Stainless steel, Tungsten carbide or silicon carbide rings	The pump shall have two mechanical shaft seals. The upper seal shall be a corrosion resistant Tungsten carbide WCCR mechanical seal running in an oil bath below the stator housing. The lower seal shall be the primary seal and consist of a corrosion resistant Tungsten carbide WCCR mechanical seal. Seals shall contain one stationary and one positively driven tungsten-carbide seal ring. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

Item	Material	Construction
Bearings		The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated and have a nominal L10 lifetime of 50.000 hours. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.
Oil Chamber		To supply oil for lubrication and cooling of shaft seals. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside.
Pump Base	For each pump the contractor shall supply and install a discharge connection made of cast iron ASTM A-48, Class 35B	The sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be accepted. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.
Fasteners	Type 316 stainless steel	All exposed fasteners
Pump Coating	All castings must be blasted before coating. All wet surfaces are to be coated with two-pack oxyrane ester Duasolid 50. The total layer thickness should be at least 120 microns. Zink dust primer shall not be used.	All metal surfaces (except stainless steel) coming into contact with pumped media shall be protected by specified coating

Item	Material	Construction
Cable Entry		The cable entry shall consist of dual cylindrical elastomer sleeves, flanked by washers, all having a close tolerance fit against the cable and the cable entry. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.3 COOLING SYSTEM

A. The motor shall be provided with an integral motor cooling system. A stainless steel cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket.

2.4 LIFTING SYSTEM

A. The following shall be provided for all new pumps.

1. Provide dual 316 SS guide rails extending from the base to the top of the wet well to provide for removal of the pump by lifting the pump without entering the wet well. The guide rail system shall be non-sparking.

2. Each pump shall be furnished with a stainless-steel bracket permanently mounted to the top of the pump, with a large loop for accommodating a lift hook. Each pump shall be fitted with a stainless steel lifting chain or lifting cable of adequate length. The working load of the lifting system shall be 50% greater than the pump unit weight.

3. The guide rail system shall include a sliding guide bracket that allows removal of the pump without binding, and properly aligns the pump to automatically seat with the pump discharge connection. Each pump shall have permanently installed discharge elbow that seats against the pump discharge connection by a machined metal to metal contact. The use of a diaphragm, O-ring, or profile gasket will not be accepted.

2.5 ELECTRICAL REQUIREMENTS

A. Pump Controls

1. The existing MCC/VFD will be utilized to power and control the pumps.

B. Motor

1. Pump motors shall be of explosion-proof design conforming to NFPA 820 requirements. In addition, pump motors shall conform to NEMA MG-1 Part 31 requirements and shall be a premium efficiency squirrel cage induction NEMA Design B electric motor conforming to the following:

Item	Value
Installation Environment	Submersible, Air Filled
Enclosure	Explosion Proof
Insulation Class	NEMA Class H or higher
Insulation	Non-Hygroscopic Polyester
Service Factor	1.15 Minimum
Synchronous Speed	1800 RPM Maximum (Variable)
Voltage	460
Phase	3
Frequency	60 Hz max (Variable)

C. Moisture Sensor

1. Provide moisture sensor in the seal oil chamber to detect moisture leakage through the outer shaft seal. The moisture sensor shall be wired to the pump control system to provide seal failure protection indication for the pump. Provide a moisture detection relay for each pump suitable for connection to SCADA network for detection of moisture in the seal chamber. The moisture detection relay shall be powered by 24-volt AC/DC and shall close a set of contacts in the relay when moisture is present in the pump seal chamber.

2. Moisture sensor shall be Flygt MiniCASII.

D. Thermal Sensors

1. Thermal sensors shall be used to monitor stator temperatures by the use of 3 thermal switches embedded in the coils of the stator winding. The thermal sensors shall be wired to the pump control system to provide overheat protection for the motors and be connected to the SCADA network similar to moisture sensor.

2. Thermal sensors shall be Flygt MiniCASII.

E. Electric Cable

1. The pump motor cable and control cable shall be FM-approved for use with motors for Class 1, Division 1, Group C & D Locations.

2.6 SPARE PARTS

A. Parts to be furnished include

1. 2 sets of mechanical shaft seals

2. 2 sets of bearings each for pump and motor

3. 3 sets of O-rings

4. 1 submersible cable of required length

2.7 MANUFACTURER

A. Flygt NP 3153 LT 3 – 413

B. Or equal

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt or dust, or other contaminants.

B. All parts shall be properly lubricated and protected so that no damage or deterioration will occur even during a prolonged delay from the time of shipment until installation is completed and the pumps are ready for operation. Pump impellers shall be rotated at least every 30 days.

C. Finished ferrous surfaces not painted shall be properly protected to prevent rust and corrosion.

D. The finished surfaced of exposed flanges shall be protected by strong wooden blind flanges.

E. Each pump shall be properly crated to protect against damage during shipment.

3.2 INSTALLATION

A. Install pumps as shown in the drawings and as recommended by the Pump Manufacturer.

B. The Contractor shall ensure that anchor bolts are set only after the discharge piping has been properly installed, to ensure exact fit with embedded piping components.

3.3 SERVICES OF MANUFACTURER

A. Secure start-up service for the pump as specified below:

Schedule of Field Service Representative on Site Time		
Service	On Site Time (Days)	Trips to Site
Equipment delivery verification and installation instruction	1	1
Installation verification, start-up and instruction of the Owner’s personnel	1	1

B. A "Day on Site" is defined as a conventional 8-hour workday excluding travel time. A "Trip to Site" is defined as complete round trip travel from the Manufacturer's factory. All expenses including salary, local/long distance travel, lodging, meals and any other per diem or miscellaneous expenses of the authorized service representative shall be the responsibility of the Contractor.

C. A factory representative of the pumping equipment shall be present to supervise start-up and ensure proper operation of all components. The Contractor shall obtain and pay for the factory representative start-up service.

END OF SECTION 43 25 00